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TECHNICAL REPORT NO. 21

SJIS
STATE JUDICIAL INFORMATION SYSTEM FINAL REPORT (PHASE III)

VOLUME II: TOPICS IN DATA UTILIZATION

MICROFICHE

SEARCH GROUP Inc.
National Consortium for Justice Information and Statistics

TECHNICAL REPORT NO. 21
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STATE JUDICIAL INFORMATION SYSTEM FINAL REPORT (PHASE III)

VOLUME II: TOPICS IN DATA UTILIZATION

Report of work performed under Law Enforcement Assistance Administration Grant No. 76SS-99-6049

SEARCH GROUP Inc.

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The Government are very keen on amassing statistics. They collect them, add them, raise them to the nth power, take the cube root and prepare wonderful diagrams. But you must never forget that every one of these figures comes in the first instance from the village watchman, who just puts down what he damn pleases.

Sir Josiah Stamp.

INLAND REVENUE DEPARTMENT (England) 1896-1919

FOREWORD

The State Judicial Information System (SJIS) Phase III Final Report is presented in three volumes. Volumes I and II document the activities of the project. Volume III contains the proceedings of the National Judicial Data Utilization Workshop. SJIS Phase III, a project of SEARCH Group, Inc., (SGI) was funded through a grant from the Law Enforcement Assistance Administration (LEAA), U.S. Department of Justice. The three volumes of the SJIS Final Report are:

Volume I.
SJIS Documentation. This report discusses the importance of system documentation, and examines "Guidelines for Documentation of Computer Programs and Automated Data Systems; Federal Information Processing Standards Publication 38" as a documentation standard for an SJIS. It presents the experiences acquired during the documentation of three existing state judicial information systems and makes recommendtions for minimum documentation for an SJIS

Volume II.
Topics in Judicial Data Utilization. This report documents research into the use of data reported to state court administration by trial courts; it presents a statistic for the validation of data for accuracy, completeness and consistency, a statistic for monitoring workload and estimating service time, techniques for the analysis of delay and a method of presenting data for ease of comprehension.

Volume III.
Proceedings of the National Judicial Data Utilization Workshop. This report is a transcription of the panel discussions and presentations heard at the workshop covering the following topic areas:

- Data Validation;
- Data Based Monitoring;
- Data Collection: Problems and Payoffs;
- State of the Art of Judicial Statistics;
- The Investigation of Delay;
- Weighted Caseload;
- Sentence Disparity Studies;
- The Infancy of Forecasting;
- Statistical Analysis and Dissemination.

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PREFACE

The work reported in this document was suported by a grant awarded to SEARCH GROUP, Inc., a consortium of the fifty states and the territories organized as a non-profit corporation to apply technology to the justice system. The SJIS grant was awarded by the Law Enforcement Assistance Administration of the U.S. Department of Justice.

The missions of the project were to provide state-level judicial administration with tools for the effective utilization of data reported by trial courts; to select state judicial information systems and conform their documentation to requirements established by the committee; to assist state judicial information system projects through the committee review of participating states' SJIS grants; to continue the assessment of the SJIS participating states and facilitate a fruitful exchange of information about system development among the participants.

This final report presents the findings of the Project Team.

Larry Polansky served as Chairman of the SJIS Project Committee and Arthur J. Simpson, Jr. served as Vice Chairman. Phillip B. Winberry chaired the subcommittee charged with oversight of the assessments and review of the participating states' grant applications. James M. Parkison chaired the subcommittee responsible for documenting three state judicial information systems and developing recommendations for SJIS documentation. Loren Hicks chaired the subcommittee responsible for data utilization research and the conduct of the National Data Utilization Workshop.

SJIS PHASE III PROJECT COMMITTEE AND STAFF

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ACKNOWLEDGEMENTS

The production of this document marks the end of SGI involvement with the SJIS Project. The management of staff of SGI gratefully acknowledge the diligent efforts of each project committee member and others involved throughout the life of the project and, in particular, those who took part in Phase III. It is virtually impossible to list everyone who contributed their time and effort to make Phase III of the SJIS Project a success. So, what follows is a partial list of individuals that were instrumental in the execution of this phase of the project. Since the work of Phase III consisted of three independent areas of activity, our acknowledgements follow the same pattern.

SJIS SYSTEM DOCUMENTATION

Several of those who were extremely helpful in providing insights into the development and use of the FIPS PUB 38, were Harry White and Bea Marron of the National Bureau of Standards, Tom Kurihara of the Department of Agriculture, Helen McEwan of the Federal Software Exchange Center, Jim Maxwell from the Department of Housing and Urban Development, and Alan Anderson from the Bureau of Labor Statistics.

The unflagging efforts of the staffs from the three states whose systems were documented are particularly appreciated. Their assistance went well beyond the call of duty. Thank-yous are extended to George Sisco and his staff in Missouri, Kathy Shelander and her staff in Florida, and Jim Martin and his staff in Louisiana.

Our thanks to Jim Parkison, Chairman, and the members of the System Documentation Subcommittee for meeting independently on several occasions so that the effort could go forward on schedule.

DATA UTILIZATION

Several who assisted in selecting states to provide data for our research were Lynn Jensen of the National Center for State Courts; Judge Arthur Simpson, Acting Administrator of the New Jersey Courts; Bill Bohn, State Court Administrator of North Dakota; Carl Bianchi, State Court Administrator of Idaho; Harry Lawson, then State Court Administrator of Colorado; and Mike Nieberding, Assistant Administrator for Information Systems, Administrative Office of the Maryland Courts.

Without the contribution of 21 reels of computer tape containing raw courts data for several years, no research, workshop or final report would have been possible, and for this, we sincerely thank Bill Bohn, Harry Lawson and their respective staffs.

All of those who appeared on the National Judicial Data Utilization Workshop program have our gratitude.

To Loren Hicks, Chairman, and the members of the Data Utilization Subcommittee, our appreciation for your insights, guidance and diligence.

GRANTS REVIEW AND ASSESSMENT

Chairman Phil Winberry and his subcommittee have had the most thankless task since the project's inception. Since the project began, they have reviewed at least one state judicial information system grant from each of the states currently actively participating in SJIS development. They have read hundreds of pages of grant narrative, examined about 30 grant budgets, questioned schedules and generally tried to assist states to structure projects that are worthwhile and can be accomplished. They performed their work often under difficult circumstances and always under pressure.

To this subcommittee, our most heartfelt thanks.

Finally, our thanks to Chairman Larry Polansky, whose leadership resulted in an extremely successful Phase III.

1. INTRODUCTION

1.1 BACKGROUND AND SCOPE

This report has been written to help state court administrators and their technical staffs to use the case related data that is reported to them by trial courts. As the amount and complexity of judicial business increases and the size of state judiciaries grow accordingly, data-based monitoring and management by exception are increasingly necessary tools for effective courts administration.

Indeed, the need for objective measures of how and how well courts are functioning is becoming critical. There has been a literal explosion of management information systems in state courts administration but there are no recognized and commonly accepted measures for monitoring and predicting workload, performance and the requirements for resources. Trial courts are reporting more and more information yet there are no simple, straight forward and rigorous techniques for routinely validating data for accuracy, completeness and consistency. Administrators rely with increasing frequency on statistical data to support decisions yet there are few aggregate measures that clearly portray the operation of the courts to assist them.

This project had two limited objectives. The first objective was to develop easily understood indices for monitoring court workload and delay. The second objective was to do a pilot study of the effects on court functioning of those factors available in the data which might be relevant. This report covers the work toward these goals.

However, these project objectives were directed toward a much broader goal: to study the actual and potential usage of court data for administrative purposes. There are many directions in which further analysis is possible. For example, sentencing disparity studies, investigation of calendaring procedures, the distribution of judicial workload, and development of social indicators to predict filings.

This study as based in part on two hypotheses.

First, that the trial court data collected by most state court administrations is underutilized. Data collected by large and sophisticated state judicial information systems is underutilized because staff effort is focused on either maintaining the system itself, that is, programming, file creation and maintenance, and accounting; or on operational functions such as providing calendaring, notification and budget assistance to the trial courts. Thus, large systems and the corresponding administrative office budgets do not generaly provide an opportunity for full-time analysts to develop creative and rigorous ways to assist data-based decision making. In small systems, on the other hand, data analysis is a part-time activity sandwiched in between other tasks such as budget preparation.

The second hypothesis was that within even the most primitive statistical gathering system, there exist a few easy-to-calculate parameters that administrators can use to monitor the flow of work through the state's courts.

This study indicates that data is generally underutilized and that there do exist some simple parameters and techniques for making data give a clearer picture of workload, performance and local procedures. These parameters and techniques partially address the underutilization of data; partially, because the national survey of state court administration that was conducted as part of this project (and is summarized in Section 1.3 of this report) indicated that all of the areas of interest in data usage and application could not be addressed in the time available.

So, the scope of the study was limited to developing parameters and techniques for data validation, trial courts monitoring and the investigation of service time or delay. The scope of the study was further limited to courts of general jurisdiction. Appellate and Supreme Courts were excluded. Juvenile cases also were excluded. Three broad categories of case types were included Criminal, Civil, and Domestic.

Initially, the states were surveyed to find a source of data for analysis. The following criteria were important:

- How long the date has been collected in essentially the same format;
- How clean (error-free) was the data;
- How complete was the data — that is, how much information about each case was recorded.

A two-person team, Roy Boswell and Leo Breiman, selected five states for site visits after examining system documents from almost all states on file at the National Center for State Courts.

After visits to these five states, and more closely examining available data, the decision was made to use data from North Dakota and Colorado. While many systems that are capable of giving complete and accurate data are either in operation or shortly will be so, the main problem was to find at least a year-long continuous stretch of data.

The two states selected have very different systems. North Dakota operates on paper forms, using case-by-case reporting and batch processing. The data utilized from Colorado was from an on-line system, which uses remote terminals in the courts to provide calendaring and notification as a primary function, and statistical monitoring as a fringe benefit.

The size of the data analysis varied. The North Dakota data consisted of records on fewer than 20,000 cases; the Colorado data included more than 400,000 cases. The North Dakota data was used for an extensive exploration. After testing and rejecting a number of ideas, the most promising approaches were selected and tested on the Colorado data.

Throughout this report examples that demonstrate the technique for validating data are based on filings and dispositions and the examples that demonstrate the analysis of service time are based on either time from filing to disposition, or time from first appearance to trial. *Readers should by no means limit the applications described here to these statistics only.* The validation techniques developed as part of this study should apply to most aggregate data and the method used to analyze sevice time should apply to the elapsed time between any two events that occur in the course of adjudicating any legal matter appearing in a court.

1.2 SUMMARY

Now, as to the project conclusions proper. For monitoring, two type of indices have been developed. The first type, the Chi-Squared Index, is used for data validation — monitoring for any unusual fluctuations in aggregate data, presented under broad case categories. The second index, called the BACKLOG Index, is a measure of how well the courts are coping with their workloads and of the average time that it takes the court to process its cases.

This report proposes a monthly summary of information in *layers*. The top layer is a short graphical summary of the behavior of these indices over all courts. This summary enables trouble spots to be quickly detected. The second layer of information contains more detailed follow-up information regarding the indices on a court-by-court basis. Thus, trouble spots can be analyzed and tracked down in more detail. Finally, the third layer of information contains the detailed and long-run information regarding the courts, found to be relevant and useful in terms of backing up the first two layers.

Concurrently, the effects on the case servicing times of various factors whose values were available in the data were analyzed. In North Dakota case servicing time was defined as the number of days from filing to disposition. The factors examined for effect on servicing time were differences among courts; differences in case type; whether the case was contested or non-contested; if conteted, whether it went to a jury or court trial; and differences in final judgment. In Colorado, only Criminal cases that went to trial were examined, and servicing time was defined as the time in days from the first appearance of the defendant to the start of trial. As relevant factors, the court at which the trial took place, the severity of the charge, the number of trial-date postponements, and the number of pre-trial actions were analyzed for effect on servicing time.

The factors that had the greatest effects were interesting and, at times, unexpected. The North Dakota study indicated that, even with all factors used being held constant, i.e., the same case type, the same court, same disposition type, etc., there was still a large variability in the service times of individual cases. In the Colorado study, the number of trial postponements and pre-trial actions had an expectedly large effect on time until trial. Holding these factors constant caused a sharp decrease in the variability of the times until trial.

1.3 RESULTS OF A NATIONAL SURVEY

In the interest of conducting a data utilization analysis and workshop that would be immediately useful to state court administration, a survey of all state court administrators was conducted between May 9, 1977, and October 1, 1977. Of the 50 questionnaires distributed, thirty-one were returned. The following paragraphs summarize the responses.

Administrators were asked if reporting accuracy from general jurisdiction trial courts posed a problem. Nearly all admitted that the level of accuracy was a serious and continuing problem. Inconsistent use of definitions among jurisdictions accounted for most of the difficulty. Many administrators try to address this problem by scheduling annual meetings as well as periodic training sessions with the personnel responsible for reporting. Another method employed to improve data accuracy is the distribution of a reporting instruction manual, which includes a list of standard definitons. A few states are attempting to overcome accuracy problems by implementing a new computerized reporting system.

Administrators were requested to describe any procedures used for checking the accuracy of information reported by trial courts of general jurisdiction. Procedures included a comparison of current period figures to previous periods, field audits and computer edits, although visual scanning is the most widely used procedure.

When asked how often reports were received very late (i.e., one month or more) or not at all, a slim majority of court administrators replied that reports are often one month late but rarely any later. A few administrators admitted that as much as 50% of the reporting is one or more months late. Telephone calls, letters and memos to the clerks and trial court administrators are the most common methods of improving reporting timeliness.

In response to the question: "How often are data reported by trial courts of general jurisdictions?," the responses here differed greatly among jurisdictions. Most trial courts report monthly, but weekly as well as quarterly reporting is common.

Administrators were next asked to note reports or numbers that were relied upon quite heavily to gain information on such items as backlog, elapsed times, dollars expended per case, and anticipated workload. Responses varied widely, but the most popular statistics include filings, dispositions, and elapsed times. Filing and disposition per judge rates, numbers of trials, backlog and disposition type. Continuance types are also popular administrative statistics.

State court administrations were queried as to whether data on the type and amount of resources expended on cases are collected. An overwhelming majority keep no such data. Two respondents did state that while they aren't currently collecting this data, they do anticipate a weighted caseload system in the future.

Administrators were asked to elaborate on the ways they would improve their systems if additional resources were available to them. The response of Mr. Bert Montague, State Court Administrator of North Carolina, was typical of many. He said that when funding is available, he hopes to implement an on-line computerized information system statewide. This would eliminate the bulk of paper reporting from the clerks to the Administrative Office, permitting data to be entered into the system in each clerk's office. Such an on-line system also would permit access to individual case data by display terminals located in the clerks' offices and in offices of other key court personnel in each county.

When asked if they had the additional resources, what additional reports, studies or calculations would they like to support their management and administrative duties, state court administrations responded in many different ways. For example, Ms. Doris M. Jarrell, Director of Information Services, Michigan State Court Administrative Office, replied that she would welcome a feasibility study addressing the use of the weighted caseload in Michigan, including an implementation plan. Mr. Bruce Freeland, Director of Research and Statistics, Office of Administrator for the Washington courts, said that it would be very helpful to his office to have reports from the trial courts showing expenditures of state and local public monies; receipts (fees, fines and forfeitures) and their distribution; judicial and non-judicial staffing and utilization; and courtroom and jury utilization.

"We have no reliable source of information on these subjects at this time," Mr. Freeland added. Mr. Clifford P. Kirsch, Assistant Court Administrator for the Pennsylvania Courts, indicated that more information on judicial activity such as "hearings on petitions" would be quite beneficial. More information regarding the nature of actions/offenses and disposition of miscellaneous matters would also be of use.

1.4 REPORT CONTENTS

This report is divided into two sections — a non-technical and a technical report. The material in the non-technical report is presented in an expository fashion and is aimed at administrators. However, the sections contained therein are required reading if the methods developed in this report are to be applied by technicians. The technical report contains more rigorous development of the topics presented for the non-technicians. However, no section of this report is beyond the capabilities of any person who has taken a college freshman algebra course and an elementary statistics course. Administrators are encouraged to read the technical report, as it will aid their understanding of the techniques developed here.

2. OVERVIEW

2.1 DATA BASED MONITORING

The basic question in monitoring is, "Is there anything out of the ordinary going on with any of our courts?" What is sought is an indication of some relatively short-term change. This is the important difference between monitoring and the annual report assessment. The annual assessment focuses on the annual changes, i.e., "How was 1976 different from 1975?" A typical statement is "Filings in the 3rd District Court rose 10% over the previous year." No mention is made (usually) of seasonal variations or of unusual short-time increases or decreases.

From an administrative point of view, short-term monitoring is extremely valuable. If there is a sudden imbalance in any court, it should be detected and efforts made to correct it as soon as possible.

However, an apparent malfunctioning may be due to bad data. For instance, a new clerk may be reporting the data incorrectly. In this case, it is better to detect the bad data quickly rather than to find out about it at the end of the year. On the other hand, an aberrant value may indicate a real short-term shift. In this case it is even more critical that the sudden shift be detected because it may require immediate administrative action such as temporary judicial assignment to compensate for a temporary surge in filings.

Next, there are the longer-term trends in which data gradually increases or decreases, usually by less than 1% or 2% per month. This type of change is caused by shifting population, changing regional socio-economic factors and so on. There are also changes in court operation spread out over the space of a few months. For instance, court procedural changes or changes in legislation may lead to sizable changes in dispositions and filings, but these effects are not generally abrupt and tend to be spread out over several months. There are also seasonal effects, which are usually quarterly in appearance.

So, data-based monitoring is detection; first, the detection of abrupt, short-term changes and the determination if these result from bad data or indicate a real shift, and second, the detection of longer term, more gradual changes or trends. Data-based monitoring detects the presence of change but does *not* explain the change. To answer such questions as, "Why have criminal dispositions for Court A doubled this month? Why is Court X twice as fast at disposing of personal injury auto cases as Court Y?" requires either detailed knowledge of local practices and procedures or extensive telephone calls and court visits. The answers lie neither in computer files nor in statistical analysis. Data-based monitoring will indicate a problem but usually will not provide a reason for the problem.

2.2 CASE-BY-CASE VERSUS AGGREGATE INFORMATION

An original assumption about monitoring methods was that individual case data could be used to construct better monitoring indices than aggregate data. But as monitoring methods were developed, it became apparent that the most effective indices were based on aggregate data. In fact, to compute the indices finally selected, all case-by-case data had to be aggregated over monthly periods.

There are two important advantages of case data over aggregate data. The first is that cases pending longer than a designated time period can be individually identified and listed in an exception report to the court in question. There is no doubt that asking, "Why is John Doe, arraigned for Assault on January 7, 1976, still awaiting trial as of July 31, 1977?" has more impact than asking, "Why does your court have 23 Criminal cases pending more than 6 months as of January 31, 1977?"

The second important advantage is in making sure that the data is accurate. One of the most important single drawbacks of aggregate data is that errors are hard to catch. Monthly totals consistantly off by 10% to 20%, will be virtually undetectable by anything except an on-site audit.

With more detailed information, more checks on internal consistency are possible. For example, if the courts report monthly filings, dispositions and pendings at the end of the month, then the increase in pendings from the previous month must equal the current month's filings minus dispositions.

However, no exception report, or case file will indicate the daily, weekly or monthly flow of work through a judge or a court. This can only be represented by aggregate statistics. The flow of work and its currency, abrupt changes in workload, and long-term trends in volumes of work are the indicators that managers and administrators use as a basis for allocating resources and asking for money. Aggregate statistics, therefore, are a valuble product of all systems.

However, excessive aggregation tends to obscure information. For instance, it might seem reasonable to look at total filings and dispositions, ignoring categories such as Criminal, Civil and Domestic, to monitor courts for abrupt changes. These gross totals would probably be insensitive to change because a large change in Criminal filings, could be masked by a compensating change in the volume of Civil and Domestic filings.

The most reasonable thing to do is to present aggregate statistics by broad categories. These categories should not be so large that "elephants and mice" are mixed together. On the other hand, they should not be so narrow that only a few cases per month are reported in each category by the smaller courts. If the number of filings and dispositions reported each month in a category is generally small, then even a comparatively large percentage change may have very little effect on the court workload. For example, in North Dakota, the three smallest district courts averaged 10 Criminal cases filed per month per court. It was decided, then, not to further subdivide the category of Criminal cases. On the other hand, in Colorado, the volume was high enough so that Criminal cases were divided into three categories:

1. Crimes against persons
2. Crimes against property

3. Crimes, other.

Generally, any case category with a reported number of actions (filings, dispositions, trials, etc.) less than five, resists most of the usual analytical approaches to detecting unusual values or spotting trends.

2.3 PRESENTATION: LAYERS OF INFORMATION

As a general philosophy of monitoring, it was decided to utilize "layers" of information. The top layer would be a single-page *graphical* summary of court-by-court activity for the previous month. The idea is to be able to quickly identify trouble spots without reading through pages and pages of numbers.

The second layer would consist of more detailed information about court functioning, and consists of a few pages per court. Upon detecting a trouble spot in the top-layer of data, the more detailed second layer of information is consulted to focus in more detail on the problem.

The third layer would consist of significant information about court functioning at the most detailed information level. For instance, detailed case-aging information and histograms of relevant service times should be included in the third layer.

2.4 DESCRIPTION OF PROJECT DATA

North Dakota

North Dakota has six district courts, the largest having five judges and the smallest, two, for a total of 19. Filings (other than Juvenile) in 1976 were:

Criminal	1,054
Civil	3,985
Domestic	3,618
Total	8,657

The data collected by its present system began in January 1976. Actually, since open cases filed prior to January 1976 were put on the system, there were records available for about 17,000 filings.

The system functions as follows: The Court Clerk fills out NCR forms for each case filed, for each intermediate event in the case, and for its disposition. Copies remain in the case file. The originals are sent to the State Court Administrative Office following the end of each month. They are keypunched onto computer files at the State Central Data Processing Division. Reports are generated from the data for use by the State Court Administrator, and by the District Court Administrators and Clerks.

The information gathered about each case is summarized by:

1. *Charge/Type of Action;* e.g., Felony A, Misdemeanor B, Divorce, Damages, etc.
2. *Trial/Hearing;* Jury, Non-Jury, Non-Contested
3. *Events Occurring;* e.g., Arraignment, Continuance, Show Cause Hearing, etc.
4. *Judgment;* e.g., Guilty, Dismissal, Divorce Decree, etc.
5. *Sentence* (Criminal only); e.g., County Jail, State Farm, etc.
6. *Filing, Event, and Disposition Dates*
7. *Name of Presiding Judge.*

Item 7 was not required for the analysis. Unfortunately, the event data was spotty for some courts. For this reasons, it was decided not to use any of the event data. Sentence was not relevant to the study and was not used. The information found to be useful, then, was:

District Number
Case Category
Filing and Disposition Dates
Trial/Hearing
Judgment.

This data was internally consistent, and contained very few irregularities. The North Dakota Administrative Staff has made a determined effort to keep their data clean; and the results indicate that they are succeeding.

Colorado

This data base was many time as large as the North Dakota data base. To begin with, it included nine courts, whose filings (other than Juvenile) in Fiscal Year 1975 were:

Criminal	9,668
Civil	20,685
Domestic	23,007
Total	53,360

This is about six times the North Dakota total. These nine courts ranged in size from Denver District, with 19 judges and 19,107 filings in FY 75 to four judges and 3,363 filings in District 19.

These nine courts went onto the on-line computer system at different times, beginning with Denver in February 1974, and with the most recent in September 1976. These nine courts account for 75% of Colorado's FY 1975 filings. As courts came on-line, older cases still pending were entered into the system. The data base used in this study (14 tapes), consisted of all Criminal, Civil, and Domestic cases put on the on-line system since its beginning, and totaled roughly 400,000 cases.

These was a tremendous amount of information in these files. Essentially, the entire case docket was entered. The initial problem was to go through this enormous amount of data and extract only that data that was statistically useful. All names, non-coded descriptions, and other non-statistical information was discarded. The following data was used for each case:

1. Court Number
2. Filing and Disposition Dates
3. Case Category
4. Statute Number, Plea, and Charge Disposition (Criminal only)
4. Judgement and Min-Max Sentence Time (Criminal only)
6. Intermediate Events, Date, Type, and Disposition

The date was, as in North Dakota, spotty in places, so internal consistency checks were developed to edit and delete questionable records. Overall, the choice of states was sound. According to the criteria described in Section 1.1 of this report the data was the best available.

Despite the wealth of information imbedded in the two systems' files, much of it could not be used because both systems carried a substantial amount of missing and inconsistent data. In other states, data accuracy was, in general, considerably worse. This is symptomatic of the large and open-ended effort that is required of state court administration to maintain quality data.

NON-TECHNICAL REPORT

3. VALIDATION: FIRST STEP IN DATA BASED MONITORING

3.1 INTRODUCTION

A natural first step in data-based monitoring is to ask, "Is this data any good?" The paragraphs that follow discuss the causes and effects of poor quality data, outline some procedures for improving data, develop a statistic for detecting unusual data in a methodical way, demonstrate the use of the statistic with layers of information, discuss the monitoring and evaluation of a reporting system, and describe some trade-offs between data quality and system type.

3.2 BAD DATA: SYSTEMIC EFFECTS AND CAUSES

A good deal of effort in this project was devoted to editing data, checking for bad data, and trying to fill in missing or inconsistent data. Since this was the case for two states with outstanding data quality, there is an inescapable conclusion that the data problems are at least as severe in other states. Some of the outstanding problems were:

Missing and Incomplete Data
Inconsistent Coding Among Jurisdictions
Illogical Data Entries
Difficulty in Extracting Statistical Information

Data cannot be used to monitor courts and to make administrative decisions with any confidence unless they are accurate and complete. Many systems now being planned are on-line, doing calendaring and carrying the case docket. Undoubtedly, as these systems evolve, the data will be used for research into court functioning. The accuracy of the data and its availability for analysis will become more important as systems increase in sophistication.

The effort to get good data is a tedious and unglamorous job. Designing and installing a new system and constructing large new computer programs to handle the data are much more exciting. Yet the limiting factor in all systems is the accuracy and completeness of the data. Having processed the records of hundreds of thousands of case files, the committee's *most strongly felt recommendation is that considerably more effort and energy be dedicated to upgrading the quality of the data entered into state judicial information systems.*

In the last 30 years, there has been an explosion of information systems, particularly with the increasing availability and lower cost of high-speed data processing. And there is bad data everywhere. Billions of dollars have been spent on systems that are fatally flawed because they are collecting data that is usable only after extraordinary measures are taken to patch and clean it up. Thus, in this sense, state judicial information systems are not unique.

Some information systems devote a great deal of effort to data quality. They are almost universally the older information systems. For instance, the United States Census, the oldest information system in the U.S., and the Bureau of Census expend an enormous effort to keep data quality high. Their data is exhaustively validated and audited.

Beyond the inability of administrators to reach valid conclusions based on data and researchers to understand the functioning of the judicial system, poor data has a subtle eroding effect on an information system. If erroneous, inconsistent and incomplete data is being reported, data that cannot or should not be used, then every staff member involved with recording, entering, processing, analyzing and displaying that data knows it is bad. Poor-quality data either being used ignoring its quality, or not being used at all is the source of a morale problem. No one likes to participate in a hollow exercise, so as time goes on, and it becomes clear that data quality is of no concern, the system will erode to the point of uselessness. Thus, poor quality data ultimately degrades all aspects of the sysem including reporting, programming and annual report preparation as well as analysis and decision making.

The two sources of poor data quality are sytem design flaws and reporting.

An often overlooked facet of system design is data quality. Most people trained in systems overlook that facet unless they have had to actually report data, because they are not routinely taught that data quality is a prime factor in designing a system. Internal edits on the sequence of events in a case must be present. Routines to check for internal consistency and mising data should reside in the system. Coding manuals should be an example of English at its lucid best. Clerks should pilot test the reporting instruments. System design that includes provisions for data quality will immeasureably improve a system.

Poor reporting, on the other hand, can usually be traced to court clerks. The weakest link in any system is data acquisition, and poor data is usually caused by unmotivated and badly trained court clerks.

The lack of motivation and training, and the inattention to data qualtiy in system design, stems from a lack of administrative commitment to high-quality data. Data quality is directly determined by the amount of importance given to it by an administrator. The administrator must insist on accurate, consistent, and complete data; must set data-quality specifications and must set staff to work aggressively meeting these specifications. Staff must analyze and determine the nature of problems with data reporting and policy must evolve to address these problems. Data validity must be built into systems in the form of specifications for accuracy, completeness and timeliness. Meeting the specifications must be a primary and ongoing part of system maintenance.

Forever after the forms are developed, the reporting instructions are written and the computer system is up and operating, low-quality data will come into the system. Data validation is probably the biggest long-term headache of operating an information system, and that includes operating the hardware and writing the programs, because it never stops. Validation continuously uses up resources and time as long as data flows through the system. Data quality must be consciously included in every system development and operation budget for as long as the system functions.

Without data validation, the information system is practically useless, even for producing an annual report. With valid data, even the most unsophisticated system can provide real insight into the operation of the state's judicial system.

3.3 DATA QUALITY AND CHECKS

This section presents some procedures for improving data quality that were suggested by discussions with the state court administrative office staffs that were visited and as a by product of validating the data used in this study.

The Court Clerks

Any system will stand or fall on the willingness and availability of court clerks to enter accurate and complete data. The state court administrative office can try to detect bad data and build more and more fool-proof systems, but at present, the most fallible link in every judicial information system is data entry by the clerks. The truth today, even more than it was in Sir Josiah Stamp's day (see frontispiece) over a half century ago, is that a complex, sophisticated multi-million dollar computerized system is worthless unless the entering data is valid.

The states with the highest data quality make continual efforts to train, retrain, and motivate their clerks. *The importance of this cannot be overstated.* The clerks must be motivated to enter good data. Once they are motivated, then the job is the less difficult one of training them.

One important part of motivating clerks is continual feedback. If local jurisdictions are aware that the data they submit is being continually checked, if they are receiving telephone calls questioning some of their entries, if reports based on their data are being sent back to them, then the administrator is telling them that the data they are entering is considered important and that its accuracy is important. Similarly, systems of reward for good data entry, even as little as verbal or written praise, can be an important motivating factor.

This kind of feedback cannot occur unless the administrative office is constantly monitoring the data.

Reporting Instructions

More than one state judicial information system operates without a reporting manual or instructions of any kind, without which there is no basis for common understanding. Likewise, there is no basis for data validation. Garbage comes in; garbage goes out.

Reporting instructions should be an example of clarity. They should be written in plain, non-technical terms for the least experienced clerk in the office. Reporting regulations, the who and when of reporting with statutory references, should not be mixed with instructions, the what and how of reporting.

Reporting instructions should include a glossary of definitions so that terms, such as disposition, termination, adjudication and sentencing, are not used indiscriminately. The purpose of such a glossary is not to actually define terms, but rather, to establish conventions for reporting purposes only.

Quality Control Procedures

With aggregate data, only a few simple checks are possible. The Chi-Squared Index presented in Section 3.4 can be valuable in detecting unusually large period-to-period changes caused by incomplete, inconsistent or inaccurate reporting.

Numbers must add up. For example, the increase in month-end pending must equal the excess of filings over dispositions. The most effective tool for ensuring accuracy in aggregate data is used by the New Jersey Administrative Office, which has had, for some time, an outstanding aggregate system. The procedure is simply an annual on-site audit of *all* jurisdictions to check all case files against the data submitted. This is the only fool-proof method for uncovering any consistent inaccuracy. A sampling approach, however, will work almost as well.

With case-by-case data, the first and most important single step for validating data is:

LOOK AT THE DUMP OF THE DATA.

That is, each month, after the data has been entered onto the computer, get a complete printout of all entries for the month on a case-by-case basis. If this involves too much paper, then use a sampling approach. For example, get a printout of every fifth case or every tenth case.

Looking carefully at such a printout is imperative in terms of understanding what types of errors are being made and who is making them. One of the first steps in analyzing the North Dakota data was to examine a complete printout of all data. The Colorado data were examined on a sample basis.

Carefully examining individual cases on the printout builds a growing awareness of where errors are likely to be found. Look for things such as: Are all essential events listed? Are they in the right order? Do the dates make sense? Is the proper code being used and is it inserted in the correct place?

Placing so much emphasis on an obvious procedure may seem like overkill. However, a good deal of misery, disappointment, and misleading results can be prevented by carefully monitoring raw data in printout form.

This approach will detect practically every kind of error except failure to enter an entire case into the system. Omissions can be detected only by an audit of case files.

Experienced data analysts live by the assumption that the data are partially erroneous, missing, incomplete, etc. and the only question is where and how much. The first and often most revealing step in finding this out is looking at a printout of the file.

The next step is to program routines that perform automatic checks for completeness and consistency. Sometimes, for example, dates are inverted on entry so that a date appears as the third day of the 16th month, 1976. This is easily detectable by a simple program. In the Colorado data the disposition date often did not make sense. An edit routine was written that checked this date against the date of the last calendared event and used the latter as the disposition date if the former was nonsensical. A common data failure is missing events, or out-of-sequence events. Events can be automatically checked with a computer program that will detect and flag all of those that fall out of sequence.

The necessary final step is to close the chain by checking back with the court clerks, informing them of the flaws in their entered data, questioning them about missing or inconsistent data and persevering in the never-ending search for perfect data.

The operators of systems that have had success in continually upgrading data quality, usually have one person who is specifically in charge of monitoring data quality and is responsible for ensuring high-quality data. The assignment of ongoing responsibility to one person is an essential ingredient in getting good data. Too many administrators, infatuated with the newly developed capabilities of computers, seem to believe that, in some way, a computerized system will ensure accurate data, so the push and energy is devoted toward programming sophisticated hardware, and monitoring data quality is given second priority. Consequently, very little in the way of resources or energy is channeled in this direction. This ensures that a system that is first-rate in most respects will turn out a second-rate product.

Monitoring Long Durations

One procedure that can enhance the data quality of a case-by-case data system is the programming of routines to flag long durations and the production of exception reports to note the cases involved. These printouts are useful for inspection both by the state court administrator's office and by the particular jurisdiction handling the case.

"Long durations" refers not only to the time elapsed since the case was filed, but to other durations that may be of importance to court functioning. For instance, in contested Criminal cases, the time from first appearance until the start of trial may be considered an important duration. Times between other events may be significant in the sense that long durations should be avoided.

Critical times for the various durations can be set. With such standards, it is a straightforward programming task to flag durations exceeding the critical value and print out all entries concerning the case in question.

Such a monitoring process will serve at least two functions. In many states there are unterminated cases present in the data files that have been pending for an inordinately long period. Flagging these cases and reporting them back to the jurisdiction may be helpful in terms of getting some action to either close them out by administrative action, or to put them into a special, more appropriate, category than simply "unterminated."

On the other hand, there may be cases present that are dragging because of a court's failure to calendar prompt action on them. Whatever the reason, such cases need to be brought to the jurisdiction's attention.

Internal Edits for On-Line Systems

For on-line operational systems, that is, those that perform calendaring and docket functions, internal edits can be built in to enforce some degree of consistency and completeness.

As a typical example, a computerized case record usually contains space to enter the charge. It may require both statute number and a verbal description. Quite often the verbal description will be present but the statute number may be missing. This situation is troublesome to the administrative office because a computer program to do a statistical analysis of Criminal case types can recognize a statute number, but not verbal descriptions unless they are written in a highly structured code.

One could build into the system an internal edit which queries for charge statute number by flashing on the screen the phrase

STATUTE NUMBER?

At a very minimum, internal edits should be present that query a clerk for misisng or inconsistent data. For instance, an illogical date can prompt the query

DATE?

Another example, suppose a clerk is typing in a Criminal case event which has to be preceded by an arraignment. If there is no such event in the file, the query

ARRG?

might appear on the screen.

A second step, beyond this gentle prompting by the query, would be to lock out further entries on the case. One thing that may have to be considered in taking this more drastic step is whether such a lockout might prevent timely entry of data and degrade some of the usefulness of an on-line system providing calendaring support to a trial court. A compromise might be to flash a message to the Clerk each time additional data is entered on the case. The possible messages might be of the form

1. OKAY
2. MISSING DATA
   STATUTE
   ARRG
   etc.

A comprehensive internal editing system, however strong the enforceability policy decided upon, will be very helpful in providing higher-quality data.

Format and Coding

In designing a case-by-case or on-line system, careful thought has to be given to the availability of the data for aggregation and statistical analysis.

For instance, data from the very comprehensive on-line Baltimore system was made available for this study by the Maryland State Court Administrator's Office. After studying the data, it was concluded that it would be virtually impossible to use in any large-scale statistical study. The reason was, simply, that the system was not designed to provide statistical information. It was designed to provide calendaring and docket information so as to coordinate the various participants involved in a case. The data is entered in a free-form verbal-description format.

On the other hand, the North Dakota system was set up mainly to provide statistical information. It is structured so that almost all information is entered in fixed numerical codes. This makes the use of the data in statistical studies relatively easy. In view of the advantages of an on-line system, and also recognizing that it is probably the wave of the future, data entry format of an on-line system should be designed in a structured, codified manner so that any information that may be wanted for statistical analysis, now or future, may be obtained.

The Colorado format gives a good example of an on-line system that still has enough structure so that important data is available. There is an extensive coding dictionary covering all calendar events and dispositions of these events. Dates for various events and the corresponding codes are in strictly defined locations. Sentencing data is codified, and the maximum and minimum sentences are in strictly defined locations.

3.4 AN INDEX FOR DETECTING SHORT TERM CHANGES

Ideally, what is wanted is an overall way of spotting which courts are reporting unusual values. That is, the first layer of information should provide a quick way to see that, for instance: Courts #1, 3, 8, 21 have reported unusual numbers of filings this month, Courts #2, 8, 17 have reported unusual numbers of dispositions. Armed with this knowledge, the more detailed information regarding filings in Courts #1, 3, 8, 21 and regarding dispositions in Courts #2, 8, 17 may be examined to see which category of filings and dispositions are responsible. That is, the second layer of information is examined.

How can a current value be compared with the past history of such values to decide if it is unusual? One approach is to compare the current value with the average of the past 6 months and note it if it differs by more than some given percentage from this mean. For instance, if dispositions reported for divorce cases in August 1977 differ by more than 50% from the average of the prior 6 months' divorce dispositions, a check should be made.

The trouble with this approach can be seen by comparing two hypothetical past histories of monthly dispositions. Suppose that 70 divorce dispositions were reported by two jurisdictions in August 1977. Both past histories average 50 dispositions per month, so August's dispositions are 40% higher than usual for both. Compared with hypothetical History A, August's 70 dispositions are definitely a high value. But compared with hypothetical History B, with prior monthly dispositions of 80 and 95, August's value is certainly not unusually large.

Divorce Dispositions

1977

	Feb	March	April	May	June	July	Average
History A	50	40	60	55	45	50	50
History B	50	20	80	95	5	50	50

The difference is clear. Histories A and B have the same average number of monthly dispositions, but History B monthly dispositions fluctuate around its mean much more wildly than History A. When looking at the difference between the current value and the average of past readings, *the yardstick of whether the deviation is unusual or not is provided by how much values in the past have tended to deviate from the mean.* This past deviation from the mean is known as the *standard deviation*. To obtain the standard deviation for each history, the monthly deviations are squared and added; this sum is divided by the number of months (6) and the square root of the quotient provides the standard deviation.

Using the two Histories A and B, we have:

Deviations from the Average

1977

	Feb	March	April	May	June	July	Standard Deviation
History A	0	−10	10	5	− 5	0	6.5
History B	0	−30	30	45	−45	0	31.2

If August's value is 70, it deviates from the common average of 50 by 20 cases. Compared with History A, this is 3 times as large as the usual diviation. But compared with History B, this is less thant he usual deviation.

The rather simple idea that lies behind the first monitoring index is to measure the "unusuality" of any current value by the ratio:

$$\text{Unusuality Index} = \frac{\text{Deviation of Current Value from Average}}{\text{Standard Deviation from Average}}$$

Therefore, a current value of 70 gives History A an Unusuality Index (UI) of

$$UI = \frac{70 - 50}{6.5} = \frac{20}{6.5} = 3.1$$

With History B, the Unusuality Index is

$$UI = \frac{20}{31.2} = 0.6$$

The larger the Unusuality Index of any current value, the more suspicious the reported values. The question is, "What is the break-even point?" That is, which values of the Unusuality Index are acceptable and which are suspiciously high. To obtain an answer it is necessary to introduce the Chi-Squared Index:

$$\text{Chi-Squared} = (UI)^2$$

The Chi-Squared Index, being proportional to UI, is also a measure of how unusual a current value is.

A rule is adopted: A current value for divorce dispositions is suspicious if its Chi-Squared Index is greater than 6.6. The selection of the 6.6 value is based on statistical distribution theory, and is explained in the technical report.

However, what is desired is a single *overall rule* for determining if *all* dispositions (or filings or trials, etc.) are normal or abnormal in the current month. To do this, the "Chi-Squared Index for All Dispositions" is defined as the sum of the Chi-Squared Indices for the dispositions in all categories. In North Dakota, where there are seven categories, the Chi-Squared Index for Dispositions is the sum of the seven Chi-Squared Indices calculated for the current dispositions in each category. The "Chi-Squared Index for Filings" is similarly the sum of the individual Chi-Squared Indices for filings in the various categories.

Thus, for each court in the current month: A Chi-Squared Index can be calculated for all categories of filings, dispositions or any other event. How large these indices can get before they are suspect depends on the number of case categories used. The larger the number of case categories used, the higher the acceptable values of these indices will tend to be. On the basis of statistical distribution theory, for the seven North Dakota categories, the value 18.5 is a reasonable suspicion threshold; for the nine Colorado categories, the corresponding suspicion level is 21.7.

This gives a brief outline of the background of the Chi-Squared Indices. Computing and updating the various averages involved is a more technical matter and is deferred to the technical part of this report. What is of more concern to an administrator is how these indices may be used to monitor court behavior.

3.5 USING THE CHI-SQUARED INDEX

The June 1977 monthly summary for Courts #1, 2, 3, 4, 5, and 7 in Colorado is shown in Figure 1. Figure 2 is the April 1977 summary for all six district courts of North Dakota. Note: *This format will accommodate summaries of up to 25 courts on a single page.*

This is a graph of the Chi-Squared Index for Filings and Dispositions. The numbers labeling the upper line in this graph range between 0 and 30. For each court, two numbers are entered on the graph — the current Chi-Squared Index for Filings and that for Dispositions. The value for filing is

denoted by F on the graph, and the value for dispositions by D. Recall that the "suspicion level" for nine categories is 21.7. This is the reason for the vertical line going down the graph 22 units out from the baseline, in Figure 1. In Figure 2, which is part of the summary sheet for North Dakota, the line is fixed at 18.

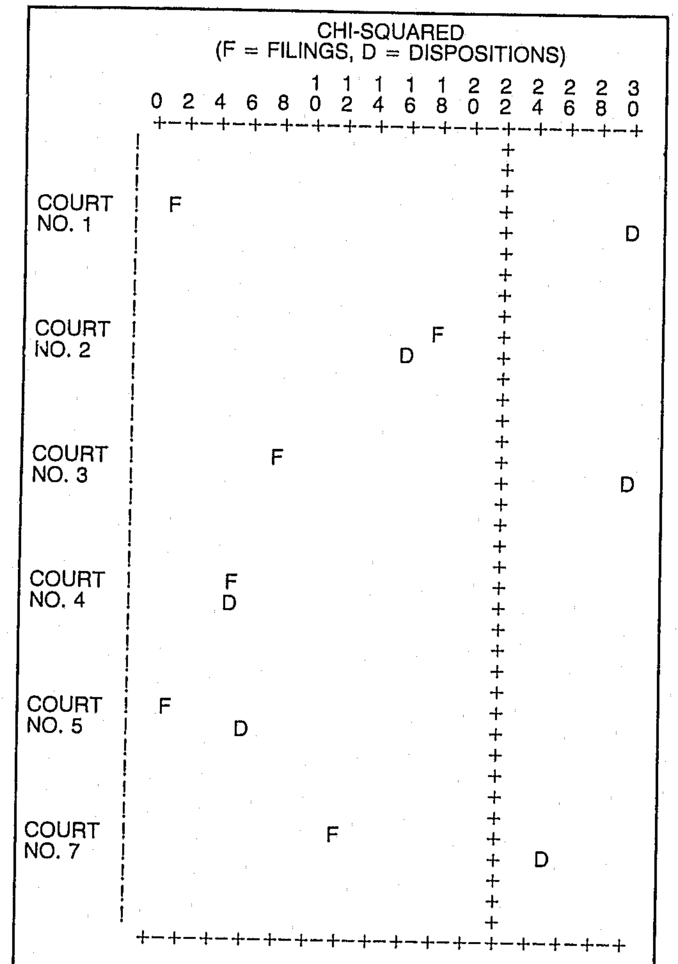


Figure 1. Colorado, June 1977

On Figure 1, three of the D or F values are outside of the "suspicion line." If June 1977 was the month just past and we were examining this summary, then this Chi-Squared graph says:

"The dispositions in Courts #1, 3, and 7 are suspicious. Have a closer look!"

Three suspect values is a bit high. For instance, in April 1977 (Figure 3) there are no suspect values. Over the last two years of data, Colorado averaged about two suspect values per month. In the last 13 months, North Dakota averaged about one suspect value every two months. Once the suspect values have been located, *then look at the secon layer of information regarding the suspect values.*

In the format used in this study and recommended for data validation, the first page (or pages, if there are more than 25 districts) is the summary. The second layer is a series of pages presenting the past history of filings and

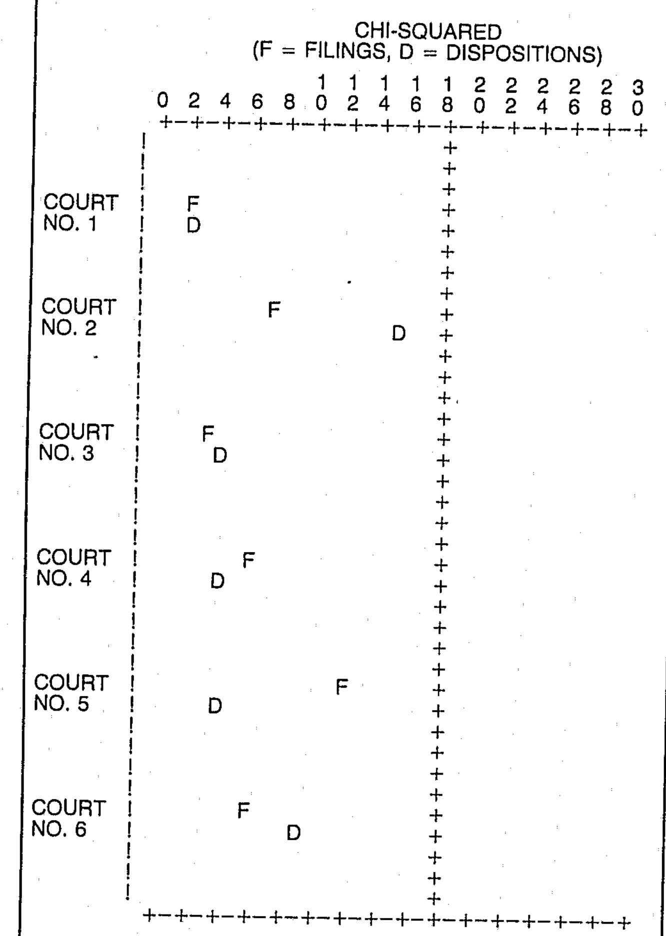


Figure 2. North Dakota, April 1977

dispositions by court. The first page of the second layer of information is a detailed look at the Chi-Squared Index for Filings for Court #1, the second page is a similar look at the Chi-Squared Index for Dispositions for Court #1 and so on for as many activities (trials, motion hearings, etc.) as are included. Since the first suspect value in the June 1977 Colorado data is for dispositions in Court #1, look at the disposition page for that court (Figure 4).

The graph plots the monthly values for the Chi-Squared Index for the last 24 months. Immediately underneath is a numerical summary of current values (June 1977) for each of the nine case categories. The values that are starred are values for which the Chi-Squared Index is greater than 6.6 — the critical value for a single category.

Looking at the Chi-Squared values by category, there are clearly two contributors to the large overall Chi-Squared value. One is CRPROP (Crimes Against Property) with a Chi-Squared value of 13.9, and the other is CROTH (Criminal-Other) with an Index of 18.1. Therefore, the suspect categories of dispositions are located.

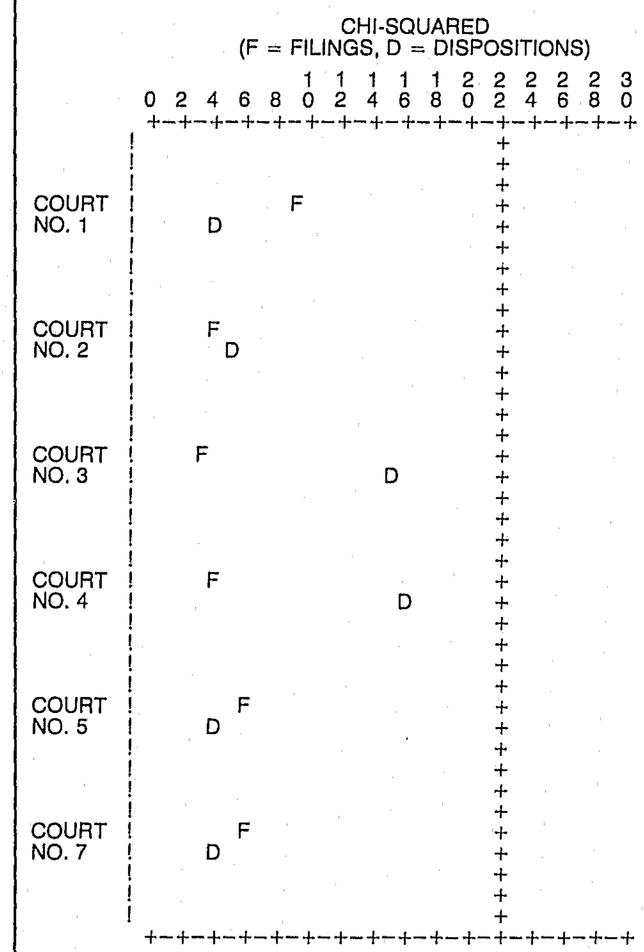


Figure 3. Colorado, April 1977

The next few lines give more specific information about the nature of the aberrant values. For instance, under CRPROP the values:

CRPROP	
CHI-SQ	13.9*
CURRENT	14
CUR. AV.	65.0
CUR. SD.	13.7

yield this information. The line labeled CURRENT is a count of the cases in the CRPROP category disposed of during the current month. The CUR. AV. is a weighted average of dispositions per month over the last six months. The CUR. SD. is the standard typical deviation of the past current values from the past current averages.

Inspecting these numbers, it is clear why the Chi-Squared value for dispositions of crimes against property is large. The average number of dispositions per month has been running at 65 (CUR. AV.) give or take around 14 (CUR. SD.). But the number of CRPROP this month is 14 (CURRENT), which is 51 cases fewer than normal, and close to four times the "typical deviation" from the average.

The dispositions of CROTH similarly are very low compared to CUR. AV. The lowness of CRPROP and CROTH suggests looking at CRPER. While this value is not starred, the CURRENT value of six is quite a bit below the CUR. AV. value of 16.8

For June 1977, Court #1 is suspiciously low in Criminal Case Dispositions, particularly in the CRPROP and CROTH categories. One possibility is missing judges, i.e., summer vacation. On the other hand, neither the Civil nor Domestic categories show any falling-off in dispositions. Another possibility is some sort of data failure. At this point, the Chief Clerk of Court #1 can be contacted, the situation explained, and the Clerk requested to track down the cause.

Similar analysis should be carried out for each of the other three suspect Chi-Squared values. For instance, suppose the almost-over-the-line Disposition Index in Court #2 of North Dakota is analyzed (Figure 2). Figure 5 is the Disposition Summary. There is one contributor to the large Chi-Squared value, CVPROP (Civil-Property). This time the problem is a bit different. CVROP dispositions have been averaging six per month. This month they are down to one disposition. This seems to be unusual, so the third level of data further down on the page is checked.

The next 11 rows of numbers give the dispositions, by category and total Criminal, Civil, and Domestic, over all months for which data is available. The stars again indicate values for whichthe Chi-Squared Index is larger than 6.6. The four months in 1977 have two out of the four dispositions of CRPROP starred. There seems to have been a systematic drop in CRPROP dispositions beginning in 1977.

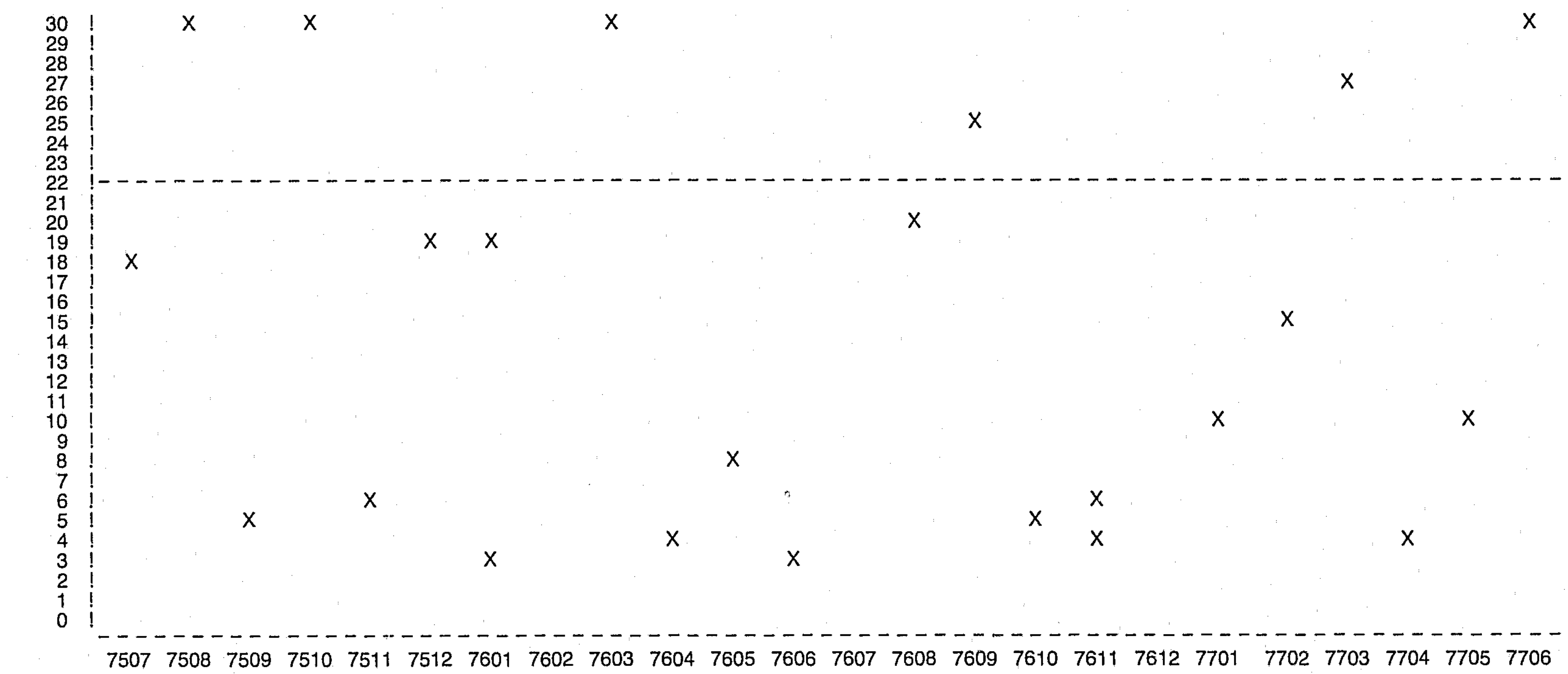
If a court undergoes an abrupt, and more or less permanent, change in its level of activity, this causes a sequence of suspect Chi-Squared values. For instance, Figures 6 and 7 give the filings and dispositions for Colorado Court #7. Notice that, in March 1976, the filings in Category DMOTH (Domestic, Other) rose abruptly and stayed at a level considerably higher than the prior months. In response, a month later the dispositions in this category increased significantly. This caused high Chi-Squared values for three months, and then stopped. The reason is that after three months of consistently high or consistently low values, the average is readjusted to the new level.

Therefore, on these pages a sequence of three starred values may indicate a sharp and fairly permanent change in level of activity. For instance, in Court #4 (Fig. 8) there is a sequence of three stared values in filings of CVMON (Civil-Money) cases starting November 1975. This clearly heralds a systematic drop of monthly filings in this category.

3.6 MONITORING A REPORTING SYSTEM

It is not enough to call a court and get a corrected value, make the chnge and move on. Valuable information is lost. The nature of the error should be discovered; because it says something about the reporting system; it was a counting error; the clerks don't understand the reporting instructions; new clerical personnel are reporting. These and other reasons snould be discovered and recorded because the reasons for reporting errors are the most important part of the validation process.

COURT #1 DISPOSITIONS

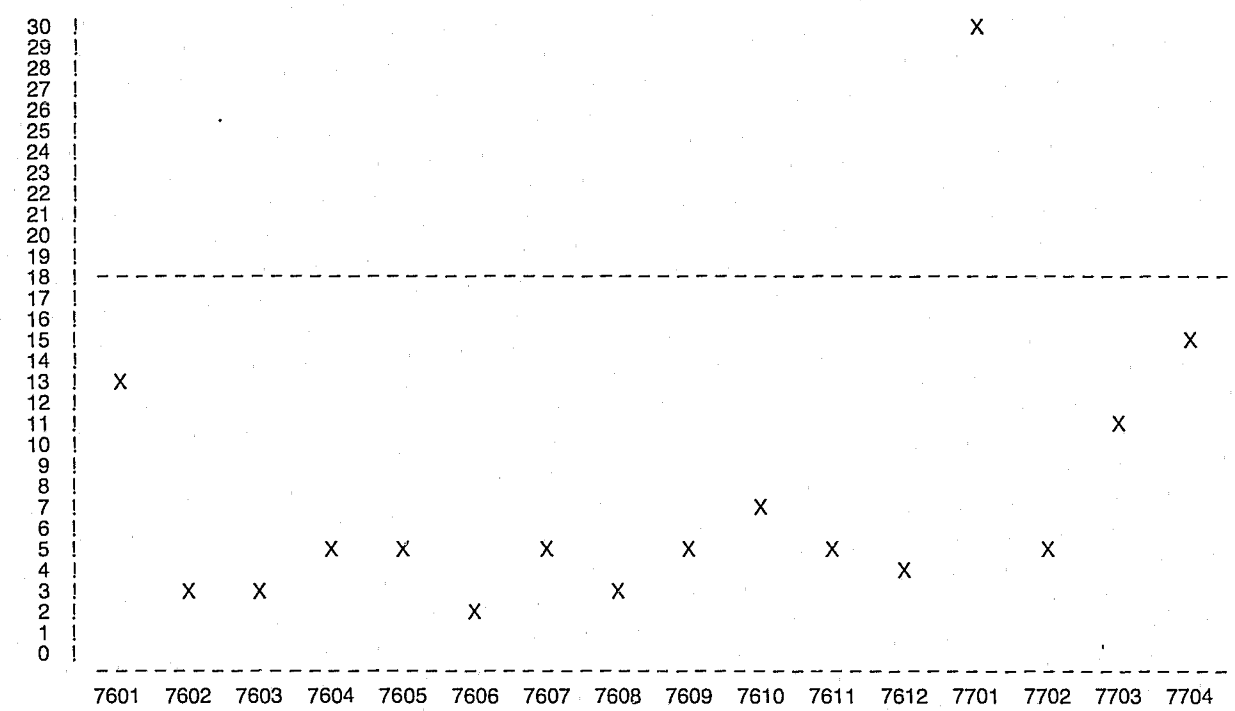


	CRIMINAL			CIVIL				DOMESTIC	
	CRPER	CRPROP	CROTH	CVMON	CVNEG	CVPROP	CVOTH	DMDISS	DMOTH
CHI-SQ	2.8	13.9*	18.1*	0.5	0.1	0.0	0.4	0.4	0.0
CURRENT	6	14	13	431	106	134	105	300	141
CUR. AV.	16.8	65.0	63.4	394.1	104.4	137.2	95.1	384.6	136.4
CUR. S.D.	6.5	13.7	11.9	54.8	6.6	27.7	15.5	131.9	21.6

	7507	7508	7509	7510	7511	7512	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	7705	7706
TOT. CRIM.	212	150	191	179	157	200	179	143	199	200	145	184	159	115	126	148	143	141	177	124	162	160	117	33
CRPER	35	19	23	16	21	25	20	24	27	27	18	29	21	16	9	17	14	28	18	16	22	19	16	6
CRPROP	72	66	83	87	74	79	79	53	80	82	50	72	70	45	61	56	66	56	88	51	76	73	53	14*
CROTH	105*	65	85	76	62	96	80	66	92	91	77	83	68	54	56	75	63	57	71	57	64	68	48	13*
TOT. CIVIL	796	736	776	745	701	713	732	585	823	730	664	667	659	650	616	732	813	693	665	624	964	771	742	776
CVMON	486	438	467	459	392	381	391	307	442	388	330	323	336	342	314	394	448	384	365	339	558*	390	450	431
CVNEG	106	84*	104	98	105	81*	100	81*	138*	110	112	106	98	80*	75*	108	113	107	89*	84*	128*	99	98	106
CVPROP	132	140	144	111	109	179	152	118	139	131	132	157	165	159	139	132	149	104	130	124	172	175	96	134
CVOTH	72	74	61	77	95	72	89	79	104	101	90	81	60	69	88	98	103	98	81	77	106	107	98	105
TOT. DOM.	790	878	743	872	545	983	921	836	788	776	579	591	529	690	482	435	593	511	533	461	581	480	426	441
DMDISS	665	628	612	618	451	850	787	677	637	624	417	642	464	527	360	337	454	351	399	322	433	324	326	300
DMOTH	125	250*	131	254*	94	133	134	159	151	152	162	149	65*	163	122	98	139	160	134	139	148	156	100	141

Figure 4. Colorado. June 1977

COURT #2 DISPOSITIONS

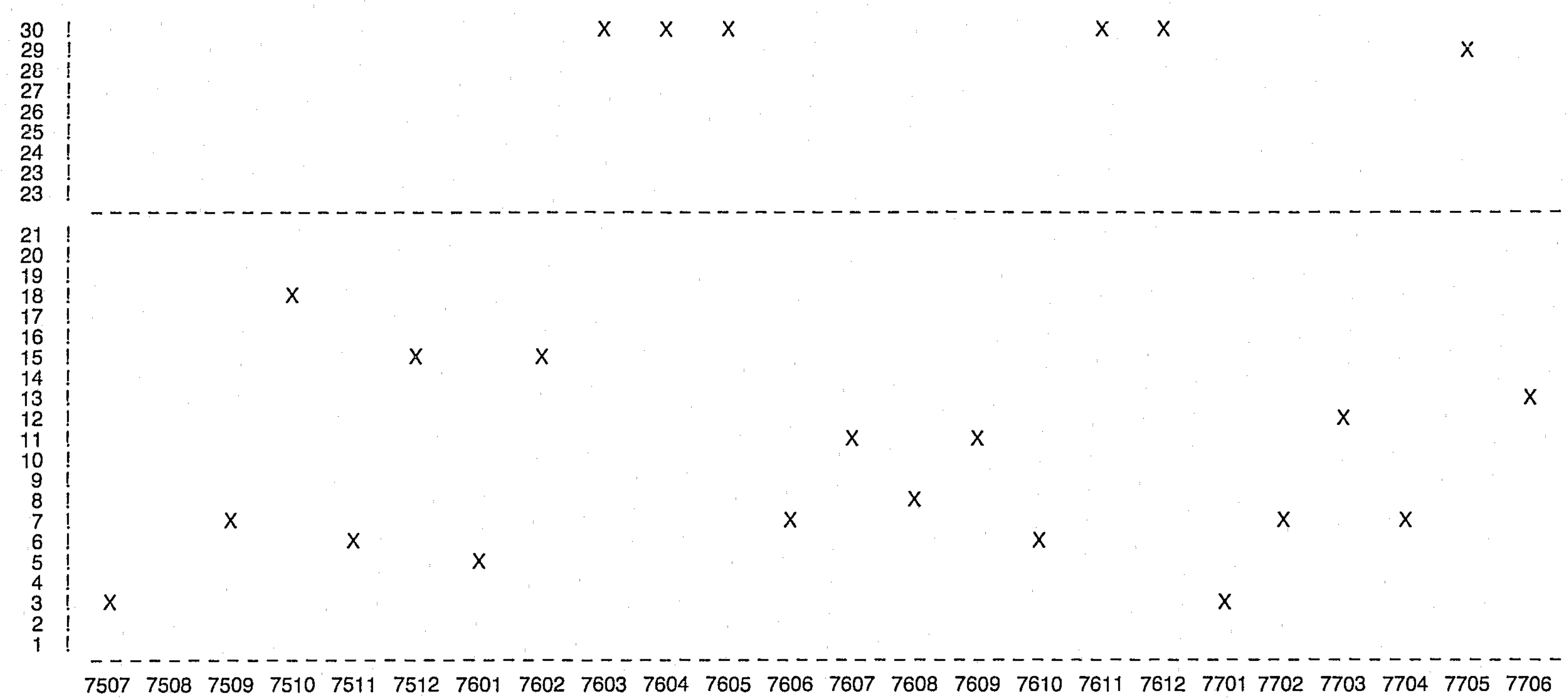


	CRIMINAL	CIVIL				DOMESTIC	
	TOTCRM	CVDMGS	CVDEBT	CVPROP	CVOTHR	DIVRCE	DMOTHR
CHI-SQ	0.7	0.3	0.3	12.2*	1.8	0.0	0.1
CURRENT	6	6	36	1	5	19	11
CUR. AV.	13.0	5.9	32.0	6.0	2.8	19.4	12.0
CUR. S.D.	8.3	2.8	7.1	1.4	1.6	6.3	2.7

	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704
TOT. CRIM.	12	5	16	16	9	22	6	3	6	13	26	20	23	12	11	6
TOTCRM	12	5	16	16	9	22	6	3	6	13	16	20	23	12	11	6
TOT. CIVIL	43	55	59	36	33	48	33	36	49	48	46	51	50	47	60	48
CVDMGS	6	9	11	2	2	5	3	6	5	10	10	7	6	4	4	6
CVDEBT	32	39	39	25	23	36	19	23	38	28	28	32	37	33	51*	36
CVPROP	4	5	7	8	7	6	8	6	4	6	6	8	1*	5	5	1*
CVOTHR	1	2	2	1	1	1	3	1	2	4	2	4	6*	5	0	5
TOT. DOM.	15	27	33	36	35	34	32	38	43	35	24	34	20	31	34	30
DIVRCE	13	15	25	27	19	24	19	27	33	18	13	23	10	16	21	19
DMOTHR	2*	12	8	9	16	10	13	11	10	17	11	11	10	15	13	11

Figure 5. North Dakota

COURT #7 FILINGS

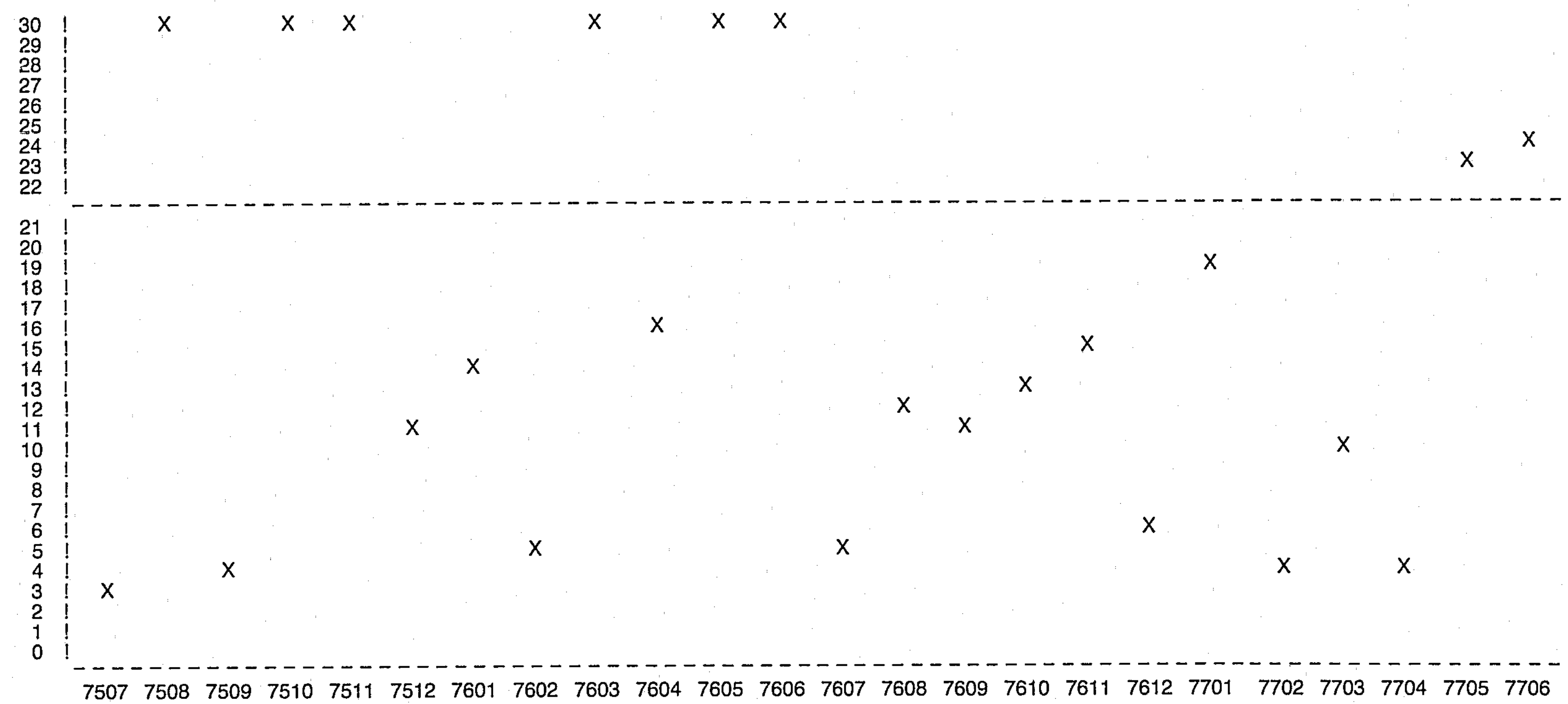


	CRIMINAL			CIVIL				DOMESTIC	
	CRPER	CRPROP	CROTH	CVMOM	CVNECT	CVPROP	CVOTH	DMDISS	DMOTH
CHI-SQ.	0.0	2.4	0.2	0.1	6.8*	1.4	0.7	0.6	0.1
CURRENT	6	7	7	50	31	32	14	124	64
CUR. AV.	5.9	14.6	9.5	53.7	17.7*	24.6	17.7	134.4	66.6
CUR. S.D.	2.4	4.9	5.9	13.3	5.1	6.3	4.6	13.8	6.7

	7507	7508	7509	7510	7511	7512	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	7705	7706
TOT. CRIM.	45	45	47	54	45	41	55	36	38	45	35	33	21	18	31	43	21	23	32	37	32	29	33	20
CRPER	6	9	9	7	3	8	10	3	7	8	5	9	7	3	3	6	3	5	7	11	5	4	6	6
CRPROP	16	23	13	22	17	18	23	19	19	18	26	17	10	11	20	28	8	15	11	18	15	15	20	7
CROTH	23	13	25	25	25	15	22	14	12	19	4	7	4	4	8	19	10	3	14	8	12	10	7	7
TOT. CIVIL	119	122	108	141	95	75	109	108	159	123	110	106	109	113	112	113	94	101	111	83	117	125	178	127
CVMON	60	66	62	87	53	38	54	50	77	60	53	38	53	40	51	59	40	45	62	40	51	56	69	50
CVNEG	19	10	11	22	13	6	11	12	18	12	17	16	23	18	13	17	8	16	13	15	25	19	22	31
CVPROP	19	17	11	20	16	13	21	34*	45*	27	24	24	21	33	30	23	29	23	18	15	24	27	67*	32
CVOTH	21	29	24	12	13	18	23	12	19	24	16	28	12	22	18	14	17	17	18	13	17	23	20	14
TOT. DOM.	159	152	153	186	158	121	170	154	184	227	200	216	232	214	241	172	159	156	211	212	228	210	189	188
DMDISS	134	115	133	160*	131	93*	139	119	139	136	129	143	151	138	169*	109	126	118	138	143	166*	154	141	124
DMOTH	25	37	20	26	27	28	31	35	45*	91*	71*	73	81	76	72	63	33*	38*	73	69	62	56	48*	64

Figure 6. Colorado

COURT #7 DISPOSITIONS

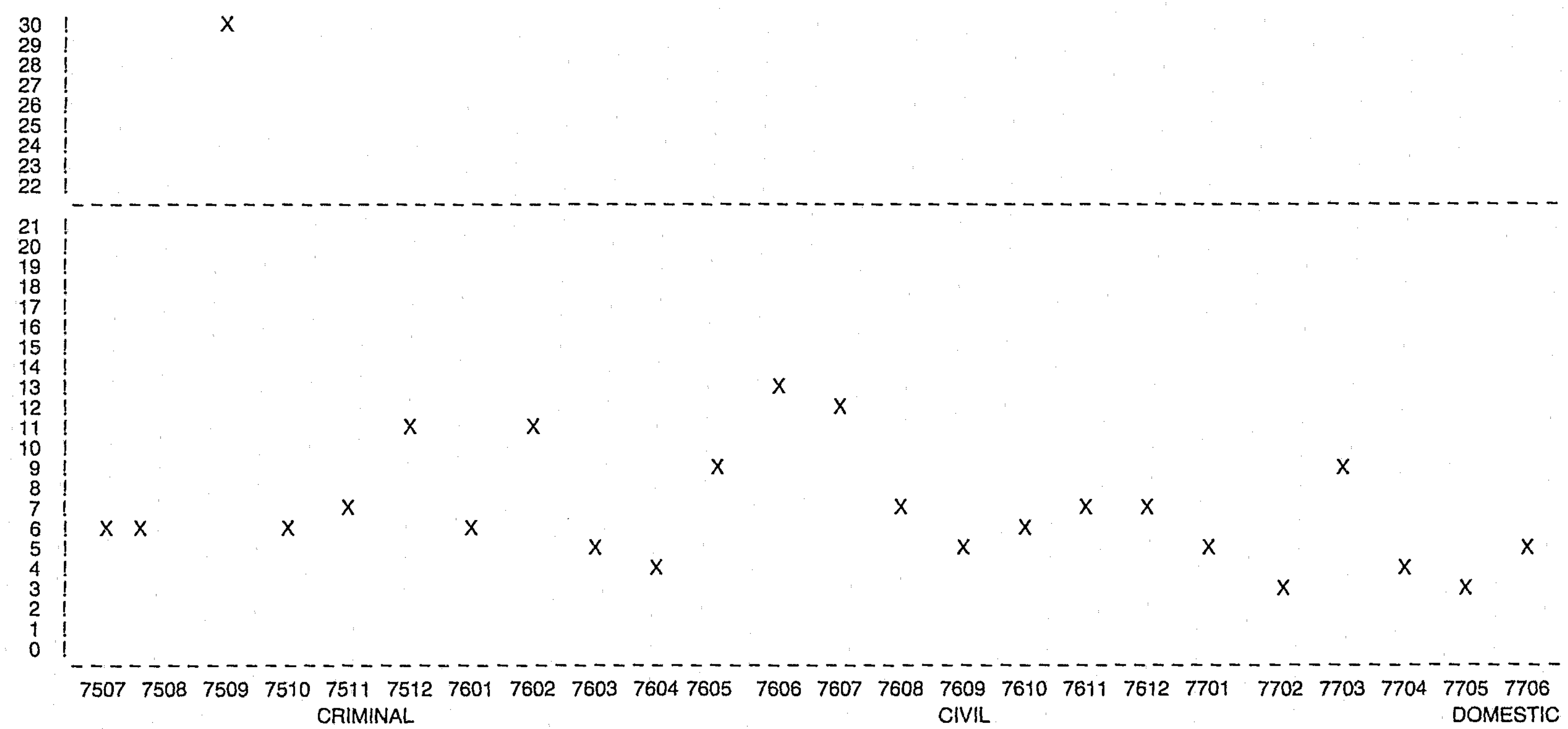


	CRIMINAL			CIVIL				DOMESTIC	
	CRPER	CRPROP	CROTH	CVMON	CVNEG	CVPROP	CVOTH	DMDISS	DMOTH
CHI-SQ	1.4	0.3	2.4	0.0	0.1	20.0*	0.4	0.7	0.3
CURRENT	2	14	7	64	13	55	25	135	59
CUR. AV.	6.9	16.6	16.3	60.9	14.1	24.5	20.4	120.9	53.1
CUR. S.D.	4.1	5.1	6.0	15.3	4.4	6.8	7.4	17.0	11.5

	7507	7508	7509	7510	7511	7512	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	7705	7706
TOT. CRIM.	35	34	40	33	43	56	28	35	72	44	54	34	47	38	36	55	56	38	39	29	49	45	46	23
CRPER	5	7	3	10	10	12	2	2	7	8	9	4	9	2	2	12	8	7	10	3	11	7	11	2
CRPROP	14	11	13	11	16	18	13	18	35*	20	18	14	23	21	21	22	29	21	9	16	12	19	15	14
CROTH	16	16	24	12	17	26	13	15	30*	16	27	16	15	15	13	21	19	10	20	10	26	19	20	7
TOT. CIVIL	129	90	110	203	126	75	83	90	120	99	145	109	118	174	85	149	100	80	103	126	127	138	150	157
CVMON	77	41	57	121*	69	37	45	43	55	49	77	47	56	80	34	69	47	33	50	69	70	74	63	64
CVNEG	8	17	11	24	9	12	15	16	12	9	13	16	19	20	13	28*	7	16	18	10	17	12	16	13
CVPROP	20	12	17	26	24	14	17	23	34	26	34	26	22	39	25	38	29	19	23	16	15	25	54*	55*
CVOTH	24	20	25	32	24	12	6	8	19	15	21	20	21	35	13	14	17	12	12	22	25	27	17	25
TOT. DOM.	139	340	145	209	254	116	179	159	105	133	205	169	161	190	193	191	148	151	247	180	176	156	164	194
DMDISS	121	308*	121	132	224*	93	132	128	81	79	140	96	108	135	107	129	115	99	185*	114	128	115	132	135
DMOTH	18	32	24	77*	30	23	47*	31	24	54*	65*	73*	53	55	86*	62	33*	52	62	66	48	41	32	59

Figure 7. Colorado

COURT #4 FILINGS



	CRPER	CRPROP	CROTH	CVMON	CVNEG	CVPROP	CVOTH	DMDISS	DMOTH
CHI-SQ.	1.1	0.3	0.8	0.3	0.1	0.2	0.0	0.6	2.1
CURRENT	29	66	27	109	20	48	21	247	121
CUR. AV.	23.3	73.0	34.6	99.4	21.5	53.7	21.2	229.0	100.5
CUR. S.D.	5.5	13.6	8.7	17.5	5.0	13.5	5.3	23.1	14.1

	7507	7508	7509	7510	7511	7512	7601	7602	7603	7604	7605	7606
TOT. CRIM.	158	139	171	124	143	147	128	142	129	121	126	140
CRPER	21	24	34*	19	18	30	22	20	15	27	23	37*
CRPROP	72	70	90*	59	77	81	79	77	61	53	69	63
CROTH	65	45	47	46	48	36	27	45	53	41	34	40
TOT. CIVIL	242	238	230	204	195	198	196	196	218	193	171	180
CVMON	130	137	126	113	101	104	111	72*	113	102	72*	97
CVNEG	21	24	25	21	21	18	21	24	25	18	18	15
CVPROP	61	61	61	51	55	51	41	74	56	47	60	42
CVOTH	30	16	18	19	18	25	23	26	24	26	21	26
TOT. DOM.	311	314	389	351	331	273	337	294	369	317	329	330
DMDISS	203	207	257	253	227	194	255	193	251	217	242	234
DMOTH	108	107	132*	98	104	79	82	101	118	100	87	96

	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	7705	7706
TOT. CRIM.	139	157	152	123	130	133	172	118	144	104	144	122
CRPER	35*	27	28	25	19	15	25	18	35*	19	27	29
CRPROP	70	93	91	65	72	81	103	69	76	54	81	66
CROTH	34	37	33	33	39	37	44	31	33	31	36	27
TOT. CIVIL	164	165	179	201	168	187	189	194	215	210	184	198
CVMON	92	85	96	84	73	105	83	83	95	109	104	109
CVNEG	17	18	25	34	25	25	25	25	23	19	16	20
CVPROP	39	43	40	56	61	41	53	63	74	58	46	48
CVOTH	16	19	18	27	9	16	28	23	23	24	18	21
TOT. DOM.	338	359	334	308	286	313	318	290	341	329	327	365
DMDISS	248	247	248	227	196	189	224	208	232	236	231	247
DMOTH	90	112	86	81	90	12	94	82	109	93	96	121

Figure 8. Colorado

The history of these reasons for reporting errors become the basis of specific staff recommendations to administrators. For example, the same mistake made by most or all of the courts can indicate problems with reporting instructions. A repeated mistake, unique to only one court, probably indicates the need for some on-site clerical training. The same mistake repeated after training may indicate an atmosphere of indifference about reporting, which might call for more and wider training or a letter to the clerk laying out the importance of reporting. This accumulation of experience, summarized and reported monthly to the proper authority, with some kind of a recommendation for action, is the real point of data validation. This is monitoring the reporting system.

On the other hand, if the shift is not erroneous reporting but is some real, short-term drastic phenomenon, then the information should be forwarded to an administrator for some kind of follow-up. At least, questions such as "Is there an absence on the bench; does the court need temporary assistance?" need to be asked. The kind of usual questions that flow from extreme short-term changes in reported data. Whether the data is in error or the change is real, this kind of a validation process notifies an administrator of a problem.

3.7 DATA QUALITY AND SYSTEM TYPE

At the present time there are three different kinds of state judicial information systems that are functioning in the states. There are aggregate systems such as found in California. During each month clerks tally the number of several events, such as filings, by a few rough categories. At the end of the month, the tallies are transferred to a form and sent to the administrative office. So, basically, each month perhaps 50 totals are sent to administration from each court. Then, there are forms-based case tracking systems based on batch processing, wherein sections of a multi-part form are submitted after certain milestones in a case, are entered and batch processed. Finally, there are the on-line systems, such as Colorado's, that are primarily used for trial court operations such as calendaring and notification, with management information extracted as required. In other words, the primary function is assisting the operation of a court and the administrative office strips off statistical information. It is tempting to believe that data quality can be upgraded by moving to a complex system such as this. However, the more complex a system, the more expensive the effort to get high quality data.

There are trade offs between the different kinds of systems. The trade offs are basically among the amount of information, the types of data errors, the cost of producing good data and the amount of auditing and training that are necessary to operate the system.

First of all, the aggregate systems yield the least amount of information. They give totals such as number of cases filed by categories, number of disposals, cases pending, perhaps cases awaiting trial, and so on. A system such as this requires a fairly simple reporting manual. A case by case tracking system based on forms and batch processing such as in North Dakota, provides information about each case, individual dates of filing, individual dates of disposition, type of judgment, jury or judge trial, and so on. This type of system requires a reporting manual that includes a code book containing a manageable number of codes for different types of events. An on-line operational system such as the one in Colorado requires a code book consisting of many hundreds of words, and the amount of information entered is enormous. The data base may maintain a record for every event and every participant in every case with code words for each. The plus side of such a system is that it will provide hundreds of times as much information in any particular case as the other two system types.

The ease of data processing goes down drastically as system complexity increases. An aggregate system may require nothing more complex than an adding machine. A batch processing system, however, requires that all cases be entered onto a computer. So the batch system requires a computer installation, programs and data entry personnel. Finally, in an on-line system, data retrieval problems become significant. For each case an enormous file must be searched to strip off the desired management information. This requires fairly sophisticated programs that sift through each case file, isolate and retrieve the required management information.

The cost of producing clean data increases with system complexity. The steps from aggregate to case tracking to on-line require corresponding cost increases to produce clean data. An on-line system contains hundreds of data elements and each must be checked for validity.

Finally, there are characteristic errors found in the various systems. In an aggregate system, events are missing, misreported or inflated. Comparisons with the past and field audits are the tools for data validation. In a forms-based case by case system, once the initial form is filed, the case cannot be lost. Edits on the logic of the sequence of entries and monitoring times between events are data validation tools once the case is entered. Since the number of code words is manageable, reporting incorrect codes is not an insurmountable problem and surfaces most frequently when new clerks first begin reporting. As with the aggregate system, on-site audits are required to find cases never entered into the system. With an on-line system providing support to court operation, there are usually no missing cases. As with a batch system, the errors will be lack of completeness, namely, internal events missing, incorrect coding, or non-uniorm coding. However, clerks that report to large systems with hundreds of codes often use pet systems of coding. Clerks cannot memorize all of the codes, so rather than constantly refer to a code book they will select a small subset of the codes and use those over and over again, even if they are not always the correct codes. So, field auditing is necessary and requires a check between the files and the recorded data. An on-going auditing effort is also required to observe the clerks actually coding. To summarize, the more complex the system the:

- more management information provided;
- more the cost of retrieving the information;
- more costly and difficult data validation becomes.

4. MONITORING WORKLOAD

4.1 INTRODUCTION

The Chi-Squared Index provides a warning of any unusual changes in reported data. An index to detect more gradual changes and to describe how well the courts were coping with their workload was also proposed as part of this study. This index should also be a rough measure of how fast cases are being processed by the courts. The two concepts are related in that the more pending caseload increases, the longer it will take to dispose of an entering case.

4.2 THE PROBLEM OF COMPARING COURTS

Various indices have bee proposed in the literature; for instance, the median pending time or the 90th percentile of the pending times. The latter is obtained by starting with the longest time a case has been pending, then the second-longest, and so on until a tenth of the cases have been ranked i.e., if there are 200 pending cases, then the 20th-longest pending time is the 90th percentile value. These indices were tested on the North Dakota data and were rejected on two grounds:

First, they fluctuated too much from month to month, and Second, their meaning could not be easily interpreted in concrete terms.

Referring to the second point: Suppose that the 90th percentile pending time was eight months. Given that a case is filed today, how can the above be interpreted in terms of how long it will take for this case to be processed by the court?

Another reasonable requirement of a good index is that it does not depend directly on the size of a court. For instance, if total cases pending was used as an index, a larger court would generally have a much larger Index than a small court. At the same time, the larger court could be disposing of cases more quickly. For this reason, many states, in their annual reports, have gone to "per-judge" values. That is, dispositions are given as dispositions per judge; pendings as pendings per judge, etc. There is some difficulty in this approach.

First of all, the conditions in which the courts work may vary. In the rural areas, a district judge may travel over a wide circuit and sit in a number of counties, resulting in a lower disposition-per-judge figure.

The case mix may differ from court to court. In order to correct for this possibility, some states have gone to weighted caseload indices. Other states claim that the difference in mix washes out statistically and simply use the total caseload. When as part of this study, the weights developed by the National Center for Washington State were applied to raw filings for North Dakota, a .98 correlation between the weighted and unweighted filings was obtained. Consequently, no attempt was made to deal with this complicated issue. Instead, by developing an index that would not be too sensitive to differences in case mix, it was hoped that the issue of weighting could be avoided.

Another difficulty with the per-judge approach is that, *from a monitoring point of view, it does not say whether something is going wrong in the court.* To some extent, courts seem to adjust to their caseloads. The larger courts generally have higher per-judge filings, but also higher per-judge dispositions. Smaller courts can have lower per-judge filings and dispositions, and still have higher per-judge cases pending than the higher volume courts.

Even pending cases per judge does not give an effective summary. In courts that have a higher disposition rate per judge, more cases are processed per judge and a higher cases pending per judge does not necessarily imply a longer time to disposition.

Even with these disadvantages, the per-judge statistics have the advantage that they give numbers that are comparable between courts, regardless of their size. A boundry condition of this study was, that any index would also have to have this feature of court-to-court comparability.

4.3 AN INDEX FOR MONITORING WORKLOAD

As this study progressed one index seemed to have more desirable properties than any other that was examined. This is called the BACKLOG index which is defined as:

$$\text{BACKLOG} = \frac{\text{Number of Cases Pending}}{\text{Average Current Dispositions per Month}}$$

BACKLOG is expressed in months. It can be interpreted as the number of months it would take the court to work off the number of cases currently pending if the current disposition rate was maintained. That is, suppose no more new cases were filed and the court worked only on cases currently pending. The number of months it would take to dispose of all pending cases is the BACKLOG value. For instance, if there are 150 cases pending, and the current disposition rate is 50 cases per month, then the BACKLOG is three months.

The BACKLOG statistic was discovered in the literature early in the project. As part of the analysis of service time, or delay, times from filing to disposition were analyzed and a simple theoretical model for court filings and dispositions was constructed. In this model, some uncomplicated calculations led to the conclusion that *the average time from filing to disposition is exactly equal to BACKLOG.* This led to further consideration and the eventual decision that BACKLOG was the best overall summary index of the type that was wanted.

Because of their differing nature and with different levels of concern for speedy trial, BACKLOG Indices were computed for the Criminal, Civil, and Domestic categories.

4.4 USING THE BACKLOG INDEX

As pointed out above, the BACKLOG index is a measure of two things:

First, how many months of work a court has hanging over its head is pending cases, and

Second, the average time it takes a case to be processed by the court.

The index can change in two ways: the number of cases pending can change, or the average current disposition rate can change. The BACKLOG Index is not designed to pick up an abrupt one-month change. This is done by the Chi-Squared Index. With BACKLOGs, more systematic trends over a period of several months are sought. BACKLOG indicates situations in which filings have begun to outdistance dispositions, the disposition rate has systematically dropped, and so on. In particular, any large increases in BACKLOGs should be detected.

Refer to Figure 9. The first layer, one page summary, has been expanded from Chi-Squared only to include the BACKLOG index calculated for the three general case categories under consideration. This summary sheet for courts in the suggested format gives the *changes* in Criminal, Civil, and Domestic BACKLOGs over the last three months. Scanning these bar graphs, will quickly reveal any courts with a significant increase in BACKLOG. The level at which administrators want to do further checking is at their own discretion. The rough rule-of-thumb used during the study was that any increase of two or more months should be investigated. For instance, looking at Figure 9, the summary sheet for Colorado in June 1977. The only suspect value, by the rule of thumb, is the increase of over two months in Criminal BACKLOG in Court #1.

To investigate this, the second layer of information is examined. For each court, there is a graphical printout of each of the three BACKLOGs followed by a numerical summary.

The page giving the Criminal BACKLOG for Court #1 is on Figure 10.

The axis of the graph on the left-hand side is in months. The BACKLOG has been steadily rising since June 1976, with a more rapid rise in the last few months of 1976.

The graph consists of a darker portion filled with X's and a lighter portion filled with dots. The height of the dotted portion of the graph is called the SIX-MONTH BACKLOG which equals:

$$\frac{\text{Number of Cases Pending Less than 6 Months}}{\text{Current Average Dispositions per Month}}$$

The height of the portion filled with X's is therefore the BACKLOG of work in those cases that have been pending six or more months, or the time it would take to dispose of criminal cases pending six or more months.

In Court #1, the SIX-MONTH BACKLOG has remained fairly constant. The problem has been the rapid increase in cases pending for six or more months. The two bottom lines of numbers under the graph give the values of the SIX-MONTH BACKLOG and the total BACKLOG. The BACKLOG in cases pending six or more months is the difference of the two.

The growth in total BACKLOG from 14.3 in 7606 (June 1976) to 21.8 in 7706 (June 1977) is concentrated in a rise of 3.0 months in 7606 to 7609 and a rise of 2.2 months in 7704 to 7706.

The other numerical data helps in further tracking down the cause of the rise. The first two lines give filings and current average filings. One possible reasons for a BACKLOG increase is a systematic increase in filings. Compare the filings for the period in question with the current averages to see if this is the case. For 7704 to 7706 these number are:

	7704	7705	7706
Filings	188	165	191
Cur. Av.	196	191	191

The filings, if anything, are slightly below normal. The next two lines list similar data for dispositions:

	7704	7705	7706
Disps.	160	117	33
Cur. Av.	153	147	147

The problem, clearly, is with the unusually low dispositions in 7705 and 7706, respectively.

Looking at the situation in 7606 to 7609:

	7606	7607	7608	7609
Filings	172	201	212	184
Cur. Av.	201	201	203	200
Disps.	184	159	115	126
Cur. Av.	177	174	164	158

Again, the cause for the increase in BACKLOG is dropping dispositions. A close examination of disposition data, shows the drop in dispositions over these summer months is a permanent shift. The current average number of dispositions went from around 180 per month before 7606 to about 150-155 after 7609. The fillings gradually drop over the two-year period, but not enough to offset the drop in dispositions.

Re-examining the summary sheets, there are no increases greater than two months until December 1976, when Court #2 shows an almost four-month increase in Criminal BACKLOG and Court #3 has a 2+ month increase in Civil BACKLOG (Figure 11). The second layer indicates that the problem in Court #2 was caused by a three-month stretch of low dispositions.

The BACKLOG graphs for both states are revealing. In both instances, there are many courts that have a marked increase in BACKLOG over the summer-vacation months. In fact, Figure 12, which is the North Dakota summary sheet for September 1976, shows that in all but one of its district courts, the Criminal BACKLOGs have increased over July, August and September by more than two months. In some of these courts, the judges, probably refreshed by their vacations, worked harder on their return and the BACKLOG was reduced yet there remains a permanent marginal increase (Figure 14).

When one recalls that BACKLOG is a measure of the average disposition time, then an increase in BACKLOG of two months is an event that should be taken seriously by state court administration.

In Colorado, SIX-MONTH BACKLOG for Criminal cases was computed because this was the critical time for Criminal cases as set by that state. TWELVE-MONTH BACKLOGs for Civil cases and SIX-MONTH BACKLOGs for Domestic cases also were computed.

In North Dakota, where the goal had been set of disposing of Criminal cases in less than four months, FOUR-MONTH BACKLOGs for Criminal and Domestic, and 12-MONTH BACKLOGs for Civil were calculated. The point is, to have separate values and graphical displays for those cases whose pending times are less than the figure that state court administration considers critical, and those cases that are considered "over-aged."

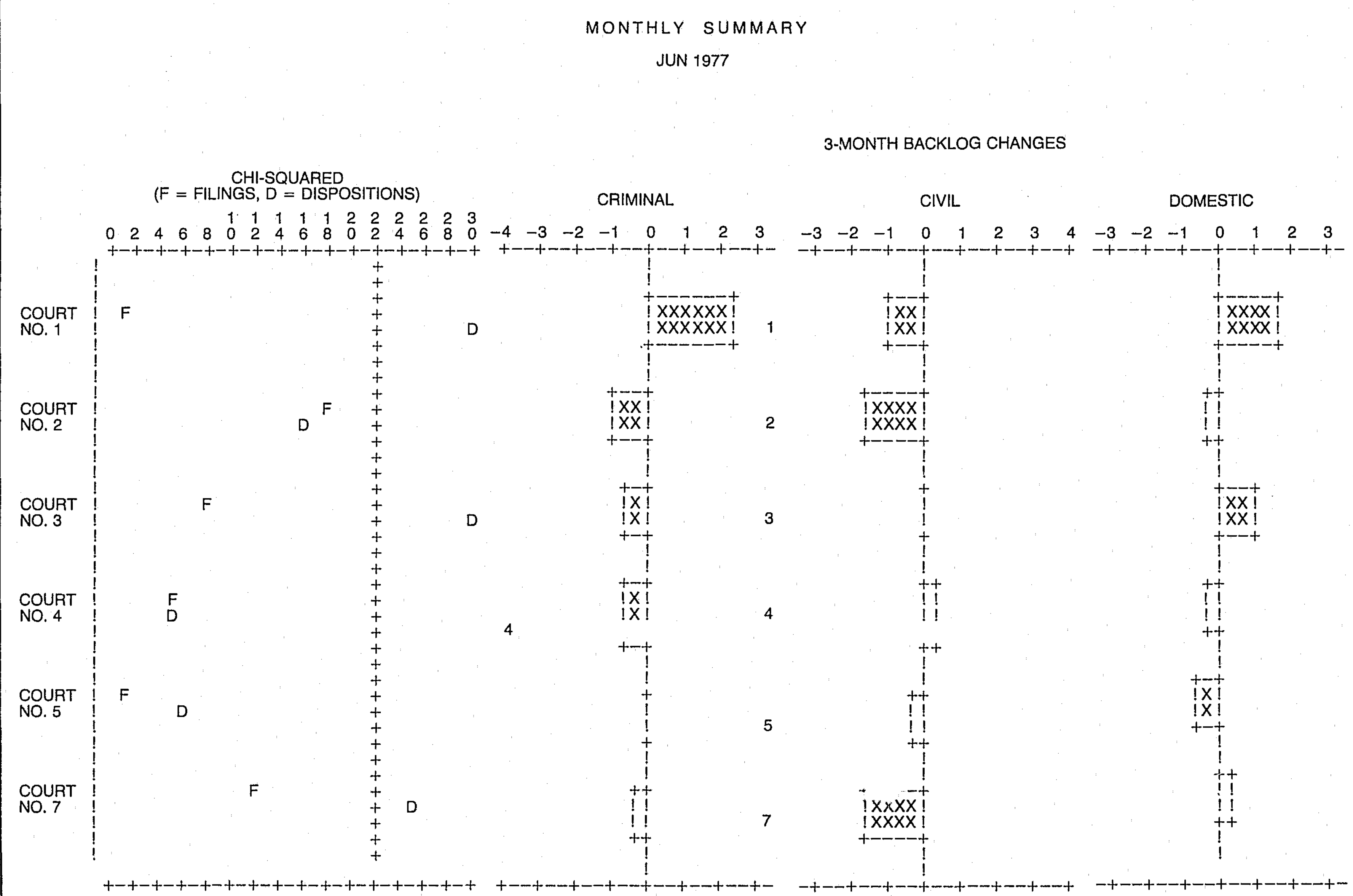
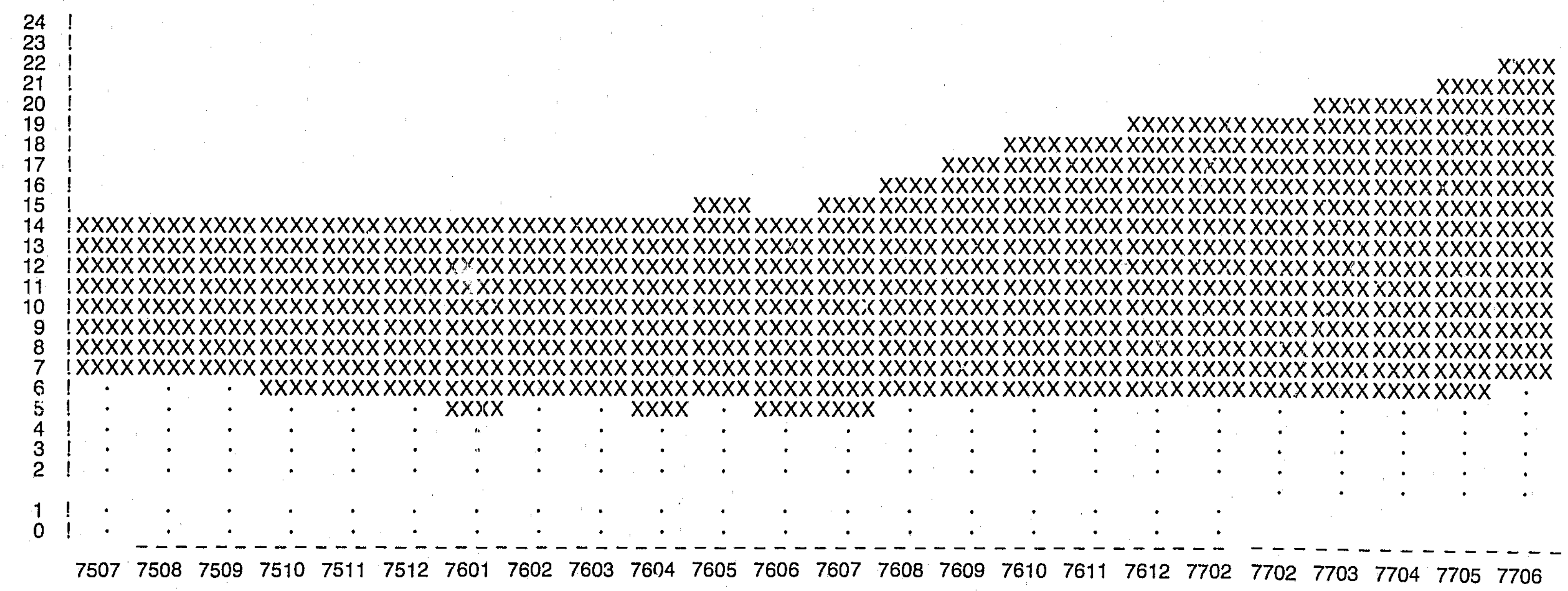


Figure 9. Colorado

COURT #1 CRIMINAL BACKLOGS



CRIMINAL CASE SUMMARY

	7507	7508	7509	7510	7511	7512	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	7705	7706
FILINGS	225	110	253	231	173	217	171	189	230	201	204	172	201	212	184	225	180	197	194	170	215	188	165	191
CUR. AV.	217.	217.	223.	224.	216.	216.	208.	205.	209.	208.	207.	201.	201.	203.	200.	204.	200.	200.	199.	194.	197.	196.	191.	191.
DISPS.	212	150	191	179	157	200	179	143	199	200	145	159	115	126	148	148	143	141	177	124	162	160	117	33
CUR. AV.	162.	160.	165.	167.	166.	171.	173.	168.	173.	177.	172.	177.	174.	164.	158.	155.	153.	151.	155.	150.	152.	153.	147.	147.
PEND LE 6	1119	1059	1076	1031	979	955	908	968	968	932	949	891	913	957	953	973	951	958	928	922	947	922	923	979
PEND TOTAL	2271	2231	2292	2343	2359	2376	2370	2418	2451	2452	2510	2497	2539	2636	2693	2769	2804	2860	2577	2923	2976	3004	3052	3210
6-10 BKLG	6.9	6.6	6.5	6.2	5.9	5.6	5.3	5.8	5.6	5.3	5.5	5.1	5.3	5.9	6.1	6.3	6.2	6.4	6.0	6.1	6.2	6.0	6.3	6.6
TOTAL BKLG	14.0	13.9	13.9	14.0	14.2	13.9	13.7	14.4	14.2	13.8	14.6	14.3	14.8	16.3	17.3	17.9	18.4	19.0	18.5	19.5	19.6	19.6	20.7	21.8

Figure 10. Colorado

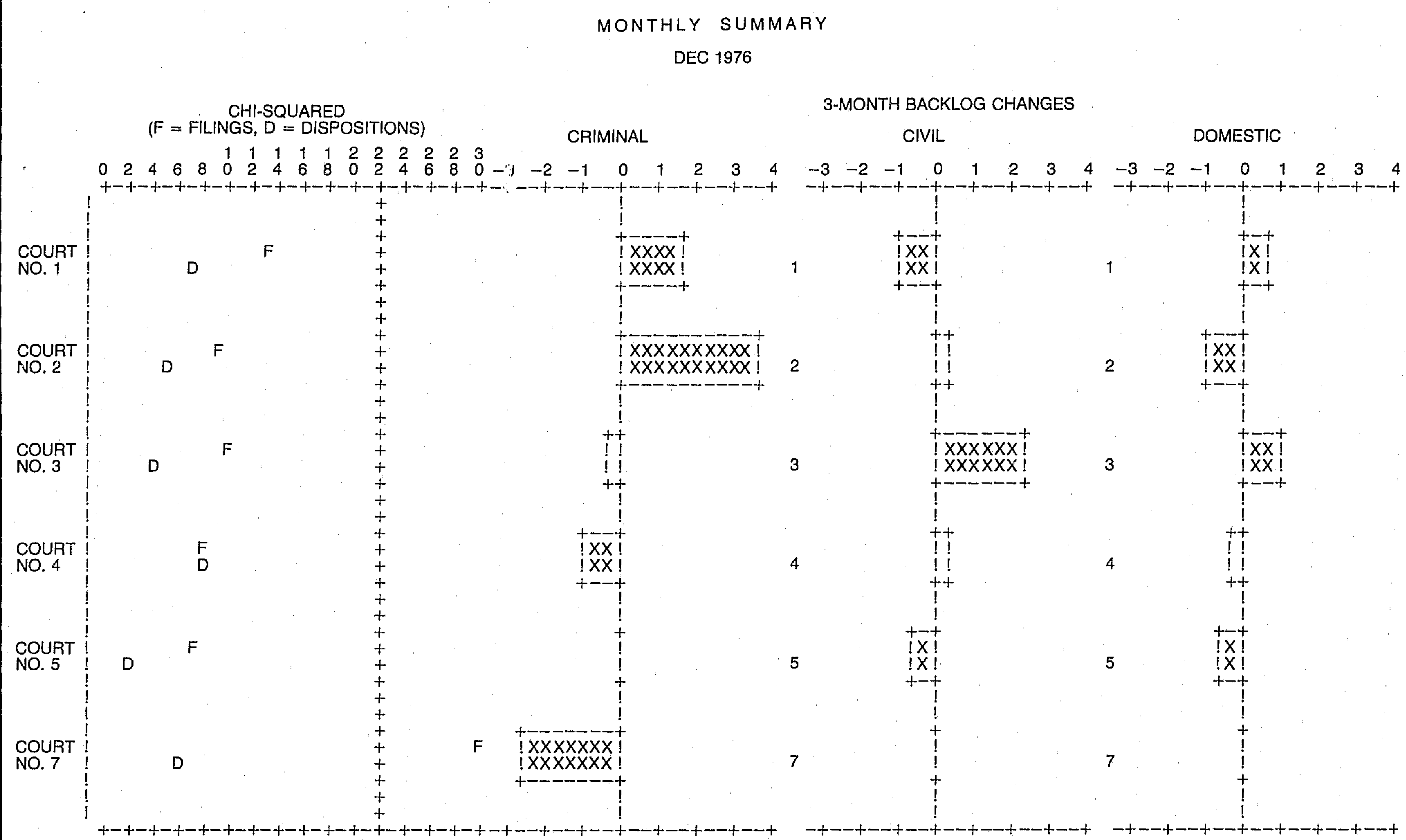


Figure 11. Colorado

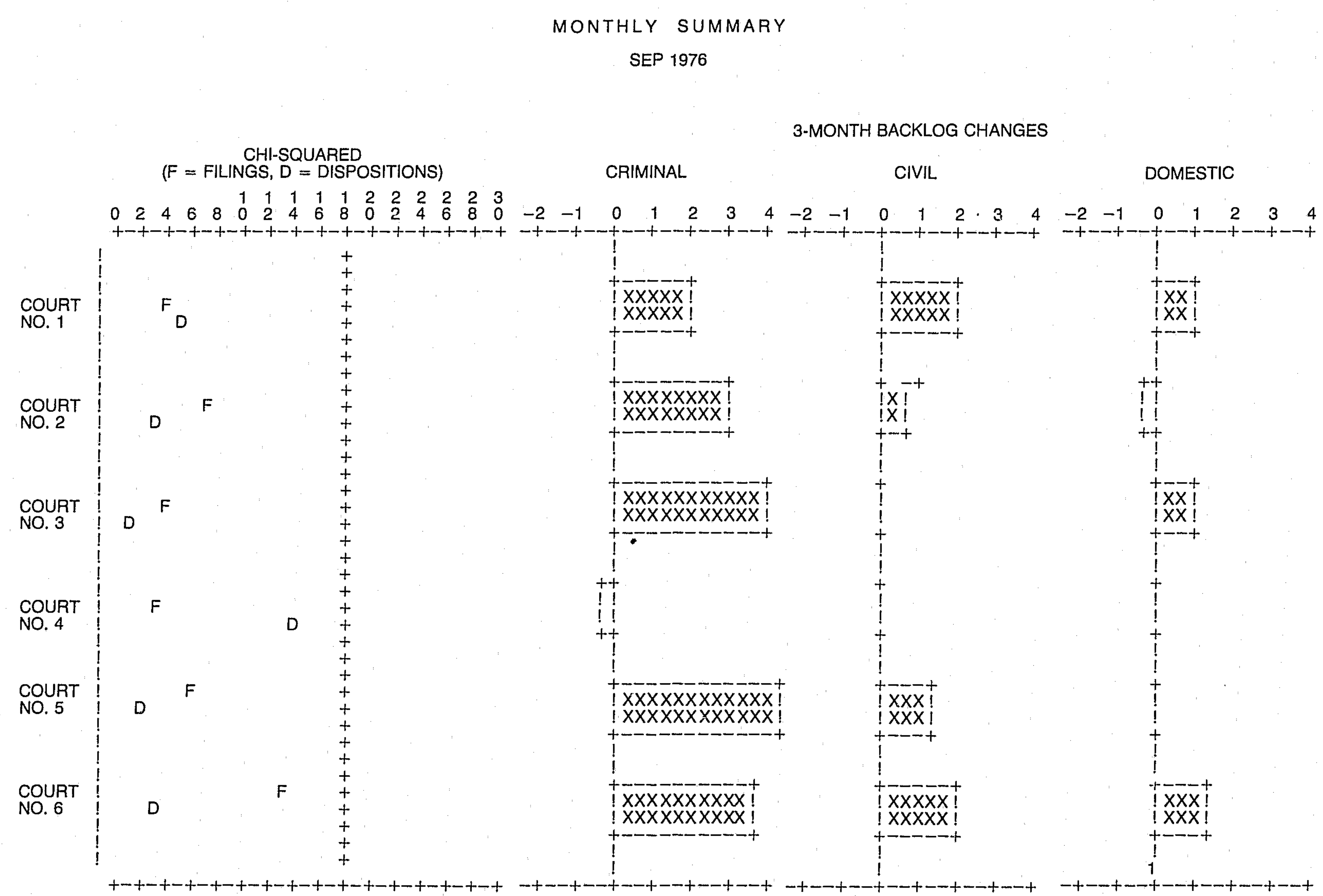
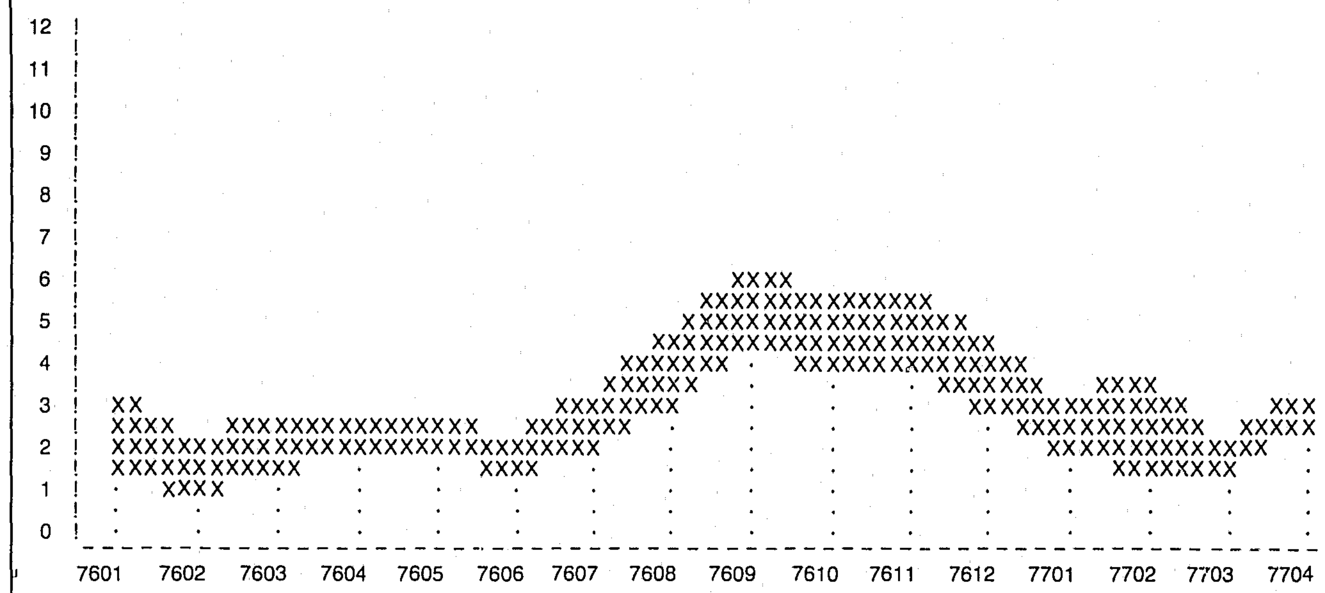


Figure 12. North Dakota

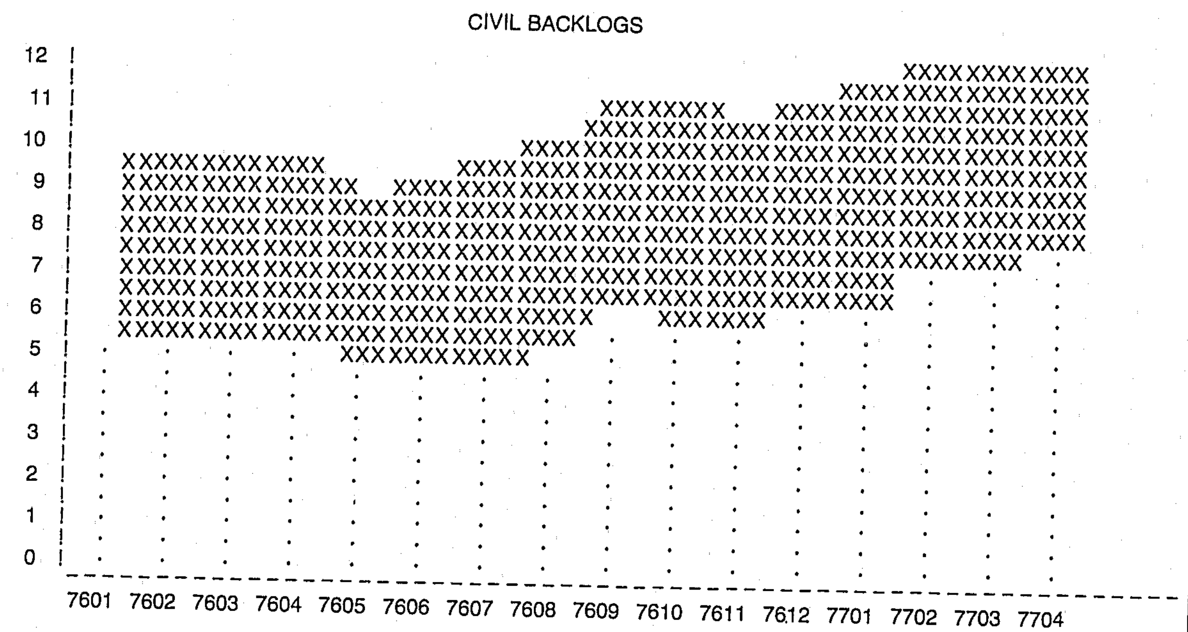
CRIMINAL BACKLOGS



CRIMINAL CASE SUMMARY

	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704
FILINGS	6	3	9	8	4	3	6	8	11	10	4	6	2	4	4	10
CUR. AV.	7.	6.	6.	7.	6.	6.	6.	6.	7.	7.	7.	7.	6.	6.	5.	6.
DISPS.	4	7	7	7	5	5	2	3	4	13	4	12	7	4	8	5
CUR. AV.	6.	6.	6.	6.	6.	6.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
PEND LE 4	8	5	11	14	12	10	12	14	21	20	19	15	11	8	7	12
PEND TOTAL	17	13	15	16	15	13	17	22	29	26	26	20	15	16	12	16
4-MO BKLG	1.3	0.8	1.7	2.2	1.9	1.7	2.2	2.8	4.4	4.2	4.1	3.2	2.2	1.6	1.3	2.3
TOTAL BKLG	2.8	2.1	2.4	2.5	2.4	2.2	3.2	4.4	6.0	5.4	5.6	4.3	3.0	3.3	2.2	3.0

Figure 13. North Dakota



CIVIL CASE SUMMARY

	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704
FILINGS	28	26	27	29	39	28	26	25	44	23	27	32	35	41	34	23
CUR. AV.	30.	29.	29.	29.	30.	30.	29.	29.	29.	28.	28.	28.	29.	31.	32.	30.
DISPS.	37	27	28	29	39	24	25	22	21	28	43	21	24	25	29	16
CUR. AV.	29.	28.	28.	28.	30.	29.	28.	27.	26.	27.	27.	26.	25.	25.	26.	24.
PEND LE12	154	152	155	153	158	152	148	153	175	162	155	161	170	188	189	189
PEND TOTAL	266	265	264	268	269	272	295	290	275	285	296	312	317	324		
12-MO BKLG	5.4	5.4	5.5	5.4	5.2	5.2	5.2	5.6	6.6	6.1	5.8	6.3	6.7	7.4	7.3	7.8
TOTAL BKLG	9.3	9.3	9.3	9.3	8.7	9.2	9.4	9.9	11.2	10.9	10.3	11.1	11.7	12.3	13.2	13.3

Figure 14. North Dakota

5. ANALYZING SERVICE TIME

5.1 MEASURES OF SERVICE TIME

One of the purposes of this study was to examine the effect on service time of any factors present in the data. Service time is an estimate of the elapsed time until a case is adjudicated. The best estimate would contain only that elapsed time attributable to the court. Times beyond the control of the court, such as that required for preparation of presentence reports would be removed.

The best estimate of service time using North Dakota data was the time from filing to disposition. The Colorado criminal data, with more internal events and dates, provided a better estimate of service time — time from first appearance to trial commencement — which effectively removed some of the duration attributable to prosecutors and probation departments.

5.2 WORKING TOWARD CONTRADICTIONS

The idea behind this kind of analysis is to discover contradictions. If the analysis indicates that misdemeanors require less service time than felonies, there is no surprise. However, if one metropolitan court requires one-third as much time to adjudicate felonies as all other metropolitan courts, one has to ask why and ideally assign staff to go into the field to find out why. A procedure, or a particular technique used by a judge or the calendering section of the clerk's office may be discovered and passed on at seminars or clerical training sessions. This analysis then, is designed to discover which factors affect case duration as a prelude to understanding why. If nothing else, such analysis leads to a better understanding of court operation.

The next problem is how to analyze the effects of all factors in all combinations on case service times. For instance, which factors are the most important and when? It is possible that, for some categories of cases, one factor is more important, and for a different category, another factor. Fortunately, there is an approach to analyzing such situations, using a concept that is embodied in a computer program entitled AID, which was developed at the University of Michigan Institute for Social Research [5].

5.3 THE NORTH DAKOTA ANALYSIS

With the North Dakota data, the estimate of service time was the time from filing to disposition. There were 16 months of data available, from 7601 to 7704 inclusive. However, not all of this data could be used in the study. Of course, cases not terminated by the end of the period could not be included. A bit more subtle was the fact that, if the last few months of data were used, the only cases filed in this period and were also terminated, would have to be short-service-time cases. Thus, the data would be biased by the exclusion of those cases filed in the period that were not terminated by the end of the period.

Generally, the service time for Civil cases was on the order of a year. For this reason, an unbiased analysis of Civil case service times was not possible. Criminal and Domestic case service times were analyzed separately using the first nine months of data. The Criminal and Domestic cases with service times greater than seven months were a small fraction of the total, so a negligible percentage of cases filed in the first nine months would be unterminated at the end of the 16-month period.

With both types of cases, factors that had a significant effect on service times were sought. For Criminal cases, the factors considered were:

- District in which Case Heard
- Type of Charge
- Type of Disposal, i.e.,
  - Jury Trial
  - Court Trial
  - Not Contested (Guilty Plea)
- Outcome, i.e.,
  - Guilty
  - Acquittal
  - Dismissal
  - Other

In Domestic cases, the factors whose effects were studied were essentially the same: district, type of action, type of disposal, and outcome.

North Dakota Criminal Case Service Time

AID operates as follows: Initially, there was one group of 800 North Dakota criminal cases having an overall average service time of 73 days. The 800 cases consisted of some categories with long service times and some categories with much shorter service times. There were six charge categories:

1. Felony A
2. Felony B
3. Felony C
4. Misdemeanors and Infractions
5. Appeals
6. Special Remedy and Other Criminal.

Suppose the 800 cases are split into two groups, say,

Group 1 = All Felonies
Group 2 = All Non-Felonies

How well does this sort out the longer service times from the shorter? Or, the 800 cases can be split into two groups, by,

Group 1 = Felonies A and B and Appeals
Group 2 = All Others.

Perhaps this does a better job of separating the longer service times from the shorter.

Or, instead of sorting out the charge variable, try sorting by the method of disposal. For instance, the division into

Group 1 = Not Contested Cases
Group 2 = Trial Cases

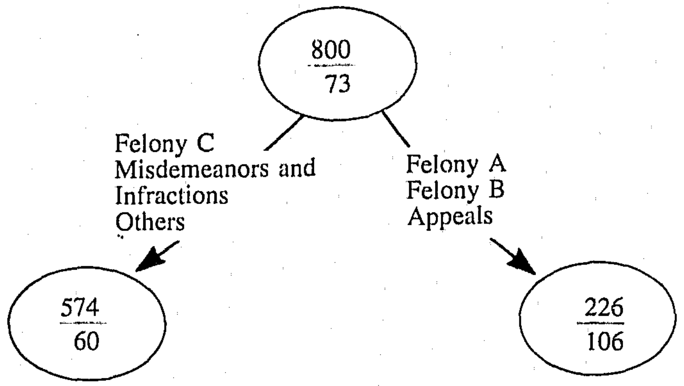
might do a better job of separating longer and shorter service times than any split using the charge variable.

AID proceeds by checking all possible splits, using all of the four variables and selecting that split that does the best sorting into long and short service times. The best split turned out to be the second one above, in which the cases were split into

Group 1 = Felonies A and B and Appeals

Group 2 = Felonies C, Misdemeanors and Infractions, and Others

Pictorially, this can be represented as



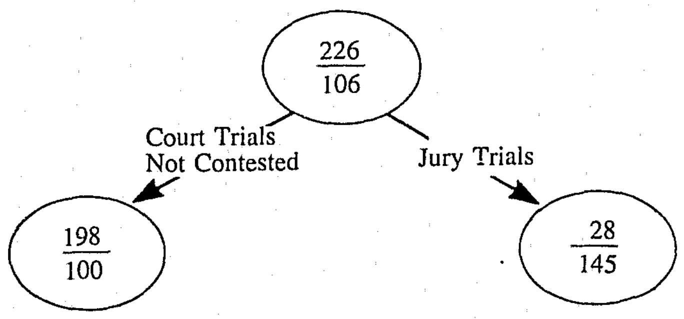
The top circle represents the original 800 cases having an average service time of 73 days. The best split is on the CHARGE variable, with the group consisting of charges Felonies A, B, and Appeals represented by the right circle. There are 226 cases in this group with an average service time of 106 days. The group of cases with the other charges is represented by the left circle. There are 574 of them with an average service time of 60 days. As one might expect, the more serious offense charges and appeals take significantly longer — on the average, about 46 days longer — to service than the less serious offenses.

Next, the 226 cases of Felony A, B charges and Appeals were examined. These had an overall of 106 days. Repeat the process of trying to find combinations of splits among the variables of district, charge, disposition, and outcome that best sort these into longer and shorter service times. The AID program found the best split to be

Group 1 = Jury Trials

Group 2 = Court Trials and Not Contested

The diagram below represents this split:



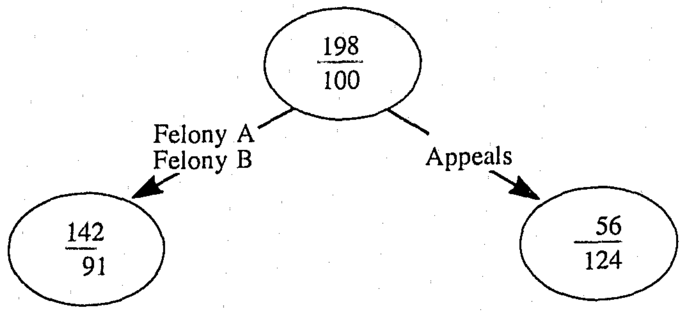
Again, the expected occurs: Cases involving jury trails take, on the average, 45 days longer than non-jury trials or uncontested cases.

An attempt to split up the group of 28 cases tried by jury was made, but the result was that no split produced a significant sort into longer and shorter cases.

Looking at the non-jury cases, the best split was again produced by charge:

Group 1 = Felonies A and B

Group 2 = Appeals

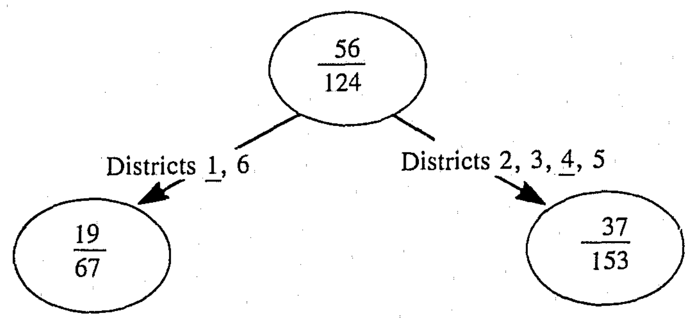


The 56 Appeals take, on the average, 33 days longer than the 142 Felony A, B cases.

There was no split of the 142 Felony A, B cases that significantly sorts into longer and shorter. However, there was a split of the 56 Appeals cases into

Group 1 = Districts 1 and 6

Group 2 = Districts 2, 3, 4, 5

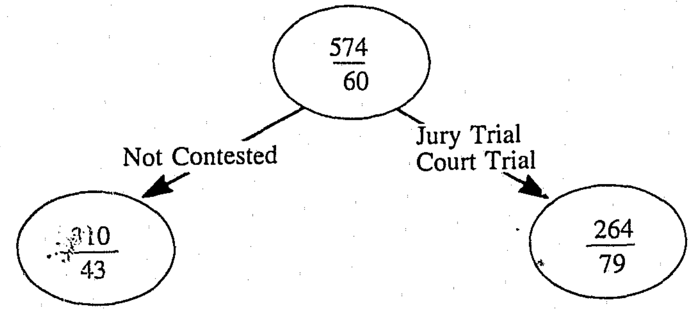


This was the first unexpected result. There is an 86-day average difference in service times on appeals between Districts 1 and 6 and the other courts. This is a curious and interesting finding; because Districts 1 and 4 are both metropolitan courts with comparable caseload and the bulk of the cases in each split is due to these two courts. However, in absolute numbers, these cases do not represent a large proportion of either court's criminal caseload.

Looking at the 574 cases consisting of the less serious charges, the most significant split was on disposition

Group 1 = Not Contested

Group 2 = Jury or Court Trial.

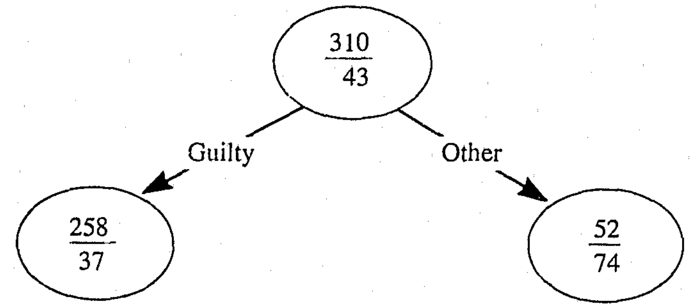


This is an expected result, with Trial cases averaging 36 days longer than Not Contested.

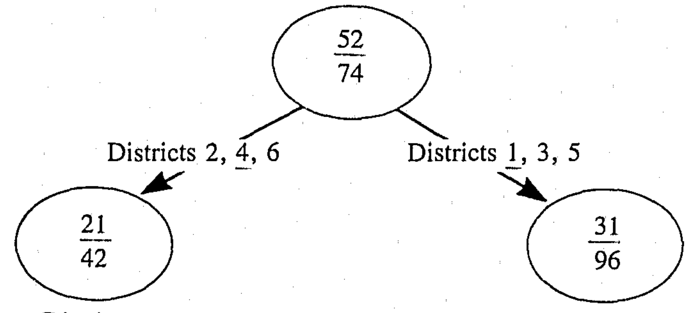
Of the 310 Not Contested cases, the best split was the division into

Group 1 = Guilty

Group 2 = Dismissal or Other.

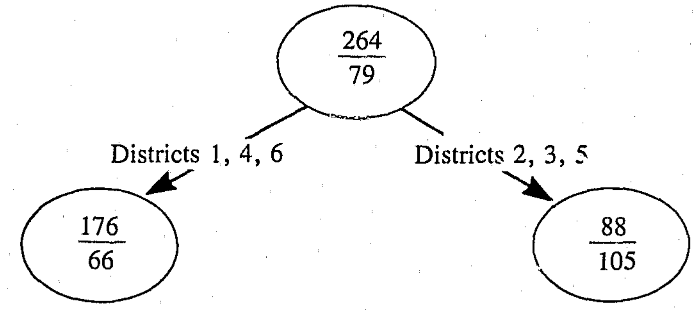


This is a bit surprising. The cases resulting in other than guilty judgments take 27 days longer, on the average. The next split was even more surprising. There was no particularly significant split of the 258 Not Contested, judged Guilty cases, but there was a large disparity by district in service times of the 52 Other Than Guilty judgments.



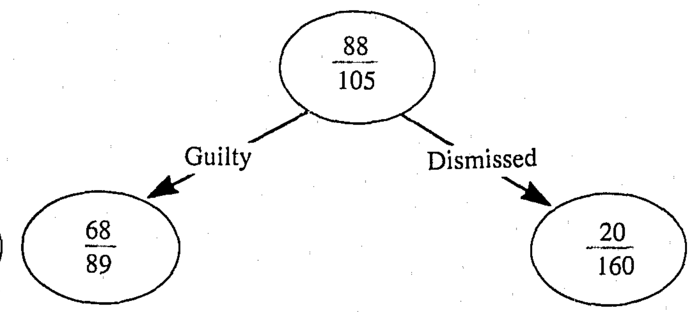
Districts 1, 3, 5 take an average of 54 days longer with their 31 cases of this type than do Distrits 2, 4, 6 with their 21. Even though the difference is large, the number of cases involved is so small that it does not represent a significant part of court workload.

The group of cases left to be examined were the 264 less serious charges that went to trial. Here, for the first time there is a significant difference between districts on a substantial portion of their Criminal caseload. In diagram form:



Districts 1 and 4 are the most urban in North Dakota, with the heaviest caseload. District 6 has a small caseload, so that the group of cases on the left above are essentially those processed by the two high-volume 1st and 4th Districts. The 2nd, 3rd and 5th Districts are more rural, low-volume courts, and seem to adopt a more leisurely pace in bringing to trial and disposing of the less serious charges.

Searching for a split of the latter group of 88 cases processed by Districts 2, 3, 5, the most distinguishing feature was Outcome. If the outcome was guilty or acquited, then the service times were lower. If the case was dismissed, this was a longer process.

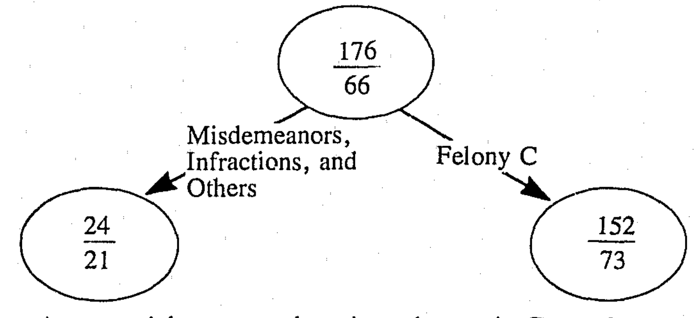


Neither of these two groups of cases split into significantly shorter and longer times.

The group examined next was the 176 less serious charges brought to trial in Districts 1, 4, 6. The most significant split of these was on charge:

Group 1 = Felony C

Group 2 = Misdemeanors, Infractions and Others



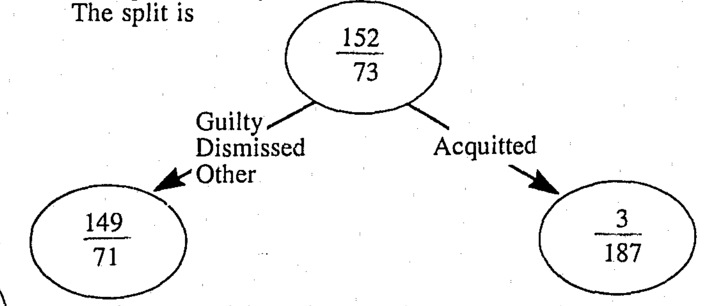
As one might expect, the minor charges in Group 2 are quickly disposed of.

Finally, in the 152 Felonies C, a last significant split was:

Group 1 = Acquitted

Group 2 = Guilty, Dismissed, and Other Remedies.

The split is



Only three out of the 152 cases tried resulted in acquittals. But these three cases took an average of 116 days longer than the cases resulting in other outcomes.

North Dakota Domestic Case Service Time

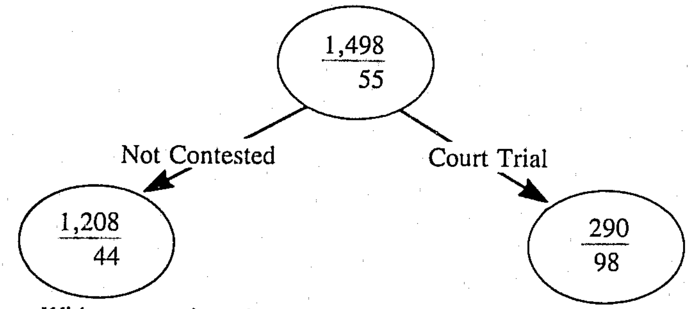
A similar analysis was carried out on the 1,498 domestic filings in North Dakota in the first nine months of 1976. The variables affecting the time to disposition were:

- District (1, 2, 3, 4, 5, 6)
- Action Requested
  - Divorce
  - Reciprocal Support
  - Adoption
- Disposition Type
  - Court Trial
  - Not Contested

Outcome
- Default after Trail
- Default Judgment
- Summary Judgment
- Voluntary Dismissal
- Involuntary Dismissal
- Decree — either Divorce or Adoption
- Other and Special Remedy

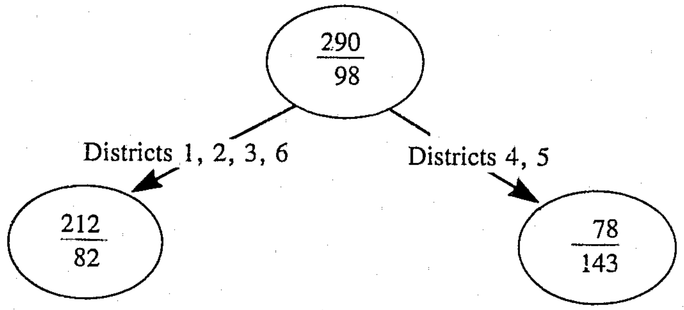
There were so few jury trials that these and other minor assorted cases not fitting into the above structures were deleted.

The sequence of splits was as follows: the 1,498 cases had an average disposal time of 55 days. The first split was:



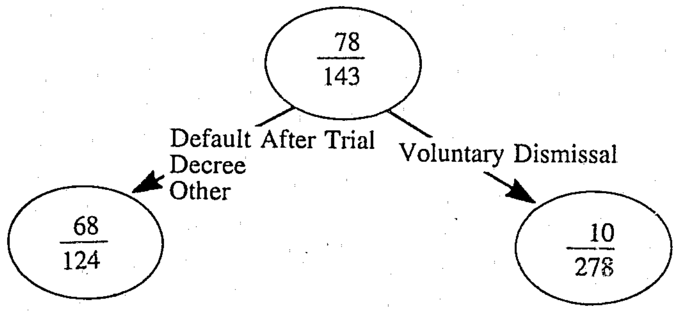
Without surprise, the most significant determining factor on the duration of a domestic matter is Not Contested versus Trial, with an average of 54 ys' difference in disposal time.

Following the Contested cases, the most significant split was, unexpectedly, by District:



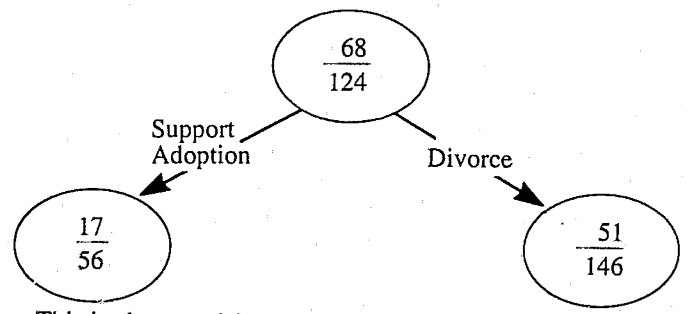
For some reason not apparent from the data, Districts 4 and 5 take much longer to process Contested Domestic cases.

There was no further good split of the 212 Contested cases handled by Districts 1, 2, 3, and 6. But the 78 cases in 4 and 5 had a significant split on Outcome type.



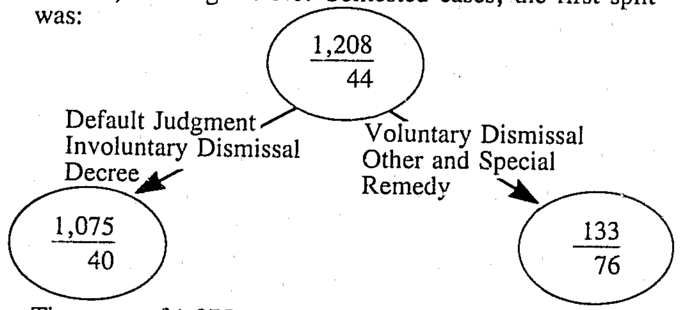
There were 10 cases, around for a long time, in which the parties agreed to a dismissal.

There was a final significant split of the remaining 68 cases:



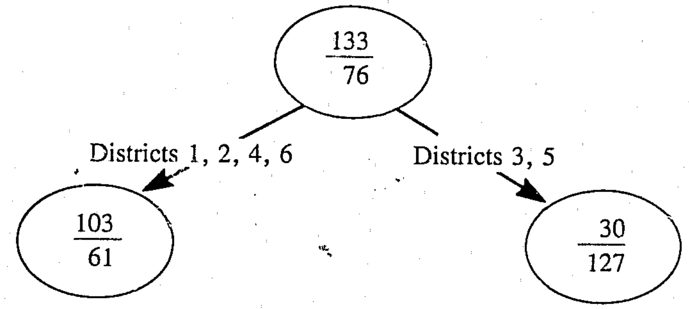
This is also surprising. The Contested Divorces take much longer than the Contested Support or Adoption cases.

Now, tracking the Not Contested cases, the first split was:



The group of 1,075 cases on the left have no further significant split. They consist, in the main, of Divorce cases (831) and Adoptions (209) in which decrees were granted.

The 133 cases on the right above unexpectedly split on District:



Again, for reasons not apparent from the data, Districts 3 and 5 are taking much longer to process the particular type of case in question.

5.4 THE COLORADO ANALYSIS

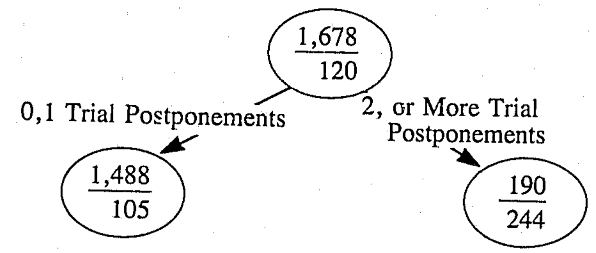
In this study, all Criminal cases in the major categories that came to trial in five Colorado courts were used. The estimate of service time was provided by the time from the defendant's first appearance in court to the time of the start of trial. There were 1,678 such cases with an average time to trial of 120 days. The following variables were analyzed for significant effects on service times:

- Court: 1, 2, 3, 4, 5
- Severity of Charge: Felony 1, 2, 3, 4, 5
  - Misdemeanor 1, 2, 3
- No. of Triai Postponements
- No. of Pre-Trial Actions

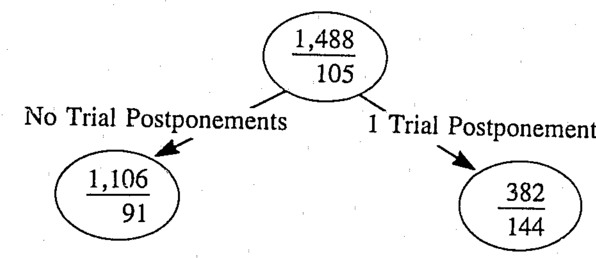
Each time that a trial date was set and then reset for a later date, whatever the cause, was counted as a Trial Postponement. The Pre-Trial Actions were Court Hearings, with the two actions listed on the same date being counted as a single action.

The one thing that stands out is that at no time was there a significant split on Severity of Charge. The main factor in determining length of time to trial was the No. of Trial Postponements, with No. of Pre-Trial Actions and Court being secondary. A systematic difference between Courts also showed up. Court 4 invariably has shorter times to trial in all categories. Courts 2 and 5 invariably have longer times until trial.

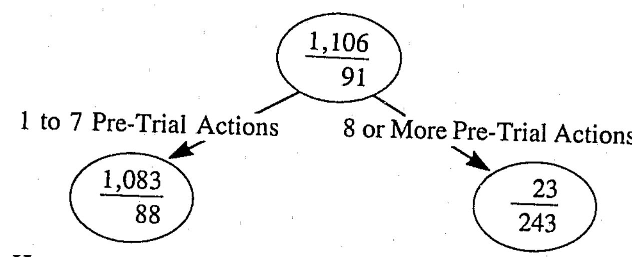
The first split is pictured below.



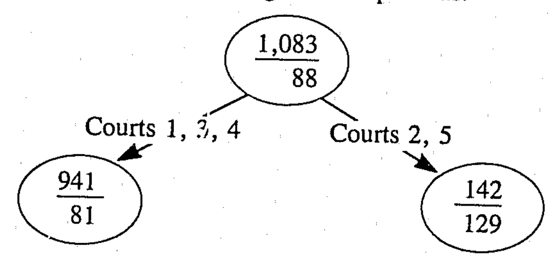
The contrast between the two averages is 105 days versus 244. The left-hand group was tracked first:



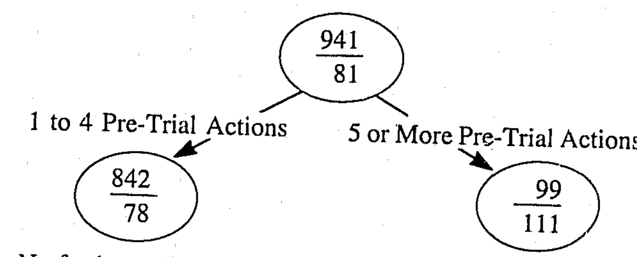
The main track is No Trial Postponements, in the sense that about two-thirds of the cases have no postponements. Continuing to follow the main track:



Here, a small number (23) with many pre-trial actions and a mean time to trial at 243 days were split off. Still following the main group, the next significant split was:

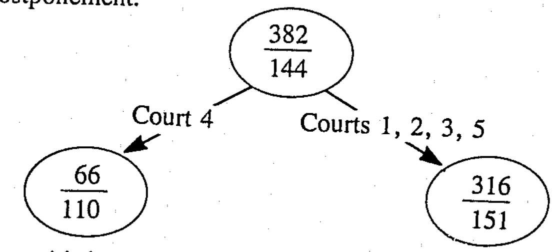


This is the first split on Court in the mainline group. In those cases with no trial postponements, Courts 2 and 5 have a significantly longer time until trial than Courts 1, 3, and 4. Continuing with the left-side group:



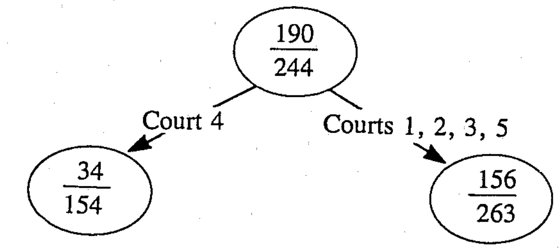
No further splits were significant past this point. The 842 cases, about half of the original, are mainline in that they have no postponements and 4 or less pre-trail actions. The average time until trial is 78 days.

The only significant split remaining with those cases having 0 or 1 postponement was on the 382 cases with 1 postponement:

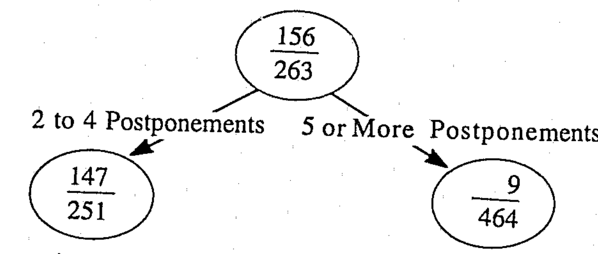


Court 4 is here singled out for its significantly shorter time to trial.

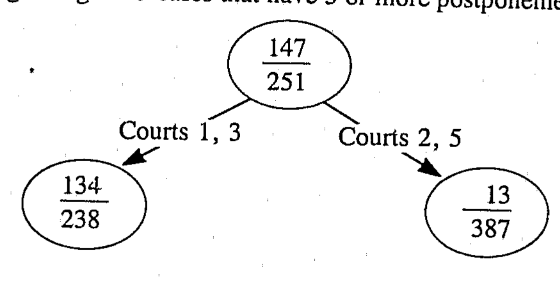
The situation with the 190 cases having 2 or more postponements starts with Court 4 splitting off again:



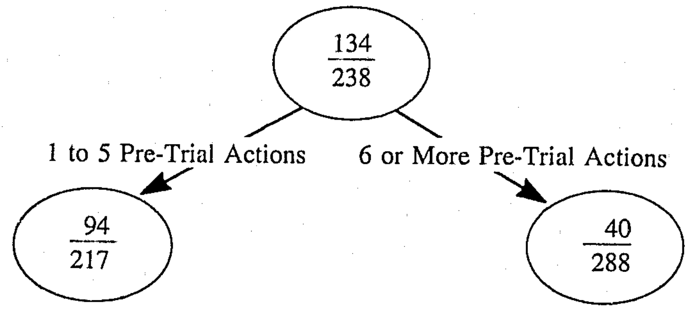
There are no more significant splits in the Court 4 cases. In the other courts the split was on postponements:



Ingnoring the 9 cases that have 5 or more postponements:



The final significant split is on the Court 1 and 3 cases:



The complete AID tree of splits is given in the technical part of this report, together with a more detailed analysis of the results.

TECHNICAL REPORT

6. A DATA VALIDATION STATISTIC

6.1 DESIRABLE PROPERTIES OF A DATA VALIDATION STATISTIC

Suppose that for administrative purposes an SJIS genertes several events (filings, trials, dispositions, etc.) for certain broad categories of cases each month. As discussed in the Non-technical Section, cases should be broken down into a few broad categories of similar case types, i.e., Felony-Criminal, Misdimeanor-Criminal, Divorce, Civil-Money, etc. There are two considerations in establishing these categories. First, categories should contain cases that are procedurally similar. Second, the numbers reported in each category per month should not be too small, even in the lowest-volume courts. As a rule-of-thumb, an average of around five per month is the lowest tolerable reported number for rigorous data validation.

Several methods are currently used for comparing the most recent value with past data to see if the latest number is reasonable. For each event, Felony A Filings for example, the current value, C_n can be compared with both the value for last month and the value for this month last year to see if the differences are large. These contrasts can be made on a straight numerical basis or the percentage changes can be calculated. There are two problems with this approach.

First, there is a great deal of computation required. For Felony A filings alone, four computations are required for every court—C_n versus last month and this month last year computed on first a numerical and then a percentage basis. Compounding these four computations by the number of events (filings, dispositions, etc.) and then by the number of case categories indicates a large number of computations. Second, there is no rule of thumb accompanying these methods of comparison that governs how large a change must be before it must be considered unusual.

Any good validation statistic, then, should have three desirable properties:

1. For any court the statistic should examine in one calculation all of the case categories for an event, and detect an unusual value within any single case category. For example, the statistic should be able to simultaneously examine filings (Felony A filings, Felony B filings, Misdemeanor filings, . . ., etc.) over all case categories and indicate whether or not one category contains an unusual value.
2. The statistic should be sensitive to differences in courts. Because of differences between courts such as size, an unusual value for Felony A filings in Court #1 would not be an unusual value for Court #2.
3. The statistic should be accompanied by a rule that clearly indicates when a current value is unusual and should be investigated.

6.2 INTRODUCTION TO THE CHI-SQUARED INDEX

An unusual value is defined as a number that deviates from what one ordinarily expects to see. One measure of the expected value for an event (e.g. filings) within some case category (e.g. Felony A) is the average, denoted A_n. Thus,

$$C_n - A_n$$

gives a measure of the deviation of the current value, C_n, from what is ordinarily expected. However, this current difference or deviation, $C_n - A_n$, should be compared with the "typical deviation" to determine if the current deviation is large. If SD_n is the current standard deviation, then

$$\frac{C_n - A_n}{SD_n}$$

gives a yardstick of whether the current value C_n is unusual. The denominator is a measure of the typical past deviations of the actual values from their averages. If the ratio is large, it means that the current difference ($C_n - A_n$) is unusually large, as compared with past history.

To arrive at an overall event index, that simultaneously examines all case categories in one pass, take the ratios for each category, square them, and sum over all categories. For instance, in Colorado, the overall filing index is the sum of nine numbers:

$$\left(\frac{C_n - A_n}{SD_n}\right)^2 \quad \text{for Crimes-Person}$$

$$+ \left(\frac{C_n - A_n}{SD_n}\right)^2 \quad \text{for Crimes-Property}$$

$$+ \left(\frac{C_n - A_n}{SD_n}\right)^2 \quad \text{for Crimes-Other}$$

$$+ \left(\frac{C_n - A_n}{SD_n}\right)^2 \quad \text{for Civil-Money}$$

$$+ \left(\frac{C_n - A_n}{SD_n}\right)^2 \quad \text{for Civil-Negligence}$$

$$+ \left(\frac{C_n - A_n}{SD_n}\right)^2 \quad \text{for Civil-Property}$$

$$+ \left(\frac{C_n - A_n}{SD_n}\right)^2 \quad \text{for Civil-Other}$$

$$+ \left(\frac{C_n - A_n}{SD_n} \right)^2 \quad \text{for Domestic-Dissolution}$$

$$+ \left(\frac{C_n - A_n}{SD_n} \right)^2 \quad \text{For Domestic-Other}$$

It is necessary to square each ratio because if the raw, unsquared ratios were summed then current values larger than average would tend to be cancelled by those smaller than average, masking any unusual values.

If this combined index is "too large" for April 1977 in Court #3, say, then filings for that court for April 1977 have to be examined more closely to see which category of filings is responsible for the size of the filing index.

This raises the question of "how large is too large?" To answer this question, a bit more statistical background is needed. Assuming that the filings in each category are normally distributed, then the ratios

$$\frac{C_n - A_n}{SD_n}$$

will be normally distributed with mean, O, and standard deviation, 1. That is, they will have standardized normal distributions.

Assuming, furthermore, that the filings in each category are independent of each other, then the sums of the squares, of these ratios will have the distribution of a sum of squares of independent standardized normal variables. This is the well-known Chi-Squared distribution with the number of degrees of freedom equal to the nuber of categories summed over. In Colorado, then, the number of degrees of freedom is nine. In North Dakota, there are seven degrees of freedom.

Figure 15 gives a table of the Chi-Squared distribution. The column headed .990 gives values such that the probability that a Chi-Squared variable exceeds those values is .01. The column on the extreme left gives the number of degrees of freedom. For North Dakota, enter the table at the row for seven degrees of freedom, coming to the value 18.5 in the .990 column. Therefore, under the assumptions, treating the months as independent trials, if there are no aberrant occurrences, the Chi-Squared Index should exceed the value 18.5 only once in 100 months on the average. This is the reason why, that the summary sheet (Figure 2) and the backup data, contains the critical line for North Dakota at a height of approximately 18.5. If the index exceeds this value, there is good reason for further investigation to be warranted. For Colorado, with nine degrees of freedom, the critical value is 21.7 and the line is drawn at this latter height. This table has been included so that each system can determine the critical height appropriate to the number of case categories selected (See Figure 15).

TABLE 2 — Chi-Squared Distribution
Entries c are defined in terms of *P*, *n* by equation
$\rho - \rho(C_\eta < c)$

$_n{}^P$	.005	.010	.025	.050	.100	.250	.500	.750	.900	.950	.975	.990	.995
1	.0000393	.000157	.000982	.00393	.0158	102	.455	1.32	2.71	3.84	5.02	6.63	7.88
2	.0100	0201	.0506	.103	.211	.575	1.39	2.77	4.61	5.99	7.38	9.21	10.6
3	.0717	.115	.216	.352	.584	1.21	2.37	4.11	6.25	7.81	9.35	11.3	12.8
4	.207	.297	.484	.711	1.06	1.92	3.36	5.39	7.78	9.49	11.1	13.3	14.9
5	.412	.554	.831	1.15	1.61	2.67	4.35	6.63	9.24	11.1	12.8	15.1	16.7
6	.676	.872	1.24	1.64	2.20	3.45	5.35	7.84	10.6	12.6	14.4	16.8	18.5
7	.989	1.24	1.69	2.17	2.83	4.25	6.35	9.04	12.0	14.1	16.0	18.5	20.3
8	1.34	1.65	2.18	2.73	3.49	5.07	7.34	10.2	13.4	15.5	17.5	20.1	22.0
9	1.73	2.09	2.70	3.33	4.17	5.90	8.34	11.4	14.7	16.9	19.0	21.7	23.6
10	2.16	2.56	3.25	394	4.87	6.74	9.34	12.5	16.0	18.3	20.5	23.2	25.2
11	2.60	3.05	3.82	4.57	5.58	7.58	10.3	13.7	17.3	19.7	21.9	24.7	26.8
12	3.07	3.57	4.40	5.23	6.30	8.44	11.3	14.8	18.5	21.0	23.3	26.2	28.3
13	3.57	4.11	5.01	5.89	7.04	9.30	12.3	16.0	19.8	22.4	24.7	27.7	29.8
14	4.07	4.66	5.63	6.57	7.79	10.2	13.3	17.1	21.1	23.7	26.1	29.1	31.2
15	4.60	5.23	6.26	7.26	8.55	11.0	14.3	18.2	22.3	25.0	27.5	30.6	32.8
16	5.14	5.81	6.91	7.96	9.31	11.9	15.3	19.4	23.5	26.3	28.8	32.0	34.3
17	5.70	6.41	7.56	8.67	10.1	12.8	16.3	20.5	24.8	27.6	30.2	33.4	35.7
18	6.26	7.01	8.23	9.39	10.9	13.7	17.3	21.6	26.0	28.9	31.5	34.8	37.2
19	6.84	7.63	8.91	10.1	11.7	14.6	18.3	22.7	27.2	30.1	32.9	36.2	38.6
20	7.43	8.26	9.59	10.9	12.4	15.5	19.3	23.8	28.4	31.4	34.2	37.6	40.0
21	8.03	8.90	10.3	11.6	13.2	16.3	20.3	24.9	29.6	32.7	35.5	38.9	41.4
22	8.64	9.54	11.0	12.3	14.0	17.2	21.3	26.0	30.8	33.9	36.8	40.3	42.8
23	9.26	10.2	11.7	13.1	14.8	18.1	22.3	27.1	32.0	35.2	38.1	41.6	44.2
24	9.89	10.9	12.4	13.8	15.7	19.0	23.3	28.2	33.2	36.4	39.4	43.0	45.6
25	10.5	11.5	13.1	14.6	16.5	19.9	24.3	29.3	34.4	37.7	40.6	44.3	46.9
26	11.2	12.2	13.8	15.4	17.3	20.8	25.3	30.4	35.6	38.9	41.9	45.6	48.3
27	11.8	12.9	14.6	16.2	18.1	21.7	26.3	31.5	36.7	40.1	43.2	47.0	49.6
28	12.5	13.6	15.3	16.9	18.9	22.7	27.3	32.6	37.9	41.3	44.5	48.3	51.0
29	13.1	14.3	16.0	17.7	19.8	23.6	28.3	33.7	39.1	42.6	45.7	49.6	52.3
30	13.8	15.0	16.8	18.5	20.6	24.5	29.3	34.8	40.3	43.8	47.0	50.9	53.7

SOURCE: E.S. Pearson and H.O. Hartloy, *Biometrika Tables for Statisticians*, vol. 1 (London: Cambridge University Press, 1962). Reprinted by permission of the publisher.

FIGURE 15

Suppose that the critical height is exceeded, what then? The second layer of information gives the values of the squares

$$\left(\frac{C_n - A_n}{SD_n} \right)^2$$

for each category. These are listed in the first line under the graph and labeled CHI-SQ (refer to Figure 4). The probability, under ordinary circumstances, that these individual values will exceed 6.6 is .01. A value in excess of 6.6 is starred to give an indication that the events (e.g. filings, dispositions, etc.) in this category are unusual and are contributing to the excessive value of the overall index. It is possible, conceivable, that no category be starred and yet the overall index is excessive. This would be an indication that many of the categories have low or high values that month, and that the excessive overall index is due to a cumulative effect. However, in every one of the many cases that were examined, the cause of an overall excessive index was due to one or more starred categories.

The next line gives the Current Value, and the line below, the Current Average; and the fourth line gives the Current Standard Deviation. Examining these for any starred Chi-Squared value quickly indicates the relative magnitude of the unusual deviation.

The lines below indicate the filings (dispositions) by category over the last 24-month period for the court. All values which were unusual in the sense of having Chi-Squared values greater than 6.6 are starred. Starring is helpful in indicating possible causes for aberrant values. For instance, a sharp seasonal drop might be the cause, and this could be detected by backtracking to similar periods in the previous years. On the other hand, a large percentage of starred values in these lines might indicate a court with persistent data problems. As pointed out in the previous section, a succession of 3 starred values may indicate an abrupt and persistent change.

It is true that the statistical assumptions required for a rigorous theoretical justification of the critical height may be only approximately valid (for instance, a large number of dispositions in one category may force down the number of dispositions in other categories negating the assumption of mutually independent categories). But, in this study of 16 months of North Dakota data and over three years of Colorado data, the Chi-Squared Index was found to be consistently reliable as an indicator of unusual events. This is perhaps because the Chi-Squared statistic is known as robust. This means that a violation of any of the basic assumptions does not negate the utility of the statistic.

It is also true that this study applied Chi-Squared to filings and dispositions only. But there is no reason to believe that the index would not apply to other events, such as numbers of trials, motion hearings, etc. With some minor adjustments in the data this index should also be applicable as a validation statistic for elapsed times between events such as time from filing to disposition.

Finally, this Chi-Squared statistic satisfies the constraints for a desirable validation statistic discussed in Section 6.1. There remains one set of operational problems with using the Chi-Squared statistic. First, the monthly computation and updating of the means and standard deviations used with the statistic. Second, how to handle dramatic and sudden actuall shifts in current values, contrasted with reporting errors, that have a destabilizing effect on the means and standard deviations.

6.3 UPDATING MEANS AND STANDARD DEVIATIONS

In order to use the Chi-Squared Index to determine if a monthly value, say filings, is unusually high or low, two things are needed. First, a current average number of filings, A_n, to compare the current value, C_n with. Then a "typical deviation," up to now, the standard deviation, SD_n, to measure the current deviation, $(C_n - A_n)$, against.

There is an obvious way of getting a current average. Say the value of interest is filings. Then as the current average, one possibility is to take the average of the last four, six, or 12 months of filings in the case categories desired. Any fixed number of months can be used; four, six, and 12 are simply cited as examples.

There is a trade-off. If one takes too short of an averaging period, then the fluctuations and seasonal variations will have too much of an effect and the average will not reflect a gradually changing trend. If a long averaging period, say 12 months, is used, then recent trends may be hidden.

Now, averaging over the last few months to get a current average is not the wisest path to take. Suppose the last six months is used to get the current average. One disadvantage is that the monthly value six months ago is weighted just as heavily as the current month's value. A trend-responsive average should weight recent values more highly than values in the more distant past.

The second disadvantage is more technical. If a six-month average is used to update the average from last month to this month, not only will the current value and last month's average have to be carried, but also the value seven months ago.

A better approach is called *continuous update* averaging. In this method, one uses a weighted average of the current value and the past average to get the current average. Suppose that for this month, n, the Chi-Squared value has been computed for the current value of filings, C_n, and the Size of C_n is deemed *NOT* to be unusual. In readiness for next month's value, C_{n+1}, and next month's Chi-Squared computation, this monoth's value, C_n, must be incorporated into updated values for the average and standard deviation. Let A_n be the average number of filings/month used in this month's Chi-Squared computation. Take C_n to be the number of filings in tne nth month. Then the current average for next month, A_{n+1}, incorporating this month's value for filings is computed as

$$A_{n+1} = pC_n + (1-p)\,A_n,$$

where p is some fixed proportion. For example, the updated weighted average could be

$$A_{n+1} = \frac{1}{12}\,C_n + \frac{11}{12}\,A_n \qquad (1)$$

or

$$A_{n+1} = \frac{1}{3}\,C_n + \frac{2}{3}\,A_{n-1} \qquad (2)$$

could be used

The smaller p is then, essentially the larger the period being averaged over. A reasonable rule of thumb is that 1/p is about the number of months being averaged over. So, in Equation (1) above, averaging occurs over about a 12-month period; in Equation (2), about a three-month period.

In actuality, the update averaging method is a weighted average of past values. For example, Equation (2) above is equivalent to

$$A_{n+1} = .33C_n + .22C_{n-1} + .15C_{n-2} + .10C_{n-3} + .07C_{n-4} + .04C_{n-5} + .03C_{n-6} + .02C_{n-7} + \text{smaller terms}$$

That is, next month's current average is .33 times this month's current value plus .22 times last month's value plus .15 times the value two months ago, etc.

Again, the size of p needs to be adjusted to get a smoothly moving yet responsive average. p = 1/6 was selected corresponding to about a six-month averaging period. Therefore, the fundamental equation for updating weighted current averages is

$$A_{n+1} = \frac{1}{6} C_n + \frac{5}{6} A_n. \tag{3}$$

Thus, the weighted average can be updated by a computationally simple method that requires (usually — more on this in Section 6.4) the current value C_n and the current month's weighted average A_n.

Now, a continuous updating method should be developed to calculate a current weighted "typical deviation" that can be used to measure against next month's weighted current deviation, $C_{n+1} - A_{n+1}$, when next month's value, C_{n+1}, is reported or generated. To do this it is necessary to provide some statistical background.

Briefly, if one has a long sequence of, K, numbers, $x_1, x_2, \ldots, x_K$ assumed to be independently drawn from the same population of normally distributed numbers, then the average, $\overline{x}$, is defined by

$$\overline{x} = \frac{1}{K}(x_1 + x_2 + \ldots + x_K)$$

the standard deviation, s_K, by

$$s_K = \sqrt{\frac{(x_1-\overline{x})^2 + (x_2-\overline{x})^2 + \ldots + (x_K-\overline{x})^2}{K}} \tag{4}$$

and the absolute deviation, D_K, by

$$D_K = \frac{1}{K}(|x_1-\overline{x}| + |x_2-\overline{x}| + \ldots + |x_K-\overline{x}|) \tag{5}$$

where the elements in parenthesis in equation (5) are the *unsigned deviations* from the average. Because

$$s_{K-1} = \sqrt{\frac{(x_1-\overline{x})^2 + (x_2-\overline{x})^2 + \ldots + (x_{K-1}-\overline{x})^2}{K-1}}$$

formula (4) for s_K can be written as

$$s_K = \sqrt{\frac{(x_K-\overline{x})^2}{K} + \frac{K-1}{K} s_{K-1}^2}$$

Converting this notation into an updated current weighted standard deviation that incorporates this month's value, C_n, and is based on a six-month span of data, yields the expression

$$SD_{n+1} = \sqrt{\left(\frac{C_n - A_n}{6}\right)^2 + \left(\frac{5}{6} SD_n\right)^2}$$

which, with squaring and square root requires quite a bit of computation. However, it is known that under our assumptions of independence and normally distributed values,

$$SD_{n+1} = 1.253\ D_{n+1}$$

where D is defined in (5) and

$$D_{n+1} = p\,|C_n - A_n| + (1-p)\,D_n$$

It is desirable for D_{n+1} to be less trend-responsive than the average A_{n+1}, so the continuous update of the absolute deviation is based on 12 months. Thus p = 12 so that

$$D_{n+1} = \frac{1}{12}|C_n - A_n| + \frac{11}{12} D_n \tag{6}$$

along with

$$SD_{n+1} = 1.253\ D_{n+1} \tag{7}$$

are the recommended formulae for updating the current value of the weighted standard deviation.

One problem remains. It is the problem of a real and dramatic shift in a current value, that is not the result of a reporting error but instead reflects a real, albiet temporary or short-term, change. The effect of a real and dramatic change is to destabilize the current average and typical deviation, so an allowance for the effect is necessary especially if the effect is short term.

6.4 AVERAGES AND FLUCTUATIONS IN DATA

There are several scales of change inherent in month to month fluctuations in data. One is the long-term trends, i.e., gradual increases or decreases in filings due to population shifts, socio-economic changes, etc. Then there are the seasonal variations. For example, the habit of judges to take their vacations in the summer, as do most people, often causes a midyear drop in dispositions.

On the short-term level, there are simply the random fluctuations from month to month, caused by the intermittnacy in human affairs. Even these have to be distinguished into "normal" fluctuations and "odd" occurrences.

For instance, a court may close out a large number of old, inactive cases one month. This will cause a monthly disposition figure that is unusual. Or there may be several large civil damage suits resulting from a catastrophic industrial accident.

If the event data, say filings, were purely random, with no trends, seasonality, or "odd" occurrences, then the sequence of monthly filings would be independent variables having a "Poisson" distribution. One hallmark of this type of distribution is that the size of the "typical" deviation from the average is about equal to the square root of the average. More technically, the standard deviation equals the square root of the mean. The truth of this was investigated, trying to eliminate both trends, seasonality, and odd occurrences.

The conclusion is that the standard deviation ranges from about the square root of the mean to three to four times the square root, with about double being typical. This implies that some unknown mechanism causes monthly fluctuations to be *larger* than could be explained by sheer randomness. For those who would like to see in concrete actuality the fluctuation phenomenon, Figure 16, 17, 18, the Criminal, Civil, and Domestic filings and dispositions by court for the 16 months of North Dakota data, have been included here.

But to determine if a monthly value, say filings, is unusually high or low, two things are needed. First of all, a current average number of filings per month to compare it with. Then a "typical deviation" to measure the current deviation against.

There are two difficulties here: What can be done about the "odd" occurrences? For instance, suppose dispositions in a given month are four or five times the average because of closing-out of old cases. Including this odd value in the current average will cause it to jump upward considerably and give a misleading estimate of the average number of dispositions per month. A similar destabilizing effect will also be apparent in the current standard deviation.

The other difficulty is this: Suppose there is a sudden and lasting shift in the number of filings or dispositions due to factors such as assignment of additional judges, changes in court procedures, etc. How can the current average and standard deviation be adjusted to reflect this change without waiting for them to adjust themselves as the averaging period moves forward in time?

To solve the odd-value problem the following approach is recommended. Suppose that at the end of the month, D_n is the estimate of the typical deviation of the monthly readings from the corresponding averages for that month.

If the difference between the current value, C_n, and the average, A_n, at the end of the month is large compared with the typical deviation value, D_n, then *C_n will be considered to be an odd value, ignored, and for the next, $(n+1)$st* month, put

$$A_{n+1} = A_n.$$

More precisely, some number, z, will be chosen such that if the *Oddness Condition*

$$|C_n - A_n| \geq zD_n,$$

is satisfied then put

$$A_{n+1} = A_n$$

For reasons explained later, take z = 3.23.

Now the second difficulty: Suppose there is an abrupt and more or less permanent shift in the values of C_{n+1} starting at the (n+1)st month. According to the present computational scheme, what will happen is this: the C_{n+1} value will be an odd value. The *Oddness Condition* above is satisfied so that

$$A_{n+1} = A_n.$$

The value C_{n+2} will also satisfy the *Oddness Condition*, and the same average will be used again, namely

$$A_{n+2} = A_n,$$

Next month, the (n+3)rd month, the same thing will happen and the *Oddness Condition* will hold again. If the *Oddness Condition* holds three times in a row with the $C_{n+1}, C_{n+2}, C_{n+3}$ values either all *exceeding the current averages* or *all being below*, then redefine the average, A_{n+3}, to be

$$A_{n+3} = \frac{C_{n+1} + C_{n+2} + C_{n+3}}{3}$$

and proceed on to compute A_{n+4} as before using this redefined value of A_{n+3}.

The implication of this is that, after three months at the new level, the average readjusts itself to the average of the previous three months. No abrupt shift in values in the North Dakota data were discovered but this phenomenon was found in analyzing the Colorado data. There it was found, in at least two jurisdictions, that there was one or more case categories that exhibited such a shift, in filings or dispositions. The reasons are unknown, but the data and results are discussed in the non-technical report section.

When the *Oddness Condition* occurs, the values in question are starred in the computer printouts, so the occurrence of three stars in a row is an indication of this shift phenomenon.

The last piece to fit this together is the method for updating the Absolute Deviation, D_{n+1}, when the oddness condition occurs.

If C_n is an odd value, then $|C_n - A_n|$ will be so large that it may make D_{n+1} unrealistically large. If the *Oddness Condition* holds, we stipulate that

$$D_{n+1} = D_n.$$

The open question left is the *initialization*. Suppose the system goes up, data begins coming in, and A_1, D_1, A_2, D_2, etc. need to be computed. How are initial values A_0, D_0 selected to begin the computation?

Since A_0 represents the initial average, a sensible thing to do is to take A_0 to be the average for the preceding year. For instance, if computing averages for filings of crimes against the person are being calculated, A_0 could be the average monthly filings in this category in the preceding year (if this data is available). For D_0 the average of the absolute values of the differences of the monthly filings from A_0 over the last year could be used. More specifically, if, for the preceding year, the monthly filings were $C_1^p, \ldots, C_{12}^p$ where the superscript p indicates preceding year, then define

$$A_0 = \frac{1}{12}(C_1^p\ \ C_2^p + \ldots + C_{12}^p)$$

$$D_0 = \frac{1}{12}(|C_1^p - A_0| + |C_2^p - A_0| + \ldots + |C_{12}^p - A_0|).$$

In this study, no preceding year data were available, so the first available year of data was used to compute A_0, D_0 as above. This is really cheating, since when a system goes up, one does not have a year's worth of data from the system available without a high-quality crystal ball.

However, one usually has available the average number of filings per month over the last year in the category. Take this average to be A_0. If the data necessary to compute D_0 as above is not available, then use

$$D_0 = 1.2\sqrt{A_0}.$$

Now, to discuss why the appearance of the mysterious number 3.23 in the *Oddness Condition*.

For a normally distributed sequence the probability that any number differs from the average by more than 2.575 SD_n is approximately .01. In other words, on the average, about one in every 100 of the sequence $C_1, C_2, \ldots, C_n$ will satisfy the condition

$$|C_n - A_n| \geq 2.575\ SD_n.$$

Using SD = 1.25 3D, this becomes the condition

$$|C_n - A_n| \geq 3.23\ D_n.$$

In other words, if the sequence $C_1, \ldots, C_n$ contains no aberrant values, then the occurrence of a difference greater than 3.23 D_n is a fairly rare event. For monthly readings without odd values, the above condition should be satisfied only about one in every 100 months or about eight years.

Therefore, if a monthly reading does satisfy the *Oddness Condition*, there is a reasonable assurance that something out of the ordinary has occurred.

A Summary of Computational Steps

For current values in any case category in any court, use the following steps to update the Current Average, A_n, the Current Absolute Deviation, D_n, and the Current Standard Deviation, SD_n.

I. For the first month of reporting, select initial values A_0, D_0.

(a) Let A_0 be the average events per month (e.g. filings/month, dispositions/month) in that category over the preceding year.

(b) If monthly data is available for the preceding year, let D_0 be the average over the year of the absolute values of the differences between the monthly readings and the average A_0 computed in (a) above.

(c) If monthly data is not available, use

$$D_0 = 1.2\sqrt{A_0}.$$

(d) If no previous data is available, use a best guess for A_0 and then select D_0 by (c) above.

II. Assume the values A_n, D_n have been computed for this month. Check to see if the *Oddness Condition*

$$|C_n - A_n| \geq 3.23\, D_n$$

is satisfied, where C_n is the current month's value in the category.

III. If the *Oddness Condition* is satisfied, define

$$A_{n+1} = A_n$$

and flag the value C_n.

IV. If the *Oddness Condition* is not satisfied, define

$$A_{n+1} = \frac{1}{6} C_n + \frac{5}{6} A_n$$

$$D_{n+1} = \frac{1}{12} |C_n - A_n| + \frac{11}{12} D_n.$$

V. If the *Oddness Condition* is satisfied for three consecutive months, and in all three months the current value is above (below) the average, then, for the following month, define the previous current average to be the average of the three months in question.

CASES FILED — TOT CRIMINL

DIST	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	TOTAL
1	30	29	29	12	23	18	26	35	22	16	41	32	25	31	32	32	433
2	16	8	8	8	14	18	16	12	12	24	8	12	19	14	18	5	212
3	6	3	9	8	4	3	6	8	11	10	4	6	2	4	4	10	98
4	14	22	10	13	21	30	14	19	20	22	24	19	21	23	44	10	326
5	12	7	14	16	9	5	16	30	25	5	16	18	12	10	18	6	219
6	12	9	5	6	12	8	8	10	13	11	9	17	8	16	19	7	170

CASES DISPOSED — TOT CRIMNL

DIST	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	TOTAL
1	22	27	23	25	29	44	23	17	8	31	36	23	23	16	37	22	406
2	12	5	16	16	9	22	6	3	6	13	26	20	23	12	11	6	206
3	4	7	7	7	5	5	2	3	4	13	4	12	7	4	8	5	97
4	21	18	23	11	18	20	16	17	26	15	24	23	16	26	27	12	313
5	10	9	10	18	3	9	12	6	10	12	20	23	23	16	14	9	204
6	4	20	10	4	9	14	6	2	3	16	10	14	16	10	15	9	162

Figure 16. Criminal, North Dakota

CASES FILED — OTHR CIVIL

DIST	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	TOTAL
1	87	130	105	94	86	113	103	127	128	83	71	83	88	110	116	110	1634
2	47	47	44	43	31	42	34	49	62	54	51	46	46	58	69	65	788
3	20	36	40	20	19	19	18	27	31	38	31	26	13	14	35	20	407
4	74	83	93	97	97	83	92	76	63	97	72	74	89	73	90	77	1290
5	44	57	52	63	43	63	59	53	57	42	48	66	44	64	71	64	890
6	28	26	27	29	39	28	26	25	44	23	27	32	35	41	34	23	487

CASE DISPOSED — OTHR CIVIL

DIST	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	TOTAL
1	81	87	95	78	88	93	77	75	78	91	92	100	87	65	132	86	1405
2	43	55	59	36	33	48	33	36	49	48	46	51	50	47	60	48	742
3	25	23	29	18	23	28	16	32	26	26	30	38	18	11	28	26	397
4	57	78	81	90	62	62	66	70	83	73	74	77	71	68	82	70	1164
5	43	44	49	69	57	50	46	37	45	41	52	63	44	61	63	57	821
6	37	27	28	29	39	24	25	22	21	28	43	21	24	25	29	16	438

Figure 17. Civil, North Dakota

CASES FILED — DOMESTIC

DIST	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	TOTAL
1	123	113	153	140	133	131	154	144	129	114	120	113	132	138	161	130	2128
2	29	16	35	25	50	33	50	45	25	42	19	33	28	31	46	31	538
3	13	7	11	23	8	10	9	23	12	21	17	16	11	13	15	14	223
4	46	36	44	53	49	46	40	57	60	54	51	55	45	41	44	56	777
5	48	51	44	49	45	52	70	65	61	54	59	59	61	59	70	51	898
6	30	19	27	21	29	28	31	23	25	27	18	18	17	33	27	15	388

CASES DISPOSED — DOMESTIC

DIST	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7701	7702	7703	7704	TOTAL
1	81	76	113	99	116	136	110	100	116	101	75	100	110	98	154	96	1681
2	15	27	33	36	35	34	32	38	43	35	24	34	21	31	34	30	502
3	7	9	10	20	10	13	7	13	14	15	16	19	10	13	17	12	205
4	46	33	43	29	37	47	35	39	67	61	60	55	56	32	51	34	725
5	42	45	61	42	52	49	55	61	58	37	51	48	51	62	65	56	835
6	23	22	23	17	32	12	23	20	15	25	21	31	13	19	30	9	335

Figure 18. Domestic, North Dakota

7. THIRD-LAYER DATA

7.1 LOOKING AT HISTOGRAMS

In trying to understand the differences between the various North Dakota courts in terms of service times, histograms were found to be helpful. For each court, and each charge, histograms of the times from filing to disposition were constructed. (Recall that this is the estimate of service time available with North Dakota data.) This was done for all cases filed in 1976. The fact that the data base extended only to the end of April 1977 introduced some bias into these historgrams and into the computed averages, medians, and standard deviations of the service times. That is, all cases filed in 1976 which were not terminated by the end of April 1977, were excluded. This implies that some of the longer service times are omitted and that the estimates of average and median service times are on the low side.

The most useful way found for setting up these historgrams was to print out two histograms for each group of service times. The first histogram kept track of the distribution of those service times 30 days or less and simply counted how many service times were 0 days (same-day disposal), how many were one day, etc. In the display of this histogram, 0-1 category indicates 0 (same-day) service time, 1-2 indicates a one-day service time, etc.

The second histogram is a count by month of service times. The daily histogram above can be constructed only if one has actual dates of filing and disposition. If only monthly aggregated data is available, then the best that can be done is to construct the histogram of service times broken down by month. Section 7.3 discusses the use of monthly case-aging data to compute the histogram.

The monthly histogram is defined as follows: All cases that were disposed of in the same month were counted as "0-1". Cases that were disposed of in the month following their filing were counted as "1-2", and so on.

Histograms were useful to aid understanding of court calendaring and procedures. For instance, Figure 19 exhibits the daily and monthly histograms for charge (Civil-Damages) in District 1. The first line gives the average service time, the median, and standard deviation, and (N = 189) indicates that there were 189 service times in the group.

The following simple observations can be made from the daily histogram: If a case did not have a same-day disposal, then its service time was almost certain to be longer than 30 days. However, 25 out of the 189 cases filed (13%) had same-day disposals. Looking at the monthly histogram, there are 35 same-month disposals. These are pretty much accounted for by the 25 same-day disposals. If the same-day disposals are discounted, the peak of the histogram is around the five-month range. The implication is that all cases of this type that cannot be quickly disposed of are calendared about five months into the future.

A contrast is given by the histograms of Figure 20, which are for service times of Felony C cases in the same court — District 1.

About 10% of the cases (21 out of 222) have same-day disposals. But a much larger number have same-month disposals. In fact, almost half of the service times (105) are 30 days or less. Notice that this does not tally with the 67 cases listed in the monthly histogram as same-month disposal. A service time of less than 30 days does not imply that there was a same-month disposal. Looking at the daily histogram, what is characteristic is that, if there is not a same-day disposal, then the service times are fairly uniformly distributed over the next 29 days. Looking down at the monthly histogram, with its peak in the one- to two-month range, the conclusion is that Felony C cases are generally calendared less than 60 days into the future.

Some interesting differences between courts come to light in these histograms. For example, District 4 has a high case-load per judge and a high disposition-per-judge rate. All prior evidence had indicated that this district had an efficient procedural operation. The evidence in this direction turned upon the histograms. For instance, Figure 21 is the histograms for Felony C in District 4. The most noticeable characteristics are the high proportion (25%) of same-day dispositions, and the fact that over half of the cases have a same-month disposition. None of the other district courts dispatches its Felony C cases (the bulk of the Criminal cases) with as much promptness.

Similarly, looking at the histograms of Court 4 in Civil-Damage cases (Figure 22), it is striking to see how many of them (63%) are same-day disposals. Again, no other court comes close to this proportion of same-day disposals.

On the other hand, these histograms indicate that Districts 4 and 6 have a slightly more leisurely pace in handling divorce cases than the other districts.

In Colorado, total service times were available for a large number of cases. But since the Colorado data had more detail, the times from first appearance until the start of trial in contested Criminal cases were extracted and used in this as well as the analysis of service time. The bulk of the cases were Felony 4 charges — the next-to-lease-serious felony charge. These cases were histogrammed by court. Averages, medians, 75th percentiles, and standard deviation (S.D.) were also examined. Figure 23 is the histogram by week of the times until trial in Court #1. That is, looking at the figure, there are two cases with a time to trial of one to two weeks, i.e., eight to 14 days.

The top line gives the mean, S.D., etc. computed in *days,* not weeks. Notice that the 75th percentile is about five months (20 weeks), so that one-fourth of all the cases take longer than five months to get to trial. Contrast this with Figure 24, the histogram for Court #4. The medians are almost equal: both courts get about half their cases to trial in less than three months. The big difference is in the other half of the cases. Court #4 has much fewer long-time-to-trial cases. By four months, three-fourths of its cases have been brought to trial. Court #1 requires almost five months. By the end of the sixth month, Court #1 still has 15% of its cases untried; Court #4, only 8%.

```
CHARGE  1    DISTRICT  1    MEAN = 136.6    MEDIAN = 134.0    S.D. = 100.27    (N = 189)

25  0- 1 XXXXXXXXXXXXXXXXXXXXXXXXX
 4  1- 2 XXXX
 1  2- 3 X
 0  3- 4
 2  4- 5 XX
 0  5- 6
 0  6- 7
 0  7- 8
 0  8- 9
 0  9-10
 1 10-11 X
 0 11-12
 0 12-13
 0 13-14
 0 14-15
 1 15-16 X
 1 16-17 X
 0 17-18
 1 18-19 X
 0 19-20
 0 20-21
 1 21-22 X
 1 22-23 X
 0 23-24
 0 24-25
 2 25-26 XX
 0 26-27
 1 27-28 X
 0 28-29
 0 29-30
```

```
CHARGE  1    DISTRICT  1    MEAN = 5.4    MEDIAN = 5.0    S.D. = 3.29    (N = 189)

35  0- 1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 9  1- 2 XXXXXXXXX
10  2- 3 XXXXXXXXXX
18  3- 4 XXXXXXXXXXXXXXXXXX
33  4- 5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
22  5- 6 XXXXXXXXXXXXXXXXXXXXXX
12  6- 7 XXXXXXXXXXXX
10  7- 8 XXXXXXXXXX
17  8- 9 XXXXXXXXXXXXXXXXX
 8  9-10 XXXXXXXX
 8 10-11 XXXXXXXX
 4 11-12 XXXX
 1 12-13 X
 0 13-14
 2 14-15 XX
 0 15-16
```

Figure 19. Civil-Damages Cases, Service Times, District 1, North Dakota


```
CHARGE  3    DISTRICT  1    MEAN = 52.4    MEDIAN = 35.0    S.D. = 57.44    (N = 222)

21  0- 1 XXXXXXXXXXXXXXXXXXXXX
 9  1- 2 XXXXXXXXX
 4  2- 3 XXXX
 5  3- 4 XXXXX
 4  4- 5 XXXX
 1  5- 6 X
 2  6- 7 XX
 5  7- 8 XXXXX
 2  8- 9 XX
 1  9-10 X
 1 10-11 X
 0 11-12
 2 12-13 XX
 3 13-14 XXX
 5 14-15 XXXXX
 4 15-16 XXXX
 0 16-17
 2 17-18 XX
 2 18-19 XX
 6 19-20 XXXXXX
 4 20-21 XXXX
 4 21-22 XXXX
 2 22-23 XX
 4 23-24 XXXX
 1 24-25 X
 0 25-26
 1 26-27 X
 2 27-28 XX
 3 28-29 XXX
 5 29-30 XXXXX
```

```
CHARGE  3    DISTRICT  1    MEAN = 2.6    MEDIAN = 2.0    S.D. = 1.88    (N = 222)

67  0- 1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
74  1- 2 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
30  2- 3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
22  3- 4 XXXXXXXXXXXXXXXXXXXXXX
 9  4- 5 XXXXXXXXX
 5  5- 6 XXXXX
 9  6- 7 XXXXXXXXX
 2  7- 8 XX
 3  8- 9 XXX
 0  9-10
 1 10-11 X
 0 11-12
 0 12-13
 0 13-14
 0 14-15
 0 15-16
```

Figure 20. Felony C Cases, Service Times, District 1, North Dakota

```
CHARGE  3    DISTRICT  4    MEAN = 40.8    MEIAN = 19.0    S.D. = 52.93    (N = 162)

41  0- 1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 6  1- 2 XXXXXX
 0  2- 3
 3  3- 4 XXX
 4  4- 5 XXXX
 2  5- 6 XX
 3  6- 7 XXX
 1  7- 8 X
 1  8- 9 X
 1  9-10 X
 2 10-11 XX
 3 11-12 XXX
 0 12-13
 7 13-14 XXXXXXX
 2 14-15 XX
 1 15-16 X
 0 16-17
 4 17-18 XXXX
 0 18-19
 1 19-20 X
 4 20-21 XXXX
 3 21-22 XXX
 1 22-23 X
 2 23-24 XX
 0 24-25
 0 25-26
 1 26-27 X
 0 27-28
 1 28-29 X
 2 29-30 XX
```

```
CHARGE  3    DISTRICT  4    MEAN = 2.3    MEDIAN = 1.0    S.D. = 1.86    (N = 162)

83  0- 1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
32  1- 2 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
15  2- 3 XXXXXXXXXXXXXXX
12  3- 4 XXXXXXXXXXXX
 6  4- 5 XXXXXX
 6  5- 6 XXXXXX
 7  6- 7 XXXXXXX
 0  7- 8
 0  8- 9
 0  9-10
 0 10-11
 1 11-12 X
 0 12-13
 0 13-14
 0 14-15
 0 15-16
```

Figure 21. Felony C Cases, Service Times, District 4, North Dakota


```
CHARGE  1    DISTRICT  3    MEAN = 50.4    MEDIAN = 1.0    S.D. = 93.08    (N = 183)

115  0- 1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0  1- 2
  0  2- 3
  1  3- 4 X
  0  4- 5
  0  5- 6
  0  6- 7
  1  7- 8 X
  0  8- 9
  1  9-10 X
  1 10-11 X
  0 11-12
  0 12-13
  0 13-14
  1 14-15 X
  0 15-16
  2 16-17 XX
  0 17-18
  1 18-19 X
  0 19-20
  0 20-21
  0 21-22
  0 22-23
  1 23-24 X
  0 24-25
  0 25-26
  1 26-27 X
  0 27-28
  0 28-29
  1 29-30 X
```

```
CHARGE  1    DISTRICT  4    MEAN = 2.6    MEDIAN = 1.0    S.D. = 3.03    (N = 183)

119  0- 1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 15  1- 2 XXXXXXXXXXXXXXX
 10  2- 3 XXXXXXXXXX
  7  3- 4 XXXXXXX
  5  4- 5 XXXXX
  3  5- 6 XXX
  4  6- 7 XXXX
  7  7- 8 XXXXXXX
  5  8- 9 XXXXX
  3  9-10 XXX
  1 10-11 X
  0 11-12
  1 12-13 X
  1 13-14 X
  1 14-15 X
  1 15-16 X
```

Figure 22. Civil-Damages Cases, Service Times, District 4, North Dakota

```
COURT  1    MEAN = 118.2    S.D. = 87.0    MEDIAN = 92.0    75TH  PCL = 146.0    (N = 705)

 0  0- 1
 2  1- 2 XX
 3  2- 3 XXX
13  3- 4 XXXXXXXXXXXXX
12  4- 5 XXXXXXXXXXXX
25  5- 6 XXXXXXXXXXXXXXXXXXXXXXXXX
40  6- 7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
37  7- 8 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
36  8- 9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
46  9-10 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
30 10-11 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
52 11-12 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
53 12-13 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
37 13-14 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
28 14-15 XXXXXXXXXXXXXXXXXXXXXXXXXXXX
32 15-16 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
14 16-17 XXXXXXXXXXXXXX
29 17-18 XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
16 18-19 XXXXXXXXXXXXXXXX
11 19-20 XXXXXXXXXXX
19 20-21 XXXXXXXXXXXXXXXXXXX
16 21-22 XXXXXXXXXXXXXXXX
12 22-23 XXXXXXXXXXXX
12 23-24 XXXXXXXXXXXX
16 24-25 XXXXXXXXXXXXXXXX
 7 25-26 XXXXXXX
12 26-27 XXXXXXXXXXXX
 7 27-28 XXXXXXX
 5 28-29 XXXXX
 6 29-30 XXXXXX
 5 30-31 XXXXX
 7 31-32 XXXXXXX
 4 32-33 XXXX
 8 33-34 XXXXXXXX
 5 34-35 XXXXX
 4 35-36 XXXX
 2 36-37 XX
 1 37-38 X
 3 38-39 XXX
 1 39-40 X
 4 40-41 XXXX
 3 41-42 XXX
 3 42-43 XXX
 1 43-44 X
 0 44-45
 2 45-46 XX
 1 46-47 X
 1 47-48 X
 2 48-49 XX
 0 49-50
 1 50-51 X
 1 51-52 X
18 ≥53   XXXXXXXXXXXXXXXXXX
```

Figure 23. Times to Trial, Court 1, Colorado


```
COURT 4    MEAN = 97.0    S.D. = 54.1    MEDIAN = 85.0    75TH  PCL = 121.0    (N = 164)

 0  0- 1
 0  1- 2
 0  2- 3
 1  3- 4 X
 3  4- 5 XXX
12  5- 6 XXXXXXXXXXXX
14  6- 7 XXXXXXXXXXXXXX
10  7- 8 XXXXXXXXXX
12  8- 9 XXXXXXXXXXXX
10  9-10 XXXXXXXXXX
11 10-11 XXXXXXXXXXX
 8 11-12 XXXXXXXX
11 12-13 XXXXXXXXXXX
10 13-14 XXXXXXXXXX
13 14-15 XXXXXXXXXXXXX
 3 15-16 XXX
 5 16-17 XXXXX
 7 17-18 XXXXXXX
 4 18-19 XXXX
 3 19-20 XXX
 6 20-21 XXXXXX
 2 21-22 XX
 3 22-23 XXX
 2 23-24 XX
 0 24-25
 1 25-26 X
 2 26-27 XX
 1 27-28 X
 1 28-29 X
 0 29-30
 2 30-31 XX
 0 31-32
 1 32-33 X
 1 33-34 X
 2 34-55 XX
 0 35-36
 1 36-37 X
 1 37-38 X
 0 38-38
 0 39-40
 0 40-41
 0 41-42
 0 42-43
 0 43-44
 0 44-45
 0 45-46
 0 46-47
 0 47-48
 0 48-49
 0 49-50
 0 50-51
 0 51-52
 1 ≥53  X
```

Figure 24. Times to Trial, Court 4, Colorado

7.2 ESTIMATING AVERAGES AND MEDIANS FROM AGGREGATE DATA

Using the service time measured in days, then, except for the bias mentioned above, fairly precise estimates of the average and median service times may be obtained.

However, if only monthly data is available, the estimation raises a serious problem. For instance, with Criminal and Domestic cases where the average and median service time may be on the order of a month, how accurately can these be estimated from data aggregated over a month?

Estimating average and median service times using monthly data can result in badly biased estimates.

Consider estimates derived in this way: All same-month disposals were taken to have a service time of one month. All next month disposals were taken to have a service time of two months, and so on. Then the averages and medians were computed using these service times.

It was assumed the averages and medians would be biased high, but it was surprising how consistently too high they were. The following computational scheme was then adopted:

Service Time Assignment to Aggregate Data

Assign service time 0 to all same-month disposals.

Assign service time one month to all next-month disposals, etc. When the averages were recomputed, using the above assignment, the results were surprisingly close to the averages obtained using the exact length in days of the service times. Counting 30 days to the month, the estimates were checked against each other in two case categories in all courts, i.e., 12 averages were examined. The two estimates differed, in the worst case, by 5%. Overall, the difference in the 12 cases between the two estimates was 3%.

As for the medians, the median value of the service times assigned in months will be expressed in terms of full months with no fractional parts, i.e., 0 months, one month, two months, etc. This follows from the definition of the median as the middle value of the service times when they are arranged in order from the highest to the lowest. (There will be some rare exceptions when interpolation may be needed.) Because of this property, the median computed using the service times assigned in months cannot generally be a close approximation to the median of the exact values of the service times. However, when the median service time in days is rounded off to the nearest month, it almost always equals the median of the monthly data.

One way, incidentally, to get the revised estimates, is to take each of the monthly averages and medians in the printout and decrease them by one.

7.3 USING AGING DATA TO GET SERVICE TIMES

In this section, the problem of finding the service times from aggregated data is discussed. The data necessary is aging data. This is data which specifies, at the end of each month, how many cases have been pending for one month, two months, etc. For instance, typical aging data for a given case category, say, Felonies, in Court #1 is displayed below:

Aging Table: Felonies, Court #1

	1-76	2-76	3-76	4-76	5-76	6-76	. .
Filings	22	27	25	11	22	15	. . .
0-1	14	19	17	8	18	9	. . .
1-2	8	5	14	11	4	8	. . .
2-3	8	7	4	13	6	3	. . .
3-4	14	4	6	2	9	6	. . .
4-5	8	14	3	3	2	6	. . .
5-6	5	6	13	3	2	1	. . .
6-7	—	5	3	6	3	2	. . .
•	•	•	•	•	•	•	
•	•	•	•	•	•	•	
•	•	•	•	•	•	•	

This is interpreted as follows: The first row is the number of filings during the month. The subsequent rows refer to number of cases pending as of the end of the month in question. The second row, labeled 0-1, is the number of cases pending at the end of the month that were filed the same month. The 14 underlined in the table above refers to the number of cases pending at the end of 3-76 that were filed in 2-76. The 4 below the 14 refers to the number of cases pending at the end of 3-76 that were filed in 1-76, and so on.

A common misconception needs to be laid to rest. *There is no relation between average or median pending times and the average and median service time.* For example, taking a typical month, 5-76 in the aging table, for Felonies, Court #1. Pending times were assigned by the rule that cases filed during the current month have been pending 0 months at the end of the month, cases filed the month before have been pending one month, etc. All cases pending more than 12 months were deleted. Then the average pending time was computed as 3.3 months. The actual computed average service time for Felonies in this district was 1.5 months. Therefore, computing averages, etc., of pending times does not give a good estimate of court service times.

The aging table can be used to get the monthly service-time values. The procedure is relatively simple. Start with the column headed 1-76. There were 22 filings. Of these, only 14 were pending at the end of 1-76. This means that, of these 22, there were (22-14=8) same-month disposals. Now follow these 14 across to the next month. Under 2-76 the entry 5 in the third row indicates that, of the 22 filings in 1-76, then (14-5=9) were disposed of in 2-76. Of the 22, then, this gives 9 next-month filings. Continuing on, 5 decreases to a 4 in 3-76, which implies 1 disposal in 3-76, etc. In this way the aging table or table of cases pending can be converted to a service-time table.

Service Times (Months)	1-76	2-76	3-76	4-76	. . .	12-76	Total
0	8	8	8	3	. . .		. . .
1	9	5	6	4	. . .		. . .
2	1	1	5	1	. . .		. . .
3	2	4	0	•	. . .		. . .
4	0	3	•				
5	1	•					
6	•						
7	•						
8							
•							
•							
•							

Totalling the 12 monthly columns gives a result that will be exactly the data exhibited in the monthly service-time histogram distributions. This, then, gives an effective method for getting the service-time distribution and computing such

parameters as average and median service times.

The fact that average time pending is not related to average service time in no way implies that aging data is not valuable. One important use has been illustrated above. Another use is to monitor cases that are averaged. In some courts, there are a significant proportion of cases that have been pending two or three years, or more. This may be a realistic length in Civil cases, but substantial numbers of Criminal cases in this age range should certainly be checked.

Aging tables are a valuable inclusion in the third layer of information.

7.4 AVOIDING MISLEADING AVERAGES

The histograms and computations in Section 7.1 on the North Dakota service times included only those cases filed in 1976 and terminated by the end of April 1977. The Colorado computations included only those cases that were brought to trial in the data period available. In both situations, cases initiated but not terminated or brought to trial in the data period were not included in the histograms or in the computations of the mean.

This forces a considerable bias on the computations. It is more pronounced in the North Dakota situation because of the shorter data period available. The point is that the cases not terminated by the end of the data period are generally those cases having a long disposal time. By deleting these, the averages are misleadingly small. The effect on the histograms is not as pronounced in most case categories.

For instance, suppose an attempt at correcting this situation was made by confining the study to North Dakota cases filed in the first six months of 1976. Since the data goes to the end of April 1977, service times could be obtained for all cases disposed of in 10 months or less. This implies that the first 10 monthly entries in the histogram would be exactly correct. Even if disposition times for those cases not terminated by April 1977 could be found, the number of cases filed from November 1976 to June 1977 terminated in the same month, in one month, in two months, etc., would not change. However, the number of cases terminating in 11 or 12 months will be changed. Therefore, for those case categories in which only a small fraction of the cases have disposition times larger than 10 months, the histograms will give a reliable picture of the distribution of case service times.

However, this is not true for the averages. In the course of this study of the data from both states, it was noted that in every court there are a few cases which have extremely long service times compared withthe bulk of the cases. For instance, there are always a few Criminal or Domestic cases which remain unterminated for well over a year. These long termination times are not generally due to court malfunctioning. Usually, the process has been halted for some reasons which is not under the control of the court. In many instances, the cases are, in fact, no longer active but no official action has been taken to close them out. While this may not be important to court functioning, it does have a very adverse effect on the usual statistical measures.

For instance, if nine out of 10 of the cases have an average service time of 2.5 months and the occasional one case in 10 in which the usual process is halted has an average service time of 1-1/2 years, then the overall average service time is 4.1 months. Thus, including just one aberrant case in with the nine cases that are normally processed gives a considerably higher value to the average service time. This sort of phenomenon is typical of the data in this study. Obtaining measures that are descriptive of the normal functioning of the court is what is desired, and not of those cases in which the long service time is out of the court's control. Many Domestic cases, for example, possibly because of lack of action on the part of the persons filing, remain undisposed for long periods. How can these be handled in computing statistical measures?

The ideal solution would be to have an indication on the incoming data of all cases in which processing has been halted due to circumstances out of the court's control. Then these cases could be deleted from the statistical analysis. Colorado has made partial provisions for this by providing a category labeled FUGITIVE in Criminal cases, implying that the defendant has flown the coop. However, there are many cases, not so labeled, in which the service times are extremely long. There are a variety of reasons for halts in the process not covered by the label FUGITIVE and that perhaps a more inclusive coding could be helpful.

However, given that such coding is not routinely done, then what steps can be taken to remove the bias introduced by such cases?

There are a variety of answers which have some common source: Use measures of "typical" duration which is less sensitive to a few large values than the average. A few of these are briefly discussed with their advantages and disadvantages.

One such set of measures is the percentiles. For instance, the median, or 50th percentile, of a set of numbers is that number such that (as closely as possible) 50% of the numbers in the set are larger than it and 50% are less than it. The 75th percentile is the number such that (as closely as possible) 25% of the numbers on the list are larger than it. Similarly, the 90th percentile is defined as that number such that about 10% of the numbers on the list are greater. The percentiles are quite insensitive to a few large values, and are an attractive measure of "typical" duration. For instance, the 50th percentile or median service time has the intuitively concrete interpretation that half the cases are disposed of in less than that time. Based on this study, the 75th percentile appears to be the best of the percentile measures. It has the property that three-fourths of the cases are disposed of in less than this time and gives a good indication of how a court handles the bulk of its cases in the given category. Its main disadvantage is that, with a small number of cases, it can be more highly sensitive to a few values than the mean, and more variable. For instance, look at the two lists with five service times each:

List A	40	50	80	90	100
List B	40	50	60	90	100

The two lists differ in only the middle entry, which is, by design, the median. The median of the first list is 80, of the second, 60. Yet the service times on the lists do not differ a great deal. This is reflected by the means. The first list has a mean of 72, the second has a mean of 68.

The second set of measures is obtained by trying to modify the average so that it is less sensitive to a small fraction of high values. They are called, in statistics, the "Winsorized Means" and the "Trimmed Means." The Winsorized mean is actually a *truncated mean*. The idea is a simple one. Fix some critical time by the rule-of-thumb that if a service time for a given case category is greater than that critical time, then some normal process has been halted in the case. For instance, in Criminal cases, six months might be chosen as the critical time. Then all service times longer than the critical time are averaged as being equal to the critical time. For example, if the list of service times (in months) are

List C 3.2, 5.4, 12.3, 2.7, 2.9, 3.8, and

if six months is selected as the critical time, then the average of the list is computed by changing the 12.3 to 6.0, with the resulting average being

$$\frac{3.2 + 5.4 + 6.0 + 2.7 + 2.9 + 3.8}{6}$$

This Winsorized or truncated mean is a reasonable method for dealing with a few large values that at the same time remains more stable for small sample sizes than the percentiles.

The "Trimmed Mean" is actually what its name implies. A certain percentage of cases is set by the rule-of-thumb that no more than that percentage are odd or aberrant cases. Say the percentage chosen is 10%. Then the procedure is that the upper 10% of the service times are simply deleted (or trimmed) from the list and the "10% Trimmed Mean" is the average of the remaining service times. The "Trimmed Mean" is widely accepted as a reliable and stable measure.

While the above measures are designed to minimize the impact of a relatively few very-long-duration cases on the measurement of the normal flow of cases through the courts, it is often the long-duration cases that are brought to the public's attention. Therefore, vigilance is necessary in monitoring and inquiring about the state of the long-duration cases.

8. THE BACKLOG INDEX

8.1 CONNECTION WITH TIME FROM FILING TO DISPOSITION

As discussed in the Preface, one of the purposes of this study was to construct an index that would provide an approximate measure of the court service time. Because of the "speedy trail" demands, it is important that the time which cases take to be processed by the court be constantly monitored.

One estimate of service time has been defined earlier as time from filing to disposition. In many states, for Criminal cases, this time is not the most significant parameter. The time between the verdict or judgement and the final disposition is only partially controlled by the courts. For Criminal cases it is perhaps most appropriate to monitor time from the defendant's first court appearance to judgement or verdict, or in the case of Not Guilty Pleas, the time from first appearance to the start of the trial. However, this data is not available in most systems, so time from filing to disposition is the msot common estimate of service time.

If one has case-by-case data, or monthly aging data, then the previous section indicates how average or median service times can be computed. However, this computation is based on retrospective data, i.e., what has the service-time average been over the last year. The computation assumes that many months of data are available and computes the service-time statistics averaged over this past period. This makes these statistics unsuitable as monitoring indices. For monitoring, some sort of current service-time measure based on current data is required.

The best measure that has been found for monitoring is the BACKLOG Index. In this study, three BACKLOG Indices were computed for each court, one for Criminal, one for Civil, and one for Domestic. The BACKLOG Indices are very simply defined as

$$\text{BACKLOG} = \frac{\text{Number of Cases Pending}}{\text{Cur. Average Disp. per Month}} .$$

The denominator is calculated using the continuous update method described in detail in Section 6.3 of this report.

The reasons this index was selected are as follows: the Index was defined in a reference, but without any description of its properties and it was clear that it had two desirable properties.

First, it was more or less independent of court size.

Second, it had the concrete interpretation that at the previous court disposition rate, BACKLOG was equal to the number of *months* the court would have to work to clear up the cases currently pending, so it is a measure of workload as well as of service time.

After discarding a number of unsatisfactory candidates, it was observed that, if cases were served on a first-come, first-served basis, then BACKLOG would be exactly equal to the number of months an entering case would take to be disposed of (assuming the disposition rate remained constant).

The point here is that a first-come, first-served basis means that the court "customers" form a line waiting for service. As a case is filed, it *joins the end of the line*. The customer who is served next is at the head of the line. Now, consider this question: If there are 100 customers waiting in line, and if 20 are being served each month and you join the end of the line, how long will it be (in months) before your turn comes? The answer is easy — at 20 per month, it will take five months to service the 100 customers ahead of you. That is, in general, any customer who joins the tail of the current line will have a waiting time (in months) defined by

$$\text{Waiting Time} = \frac{\text{Length of Current Line}}{\text{Number Served per Month}} .$$

This last expression, translated into cases pending and dispositions per month, is the ratio that defines BACKLOG.

Since cases are not processed on a first-come, first-served basis, the formula seemed a bit tenuous. However, it did convey the impression that further exploration might be fruitful.

A simple model explains why the BACKLOG Index is a reasonable measure of the average time from filing to disposition or service time. Suppose that the court statistics are exactly the same for each month. Say that n cases are filed in every month. Of these, n_0 are disposed of in the same month, n_1 in the following month, n_2 in the month after, and so on. By the method of assigning service times, developed in Section 7.3, the n_0 cases are assigned 0 month's service time; then, the n_1 cases are assigned a 1-month service-time, the n_2 cases, a 2-month service time, and so on. The total amount of waiting time that all n cases put in waiting to be serviced is

$$\text{Total Service Time} = 1 . n_1 + 2 . n_2 + 3 . n_3 + \ldots .$$

The average service time per case is

$$\text{Average Service Time} = \frac{\text{Total Service Time}}{n} .$$

In each month, the number of cases pending are then computed. The number pending at the end of the month that were filed during the month is

$$n - n_0 .$$

The number still pending that were filed the month before is

$$n - n_0 - n_1 .$$

The number pending from two months ago is

$$n - n_0 - n_1 - n_2 -$$

Continuing, then, the total number pending is

$$\text{Number Pending} = (n-n_0) + (n-n_0-n_1) + (n-n_0-n_1-n_2) + \ldots$$

Assuming that all cases are eventually disposed of

$$n = n_0 + n_1 + n_2 + \ldots$$

Substituting this into the expression for Number Pending gives

$$\text{Number Pending} = (n_1 + n_2 + \ldots) + (n_2 + n_3 + \ldots) + (n_3 + n_4 + \ldots)$$
$$= n_1 + 2 \cdot n_2 + 3 \cdot n_3 + \ldots .$$

Therefore, the number of cases pending is exactly equal to the average time from filing to disposition.

$$\text{Average Service Time} = \frac{\text{Total Service Time}}{n}$$
$$= \frac{\text{Number Pending}}{n}.$$

If the statistics of the court are the same from month to month, then the number of dispositions each month musst equal the number of filings, i.e.,

$$\text{Dispositions per month} = n.$$

Therefore, the result is that

$$\text{Average Service Time} = \frac{\text{Number Pending}}{\text{Dispositions per month}}.$$

But the ration on the right above is exactly the BACKLOG Index.

In view of the remarks in the previous section concerning the inordinate effect of extreme service times on the average service time, the Winsorized or truncated mean can also be calculated. The idea is to pick a critical service time, say K months are truncated to be equal to K months. Thus, all cases disposed of in K+1 months, K+2 months, etc., are assigned a service time of K months. This assignment gives the Truncated Average:

$$\text{Average Truncated at K} = \frac{1 \cdot n_1 + 2 \cdot n_2 + \ldots Kn_K + Kn_{K+1} + \ldots}{n}$$

On the other hand, compute the cases pending K months or less. This is

$$\text{Number Pending L.E. K Months}$$
$$= (n - n_0) + (n - n_0 - n_1) + \cdots + (n - n_0 - n_1 - \cdots - n_K)$$
$$= n_1 + n_2 + \cdots) + (n_2 + n_3 + \cdots) + \cdots + (n_{K+2} + \cdots)$$
$$= n_1 + 2 \cdot n_2 + \cdots + Kn_K + Kn_{K+1} + Kn_{K+2} + \cdots$$

where the abbreviation L.E. denotes less than or equal to. This gives

$$\text{Average Truncated at K} = \frac{\text{Number Pending L.E. K Months}}{n}.$$

Again, equating n to Disposals per Month, we get

$$\text{Average Truncated at K} = \frac{\text{Number Pending L.E. K Months}}{\text{Disposals per Month}}.$$

The expression on the right above we call the K-MONTH BACKLOG. This gives the amount of time it wouold take to dispose of all of the cases pending less than or equal to the critical time K.

8.2 A FEW GRAINS OF SALT

While the BACKLOG Index does provide a measure of average service time when expressed as time from filing to disposition, it equals the average service time only if the court remains in "stable or steady-state" operation with the average number of filings and dispositions remaining fairly constant and the filing each month having about the same distribution of service times.

If the court is not in steady-state operation, for instance, if filings begin to exceed dispositions, or if there are sizeable seasonal fluctuations, or a court changes its mode of operation, then the approximate equality between average service time and BACKLOG no longer holds. For instance, at an extreme, suppose that a court decides to dispose of all current monthly filings in the same month. Then the average disposition time for cases filed that month is zero. On the other hand, if the cases pending do not increase in number from the end of the previous month, the disposition rate remains the same, so that the value of BACKLOG is unchanged from the previous month.

Variations of the above extremes were observed in the data used in this study. For instance, in one court where dispositions are lagging behind filings, a few of the new cases are processed fairly quickly as they come in. The few exceptions stay pending month after month, and subsequently there is a gradual build-up of BACKLOG. All the energy of the court seems to be devoted to quickly processing most of the incoming cases, and there seems to be no time available to close out old cases.

The result, if one ignores a small percentage of the cases, is a short average processing time, which is much smaller than the value of the BACKLOG Index. The two become comparable only if the few cases that have very long service times are included in the averaging. But the latter is generally not possible as many of the cases pending for a long time are still non-terminated at the end of the data period, and a service time cannot be assigned to them.

For the reasons outlined above, the use of histograms of service times as backup, third-layer information is strongly recommended. These provide the more detailed information necessary to understand the distribution of service times in the court.

Because of the fact that a court may vary its distribution of service times, and because, in many states, there are critical times established past which a case is considered over-aged, two values of BACKLOG should be computed. For instance, in North Dakota, where four months is the critical time for Criminal cases, we compute both

$$\text{FOUR-MONTH BACKLOG} = \frac{\text{No. Pending L.E. Four Mo.}}{\text{Avg. Disposals per Mo.}}$$

and the usual BACKLOG as defined previously. Then the difference

$$\text{BACKLOG} - (\text{FOUR-MONTH BACKLOG})$$

is the backlog in work of all cases that have been pending more than four months. In North Dakota, FOUR-MONTH BACKLOGs were computed for Criminal and Domestic, 12-MONTH BACKLOG for Civil. In Colorado, SIX-MONTH BACKLOGs were calculated for Criminal and Domestic, with 12-MONTH BACKLOG for Civil.

Recall that the FOUR-MONTH BACKLOG is a measure of the Average Service Time truncated at four months. That is, all cases disposed of in over four months are assigned a four-month service time in taking the average. Similarly, for the SIX-MONTH and 12-MONTH BACKLOGs. In Colorado, where large numbers of Criminal cases become over-aged, possibly because of the long period following the verdict until the final sentencing, the SIX-MONTH BACKLOG gives a better view of court functioning. Actually, in a situation where the period between verdict and final disposal is only partially under court control, it may be

desirable to monitor the average time to verdict in Criminal cases. To do this, define a BACKLOG / VERDICT Index by

$$\text{BACKLOG} - \text{VERDICT} = \frac{\text{No. of Cases Awaiting Verdict}}{\text{Avg. No. of Verdicts per Mo.}}$$

Then following the same discussion as above, this BACKLOG-VERDICT Index will give a measure of the average time from filing to verdict.

With all the above grains of salt, the BACKLOG Index is a valuable and revealing summary of court activity. In general, it was found that, whenever BACKLOg increases systematically, the average service time is also undergoing a similar increase. The BACKLOG graphs give an excellent visual summary of how well the court is handling its caseload.

9. AID ANALYSIS OF SERVICE TIMES

9.1 INTRODUCTION

One portion of this study as to determine which factors were dominant in influencing the case service times. For instance, the question has been posed in the literature [2], [3] as to the relative effects of differing caseload types versus procedural differences. Of course, without on-site visits, there is no way of determining what the differences in procedures, and their effects, are.

In the North Dakota data there was available, for each case, the total service time and a number of factors that might affect its service time. These were:

Court of Hearing
Case Type
Type of Trial or Hearing
Plea (Criminal)
Judgment, i.e., Outcome

Separate analyses were made for the Criminal and Domestic case service times. No study was made for Civil cases. The reason for the omission was that, with the long duration of Civil cases, a substantial proportion of Civil case filings, even in the first six months of 1976, were still open at the end of April 1977. If these cases were deleted, the results would be biased and incomplete. On the other hand, the Criminal and Domestic cases filed during the first nine months of 1976 were almost all terminated by the end of April 1977.

With the more detailed Colorado data base, the decision was made to analyze the time from first appearance to time of trial in Criminal cases. The variables examined for effects on service time were:

Court of Hearing
Severity of Charge
Number of Times the Trial Date was Postponed
Number of Pre-Trial Actions.

The conclusions were interesting and sometimes surprising. Overall, the service times of the same case type in the same court with the same type of trial or hearing and the same outcome were highly variable in North Dakota. In fact, this internal variability was larger than the variability accounted for by all the factors combined. Given the data at our disposal, there is no way to analyze the sources of this internal variability. Why, for example, should some non-contested divorce cases in the same court take many times as long to dispose of as others?

In the Colorado study, the picture was different. The number of Postponements and the number of Pre-Trial Actions had a marked effect on the times until trial. Taking these factors into account, the variability of the times until trial was substantially reduced.

These results are tentative. The purpose of the project was to demonstrate the use and capability of selected statistical tools. The end results are interesting, but a much closer look into the data would be necessary to understand the real implications.

Before discussing the results of the analysis, a brief introduction to the AID program is essential.

9.2 HOW AID WORKS

Consider a set of times, $t_1, \ldots t_n$; say, for instance, these are the service times of all Criminal cases. Define the total variability, TSS, of these times as the sum of the squares of their differences from their mean value, i.e.,

$$\overline{t} = (t_1 + \ldots + t_n)/n$$

$$TSS = (t_1 - \overline{t})^2 + (t_2 - \overline{t})^2 + \ldots + (t_n - \overline{t})^2.$$

Now, split these times into two groups, say, those times for the Felony cases and those times for the Others (less serious cases). Denote the Felony service times by

$$t_{F,1}, \ldots, t_{F,j}$$

and the Others service times by

$$t_{0,1}, \ldots, t_{0,k}$$

where $k + j = n$. Each one of these two groups has its own variability:

$$TSS(\text{Felonies}) = (t_{F,1} - \overline{t}_F)^2 + \ldots + (t_{F,j} - \overline{t}_F)^2$$

$$TSS(\text{Others}) = (t_{0,1} - \overline{t}_0)^2 + \ldots + (t_{0,j} - \overline{t}_0)^2$$

where $\overline{t}_F$ and $\overline{t}_0$ are the mean service times for Felonies and Others, respectively.

The total variability has been reduced by this splitting into two groups. That is,

$$TSS(\text{Felonies}) + TSS(\text{Others})$$

will always be less than or equal to the original TSS.

Here is a numerical example. Suppose there are six Criminal cases with service times (in days)

60,	50,	120,	40,	100,	80.
O	O	F	O	F	F

The letters underneath indicate whether the case was Felony or Others. The mean service time for the six cases is

$$\frac{60 + 50 + 120 + 40 + 100 + 80}{6} = 75 .$$

The total variability is

$$TSS = (60\text{-}75)^2 + (50\text{-}75)^2 + \ldots + (80\text{-}75)^2 = 4{,}950.$$

The Felony service times are

120, 100, 80

and their average is 100. Therefore,

$$TSS(\text{Felonies}) = (120\text{-}100)^2 + (100\text{-}100)^2 + (80\text{-}100)^2 = 800.$$

The Others service times are

60, 50, 40

with a mean of 50. So

TSS(Others) = $(60-50)^2 + (50-50) + (40-50)^2 = 200$.

Therefore,

TSS(Felonies) + TSS(Others) = 1,000.

The "Reduction in Variability" by splitting the times into the two groups is defined as the original variability, TSS, minus the variability after the split — that is

Reduction in Variability =
TSS - TSS(Felonies) − TSS(Others) =
4,950 - 800 - 200 = 3,950.

Now, how AID works with a hypothetical example. Suppose the service times of 1,000 Criminal cases are obtained and the effects of two variables are examined:

Case Type: Felony A
Felony B
Misdemeanors
District: 1, 2, 3

That is, there are only three case types and three district courts.

AID proceeds by looking at the first variable, Case Type, and looking at all possible divisions of these types into two groups. The possible groups are

#1	Group 1	Felony A + Felony B
	Group 2	Misdemeanors
#2	Group 1	Felony A
	Group 2	Misdemeanors + Felony B
#3	Group 1	Felony B
	Group 2	Misdemeanors + Felony A.

For each of these three possible groupings, it looks at the corresponding split in service times and computes the Reduction in Variability. The best split is defined to be the one producing the largest Reduction in Variability. Say, for instance, that this is the first grouping, which separates into one group the Felony A + Felony B service times, and into the other group, the Misdemeanor service times.

Now the AID program goes to the second variable, District, and looks at all possible divisions of districts into two groups. These are

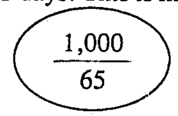
#1	Group 1	District 1
	Group 2	Districts 2, 3
#2	Group 1	District 2
	Group 2	Districts 1, 3
#3	Group 1	District 3
	Group 2	Districts 1, 2.

For each of these groupings, the corresponding Reduction in Variability is computed. The best split is the one giving the largest Reduction in Variability; suppose this is Grouping #2 above.

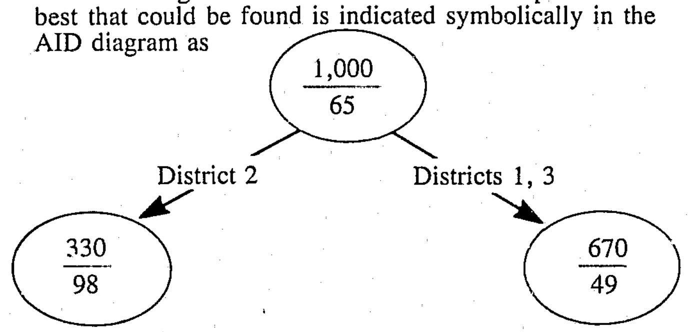
Now, the best split in the variable of Case Type is compared with the best split in variable of District in terms of which split produces the largest Reduction in Variability. Say that this turns out to be District. Then, the split of service times into the two groups of #2 above is carried out and we now have:

Group 1	All Criminal Cases in District 2.
Group 2	All Criminal Cases in Districts 1, 3.

Suppose that the original mean service time for the 1,000 Criminal cases was 65 days. This is indicated symbolically by



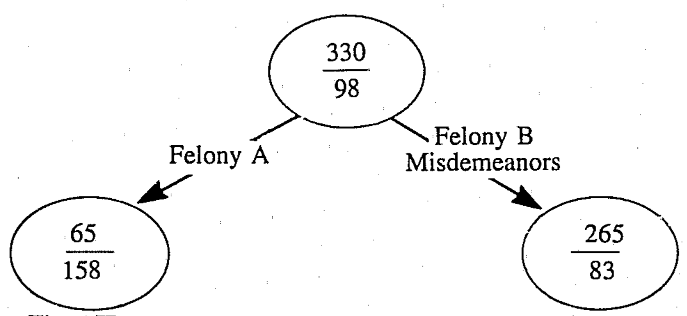
Now suppose in Group 1, above, there are 330 cases with an average of 98 days and in Group 2 the remaining 670 cases with an average of 49. The fact that the above split was the best that could be found is indicated symbolically in the AID diagram as



Now, exactly this same process is repeated on each of these two groups. That is, an attempt is made to find the best split of the 330 cases in District 2. Since the data cannot be split by District, the best split must be on Case Type. For instance, suppose the best split of these 330 is gotten by grouping into

Group 1	Felony A
Group 2	Misdemeanor + Felony B .

Then if there are 65 Felony A cases with a mean service time of 158 days and the remaining 265 cases have an average service time of 83 days, the AID diagram is

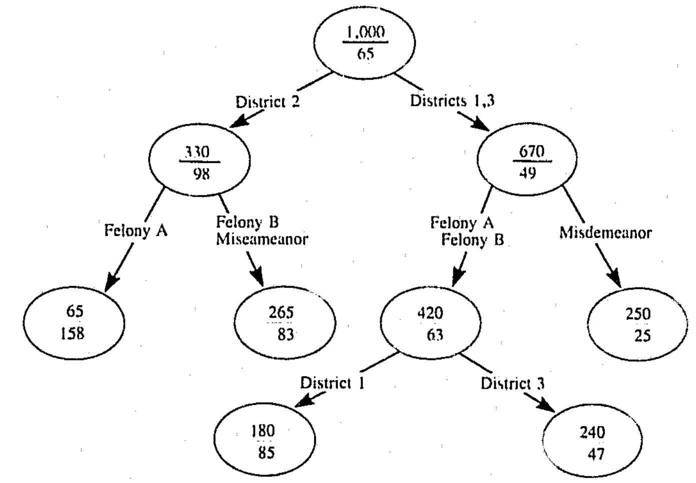


The AID program will continue to try to split groups, until either

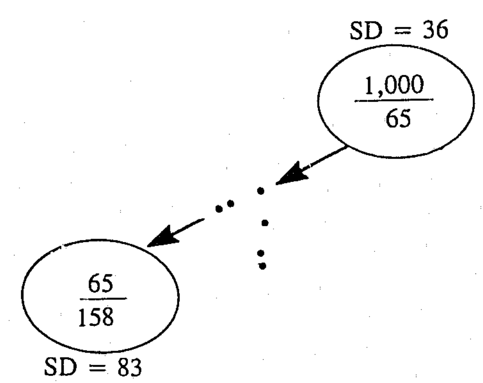
1. It runs out of splits to try, as in the left-hand group above, or
2. The amount of Reduction of Variability produced by the best split of a group is not large enough to warrant making the split.

After all the splitting is through, a complete AID tree diagram may look like this:

SAMPLE AID TREE DIAGRAM



It may also be desirable to indicate the typical variability in each of the final groups as well as the initial group. This is doen by specifying the Standard Deviation, SD, of each of these groups. Therefore, the diagram may include notations such as



These SD's indicate roughly the typical deviation from the mean of the service times in the group. As a rough rule-of-thumb, for a group of numbers, about one-third of them are further from the average than the SD. So, for example, in the bottom group above, one could roughly estimate that, of the 65 service times, two-thirds of them differed from the mean value of 158 days by less than 83 days, and about one-third differed from the average of 158 by more than 83 days.

By looking at the AID tree diagram, one can see what the most important factors are and their effects. For example, look at the sample tree diagram given above. Since the first split is on District, the conclusion is that the difference in service times between District 2 and Districts 1 and 3 is more significant than the difference in service times due to Case Type. A diagram looking like this should prompt some checking to see why District 2 was so much larger in its mean service time. Following the District 2 cases down another step, it is evident that the Felony A cases take almost twice as long, on the average, as the two less serious charges. A final point of interest is that in this district, there is not enough of a difference between Felony B service times and Misdemeanor service times to warrant a split. In the other two districts, both Felonies are put together and Misdemeanors put off to one side with a significantly smaller average service time. In neither District 1 nor District 3 is the difference in service times between the two Felonies significant enough to warrant a split.

In the next three sections, the salient features of the real AID trees will be pointed out.

9.3 AID ANALYSIS OF THE NORTH DAKOTA CRIMINAL SERVICE TIMES

The complete AID tree for the first nine months of 1976 Criminal case service times is shown in Figure 25. The variables, and their categories whose effects were traced, follow:

Variable	Categories
District	1, 2, 3, 4, 5, 6
Case Type	Felony A Felony B Felony C Misdemeanors and Infractions Apeals Special Remedy and Other
Disposition Type	Jury Trial Non-Jury Trial Non-Contested
Judgment	Guilty Acquittal Dismissed Other

The sequences of splits have been discussed in the non-technical section. Special note should be taken of the Standard Deviations. Even after the effects of the District, Case Type, Disposition Type and Judgment are accounted for, there is still an extremely high variability in service times. For example, consider the leftmost final class of cases. This class consists of 258 cases which are relatively minor charges — Felony C, Misdemeanors and Infractions, Special Remedy and Others. Each of these was non-contested, i.e., there was an initial guilty plea, and the judgment was guilty. No significant split by district was found on these, implying that the service times had pretty much the same average from one district to the other. Yet, with an average of 37 days to disposal, the SD was 46, implying that a substantial proportion, roughly by the rule-of-thumb, about one-third took longer than about 83 days.

The final printout of AID allows some more detailed analysis of both the final and intermediate groups. This can be illustrated by looking more closely at the above final group. Of the 258 cases, the charge distribution was

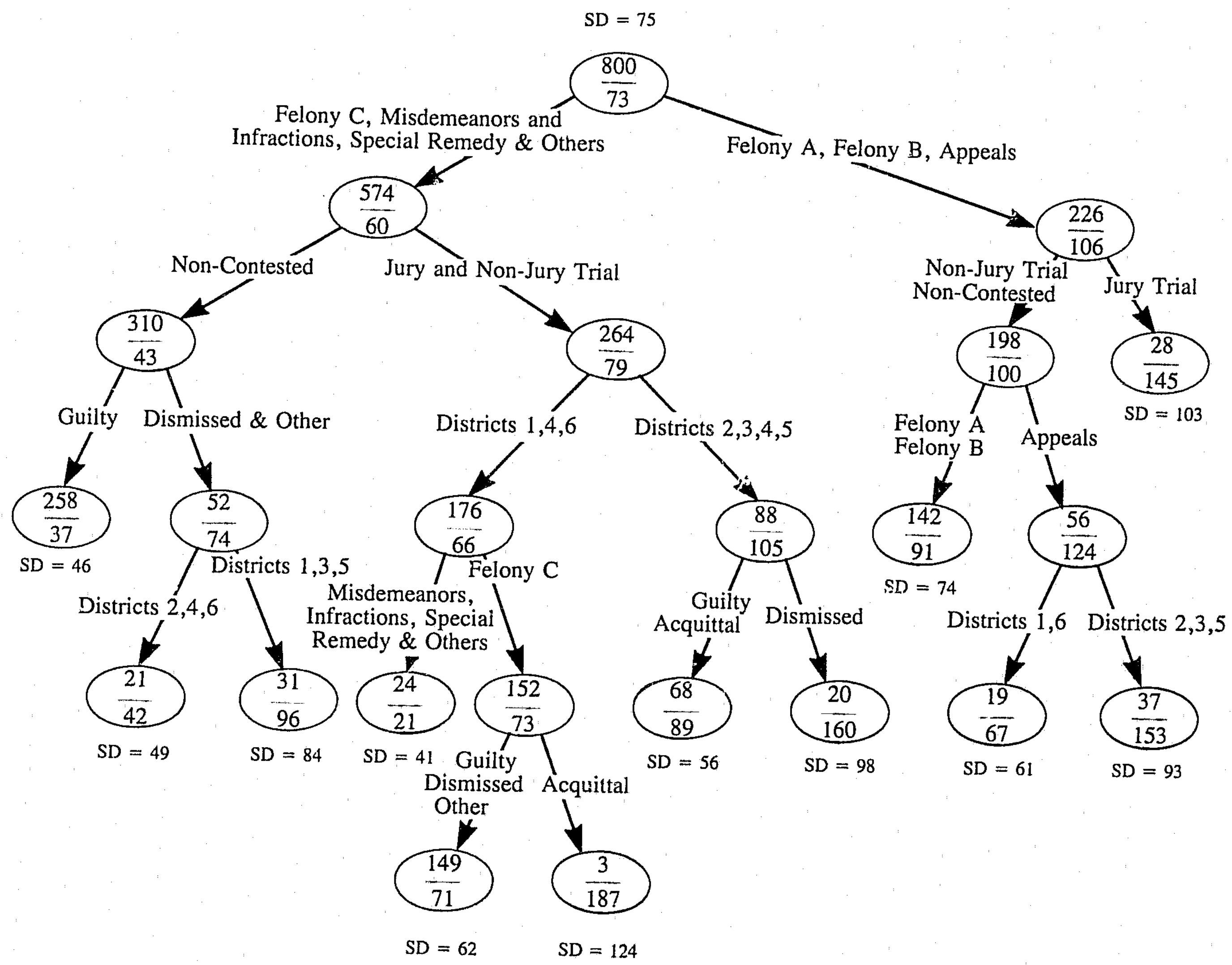


Figure 25. AID Tree for North Dakota Criminal Case Service Times

Felony C, 234
Misdemeanors and Infractions, 15
Special Remedy and Others, 9
By District we had:

District	No.	Av.	SD
1	78	40	44
2	53	32	34
3	17	53	49
4	53	32	56
5	50	36	41
6	7	44	39

An interesting note is that District 4, which had the lowest average service time, also had the highest variability.

The most significant difference between districts is in the group of 264 contested cases of a less serious nature, consisting of 235 Felony C charges, 12 Misdemeanor and Infraction charges, and 12 Special Remedy and Others. The breakdown by District was:

District	No.	Av.	SD
1	71	73	78
2	54	110	79
3	26	93	90
4	57	62	54
5	8	111	53
6	48	60	57

The disparity between the short and long service times is clear. The source of the disparity can be analyzed further. Looking at the tree, the significant split in the long-service-time Districts 2, 3, 5 is between the 20 cases that terminated in Dismissed and the 68 cases terminating in Guilty or Acquittal. The 24 Misdemeanors, Infractions, Special Remedy and Others were all located in the short-service-time Courts 1, 4, 6, and had very short disposal times. Therefore, the two groups of Districts on the Felony C cases should be compared. In the short-service-time courts, there were 16 dismissals averaging 86 days in length. The cases terminating in Guilty or Acquittal averaged 72 days in length. In the long-service-time districts, the similar cases averaged 89 days in length. This difference is not as large as the original disparity. The major source of the difference between the wo groups of courts is in the cases terminating in Dismissal. The long-service-time courts average 160 days for their 20 dismissals.

With the data available, it is not possible to pinpoint the reasons for this large difference in service times. With so few cases being involved, i.e., a total of 36, there may be an intrinsic difference in the nature of the cases rather than in court procedure. At any rate, the discussion above is intended as a brief example of the use of the AID program in spotting possible areas of interest for administrative study.

The main contribution to the generally high variability is the generally small fraction of cases which take an inordinately long time. A valuable subsequent or follow-up study to this present one would be closer investigation of long duration cases.

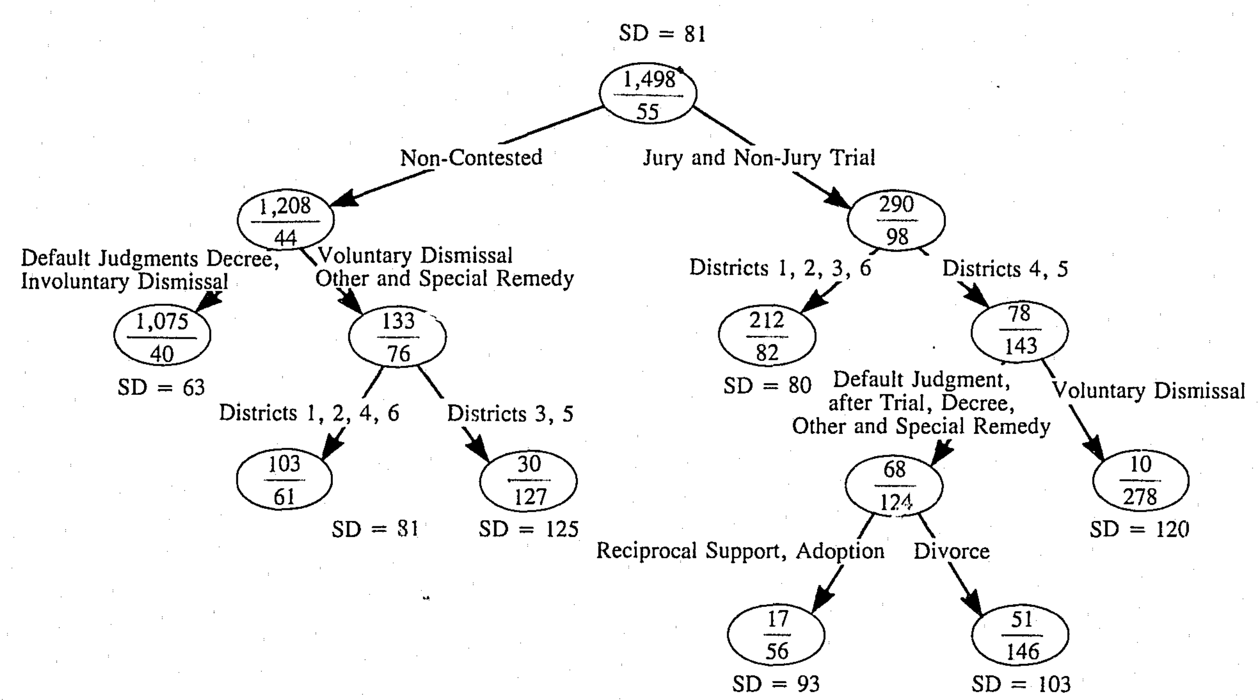


Figure 26. AID Tree for North Dakota Domestic Case Service Times

9.4 AID ANALYSIS OF NORTH DAKOTA DOMESTIC CASE SERVICE TIMES

The AID tree for Domestic cases filed during the first nine months of 1976 is shown in Figure 26. The variables whose effects were traced are shown below.

Variable	Categories
District	1, 2, 3, 4, 5, 6
Case Type	Divorce Reciprocal Support Adoption
Disposition Type	Non-Jury Trial Non-Contested
Judgment	Default Judgment after Trial Default Judgment Summary Judgment Voluntary Dismissal Involuntary Dismissal Decree Other and Special Remedy

There was such a small number of jury trials, perhaps three or four, in the Domestic cases that this category was deleted.

Note again the large variability. In Domestic cases there seems to be more of a difference between districts in operating mode. To trace this difference further, the 290 Trial cases in which there seems to be a sizable difference between districts were examined. This group broke down as follows:

Case Type	No.	Av.
Divorce	182	114
Reciprocal Support	90	81
Adoption	18	33

By District, the data is:

District	No.	Av.	SD
1	140	78	74
2	21	108	94
3	15	35	54
4	51	147	119
5	27	137	125
6	36	102	94

By looking at the attempted splits on this group, more information can be obtained. For instance, Districts 2 and 6 were more or less intermediate between the two short-service-time Districts 1 and 3 and the long-service-time Districts 4 and 5. The reductions in variability by putting 2 and 6 in with either the long- or short-time groups were almost equal. Therefore, the real source of the variability was in the difference between 1 and 3 on one hand and 4 and 5 on the other. Actually, since 3 is a low-volume district, the major contribution that is significant is the fairly rapid processing by District 1 of Contested Divorce and Support cases, as compared with the longer times taken by Districts 4 and 5.

Another point that stands out when looking at the attempted splits is that the 21 cases terminated by Summary Judgment or Voluntary Dismissal averaged 176 days in length. Even though these were only 7% of the cases, these 21 long service times contributed a substantial proportion of the overall variability.

9.5 AID ANALYSIS OF THE COLORADO TIME UNTIL TRIAL IN CRIMINAL CASES

Since event data was available in the Colorado data, the decision was made to do an analysis of the time from first court appearance until start of trial in Criminal cases. The variables selected as affecting this time were:

Variable	Category
Court	1,2,3,4,5
Charge Seriousness	Felony 1 Felony 2 Felony 3 Felony 4 Felony 5 Misdemeanor 1 Misdemeanor 2 Misdemeanor 3
Trial Postponements	1,2,3,4,5,6,7
Pre-Trial Actions	1,2,3,4,...,21

The first court appearance of the defendant was defined to be the date of the earliest recorded event in the case after filing which was neither vacated, nor defendant listed as absent.

The data processing effort needed to set up this AID run had heroic dimensions. First, from the hundreds of thousands of cases present in the Colorado files, the Criminal case records were extracted. Then, from each of these, only relevant information was extracted. This consisted of:

A Record: Filing and Disposition Dates, Case Type, Disposition Type
B Record: Charge Description
I Record: Sentencing Description
S Record: Event Descriptions

Next, those cases going to trial had to be isolated. There is a code for plea in the C Record, and it was originally thought that those cases with NG (Not Guilty) listed as plea could be identified. However, the plea was missing in many cases. Then, the S statements were searched for a JTRL (Jury Trial) or CTRL (Court Trial). It was decided to include the variable of charge seriousness. A listing of HOMI (Homicide) as Case Type could mean anything from Felony 1 to a Misdemeanor. The statute number was required to decide on the charge seriousness. Hence, all Criminal cases with a C statement containing no statute number were deleted. At that point, the data base stood at 4,000 Criminal cases containing a JTRL or CTRL.

However, a trial never took place for a sizable proportion of these cases. For instance, the sequence below might appear.

Event	Disposition
JTRL (Jury Trial)	VACT (Vacated)
JTRL (Jury Trial)	RSET (Reset)
JTRL (Jury Trial)	VACT (Vacated)
HSEN (Hearing on Sentence)	JUDG (Judgment)

In this instance, there is no record that a trial ever took place. It is surmised that the defendant changed his plea.

All cases were deleted in which there was no code indicating that a trial was held. Multiple-defendant cases were difficult to process so were also eliminated. This reduced the data base to about 1,700 cases.

One of the complicating factors was that different courts seemed to use the codes differnetly. For instance, there is a code for first appearance, FAPP, but this was used by only one or two of the courts. Even though each case must have an ARRG (Arraignment), in one district this code was never used and another code word substituted for it.

This inconsistent use of codes makes it difficult to get valid durations for things such as

time from first appearance to arraignment
time for arraignment to start of trial, etc.

The data does contain a great wealth of valuable information, but it is difficult to extract it.

Postponements of trial date was counted as follows: There are certain disposition codes in the data that indicate the trial is taking place; others, that it has been deferred. Whenever a notation was encountered of a deferred trial date prior to the time of actual start of trial, this was counted as a postponement. There were cases in which two or more consecutive trial days were listed on VACT (Vacated). These were counted as *only a single* postponement.

The Pre-Trial events were mainly hearings on motions. Events occurring the same day were counted as a *single* event. Events with a disposition code such as VACT (Vacated) or RESET (Reset) indicated no substantive action and were not counted.

The AID tree is shown in Figure 27. The outstanding characteristic of these results is the fact that the variables used accounted for a good deal of the variability in the times. This might have been expected. The number and type of events in a case have a larger effect in determining the various service times involved than the charge severity, court of hearing, etc. For instance, the 842 mainline cases with no trial postponements and four or less Pre-Trial Actions have an average time until trial of 78 days with a Standard Deviation of 34. In contrast, the 1,075 Non-Contested Domestic cases with a Decree Judgment in North Dakota had an average service time of 40 days but a Standard Deviation of 63. It may be possible that if the number of pre-judgment actions were available as a variable, that a good split between the longer and shorter service times might have been possible.

The splits into the final groups of times until trial reduced the variability by 56%. The corresponding reduction in the North Dakota Criminal case service times was 24% and only 16% in the Domestic case service times.

One question that might be of interest: Is there any court, or courts with a disproportionate number of cases in which 2 or more postponements occurred. Looking into the AID printout in more detail, the following table was constructed:

Court	Total No. Cases	Percentage of 1 or More Postponements	Percentage of 2 or More Postponements
1	920	38%	13%
2	154	28%	6%
3	170	39%	13%
4	214	48%	16%
5	30	27%	13%

So District 4, which seems to be a fast court, has a higher percentage of cases postponed than the average, while District 2, seemingly slow, has a small percentage of these cases. To check further, the average time until trial was examined:

Court	1	2	3	4	5
Average Time Until Trial	119	157	118	97	182

Therefore, Court 4, even with a high percentage of postponements, has a lower average time until trial, with the situation reversed in Court 2.

The number of postponements has the greatest determining effect on time until trial. In fact

No. of Postponements	1	2	3	4	5	6	7
No. Cases	1,106	382	126	44	8	8	3
Average Time Until Trial	91	144	215	275	288	345	481

The number of Pre-Trial Actions has a lesser effect:

No. of Pre-Trial Actions	1	2	3	4	5	6	7	8	9	10
No. Cases	589	341	214	210	129	84	34	24	17	8
Average Time Until Trial	88	110	124	120	161	166	172	228	271	307

There were 23 cases with over 10 Pre-Trial Actions. It is incomprehensible why the sudden jump in mean time until trial occurred between four or fewer Actions and five or more. It may be that a normal mainline case characteristically has four or fewer Actions, and five or more Actions is a sign of complications.

To summarize, the main effect on time until trial was the number of postponements. But this conclusion is clouded by the observation that Court 4, which had an unusually high percentage of postponements, also had the lowest average time until trial.

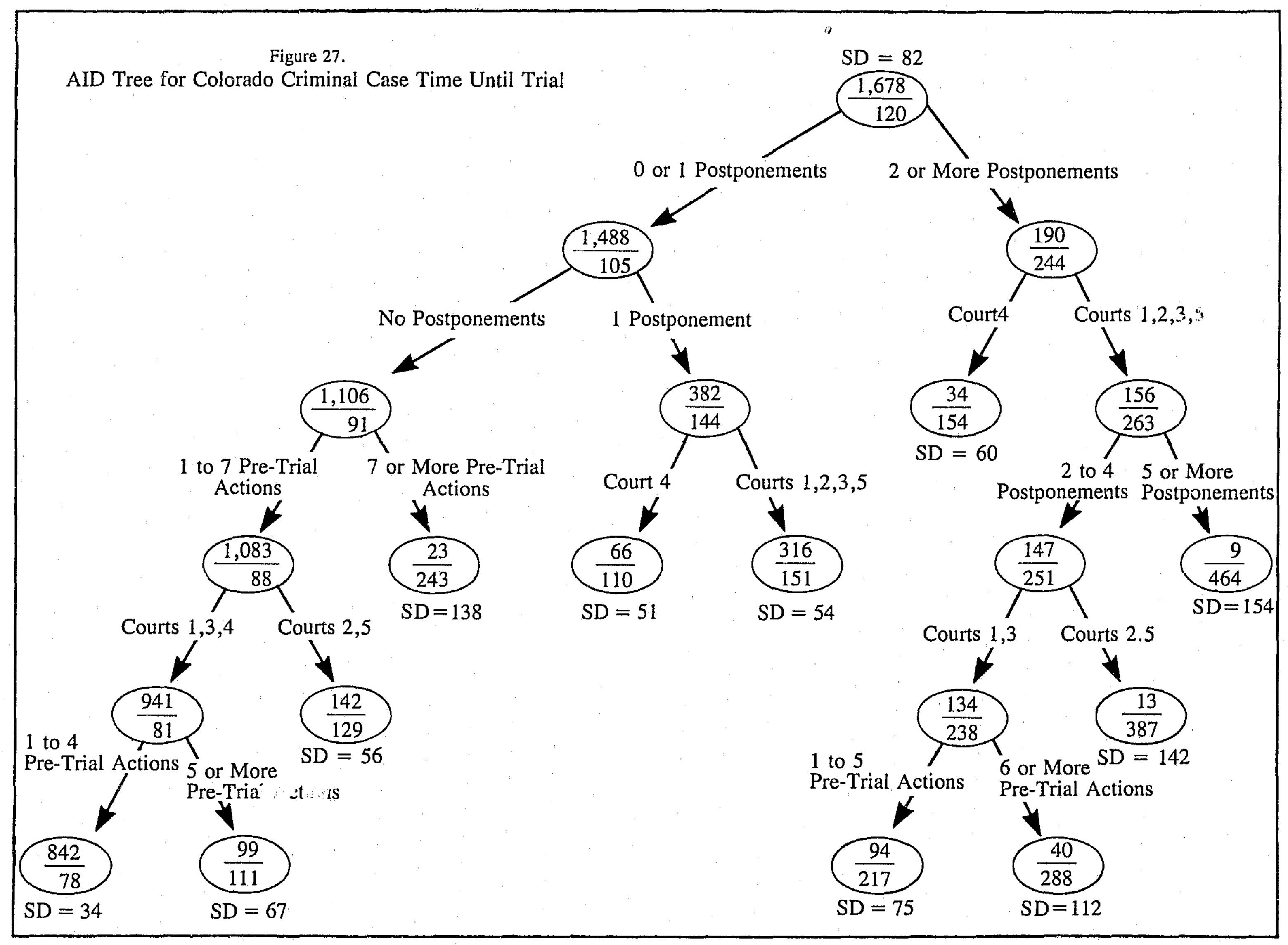


Figure 27.
AID Tree for Colorado Criminal Case Time Until Trial
SD = 82
1,678
120
0 or 1 Postponements
2 or More Postponements
1,488
105
190
244
No Postponements
1 Postponement
Court4
Courts 1,2,3,5
1,106
91
382
144
34
154
SD = 60
156
263
1 to 7 Pre-Trial Actions
7 or More Pre-Trial Actions
Court 4
Courts 1,2,3,5
2 to 4 Postponements
5 or More Postponements
1,083
88
23
243
SD=138
66
110
SD = 51
316
151
SD = 54
147
251
9
464
SD=154
Courts 1,3,4
Courts 2,5
Courts 1,3
Courts 2.5
941
81
142
129
SD = 56
134
238
13
387
SD = 142
1 to 4 Pre-Trial Actions
5 or More
1 to 5 Pre-Trial Actions
6 or More Pre-Trial Actions
842
78
SD = 34
99
111
SD = 67
94
217
SD = 75
40
288
SD=112

APPENDIX A

SELECTED REFERENCES

During the first stages of this project, a literature search was carried out with particular references to research on monitoring court productivity, sources of court delay, etc. There are few relevant studies. Of these few, the following are recommended:

1. *Indicators of Justice*, Wildhorn, Sorrel, et al. June 1976, RAND Reports R-1917-DOJ, R-1918-DOJ. The RAND Corporation, Santa Monica, California (funded by LEAA).
   Description: A lengthy and comprehensive report on measuring the performance of defence, prosecution and court agencies in Felony proceedings, applied to Multnomah County, Oregon, and Dade County, Georgia. Among the many performance measures proposed is a group that measures court delay.
2. *Judicial Productivity and Court Delay: An Exploratory Analysis of the Federal District Courts*, Gillespie, Robert W. April 1977, National Institutte of Law Enforcement and Criminal Justice, United States, Department of Justice.
   Description: A solid and competent statistical investigation of the sources of delay and the determinants of court productivity in the U.S. District Courts.
3. *District Court S .dies Project. Interim Report*, Flanders, Steven. June 1976, Federal Judicial Center.
   Description: An excellent study aimed at finding out what procedural differences between U.S. Districts underlie measured differences in productivity and service time. Based on site visits to five selected courts.
4. *Guide to Court Scheduling. 1. A Framework for Criminal and Civil Courts*, Brownstein, Sidney, et al. 1976, Institute for Law and Social Research, Washington, D.C.
   Description: An interesting and valuable investigation of court scheduling and what it can be under proper management. Good description of scheduling practices in 10 state and municipal courts. Includes examples of use of statistics to monitor the scheduling process.

The reference manual for the AID program is:

5. *Searching for Structure,* Sonquist, John A., et al. 1973, Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, Michigan.
   Description: This is a complete and comprehensive user's manual for the AID program. The FORTRAN program itself, on cards, can be purchased from the publishers, listed above, at a nominal price.

CONTINUED

1 OF 2

APPENDIX B

EXTENDED DATA DESCRIPTION

THE NORTH DAKOTA DATA

The North Dakota data is collected by the use of the two NCR forms. Each filing, event, and disposition is recorded by the Court Clerk. A copy is put in the case file and the originals are sent to the State Administrator's Office. They are punched onto IBM cards at the Central Data Processing facility and used to generate a variety of reports. The most important of these was an exception report listing of cases pending by age that is returned to the individual jurisdictions.

Fortunately, all data, from the time this system went up, has been kept on file and was made available on tape. A typical page of output is included as Figure 1. Some of the data not relevant to the study is not labeled. The coding corresponds to that given on the forms.

As mentioned in the non-technical report, because of substantial missing event data, the course selected was to exclude *all* event data and work with the remaining variables. The data, then, was virtually trouble free, and internally consistent. The final data file included about 17,000 cases, comprising those cases pending when the system opened operation in January 1976 and all cases filed up to the end of April 1977.

		CRIMINAL OR CIVIL	FILING DATE			CHARGE/ACTION	DISPOSITION DATE	TRIAL/HEARING	JUDGMENT CODE	CHANGE VENUE COUNTY	JUDGE RESPONSIBLE					CASE STATUS	DISTRICT	EVENT DATE	EVENT CODE	
6990	00008748	2	730607	2	3	20	740429	39	47	BARNES		0	0	0	0	99	3			
6991	00008844	2	740912	2	3	28	760507	39	41		HATCH	0	0	0	0	99	3	740912	16	
6992	00008845	2	740912	2	3	28	760507	39	41		HATCH	0	0	0	0	99	3	740912	16	
6993	00008859	2	741106	2	3	28	770104	40	45		HATCH	0	0	0	0	99	3			
6994	00008879	2	750408	2	3	28	0	0	0			0	0	0	0	0	3			
6995	00008881	2	760414	2	3	20	770406	40	45		HATCH	0	0	0	0	99	3	760414	16	
6996	00008884	2	750430	2	3	21	761209	39	47	CASS		0	0	0	0	99	3			
6997	00008892	2	750521	2	3	23	760702	40	50		HATCH	0	0	0	0	99	3			
6998	00008899	2	750716	2	3	22	750930	40	48			0	0	0	0	99	3			
6999	00008904	2	750811	2	3	21	760527	40	46		HATCH	0	0	0	0	99	3	750811	16	
7000	00008907	2	750814	2	3	28	761221	40	45		HATCH	0	0	0	0	99	3			
7001	00008914	2	750916	2	3	19	760504	39	43		HATCH	0	0	0	0	99	3	750916	16	
7002	00008917	2	750924	2	3	19	761217	40	45		HATCH	0	0	0	0	99	3			
7003	00008925	2	751028	2	3	19	761222	40	45		HATCH	0	0	0	0	99	3			
7004	00008927	2	751112	2	3	19	760813	39	46		HATCH	0	0	0	0	99	3	751112	16	
7005	00008930	2	751117	2	3	22	760604	40	48			0	0	0	0	99	3			
7006	00008931	2	751208	2	3	19	760917	39	45		HATCH	0	0	0	0	99	3			
7007	00008935	2	751217	2	3	19	760624	38	41		HATCH	0	0	0	0	99	3	751217	16	
7008	00008937	2	751222	2	3	19	751216	40	45		ECKERT	0	0	0	0	99	3			
7009	00008940	2	760107	2	3	22	760107	40	49		BEEDE	0	0	0	0	99	3			
7010	00008941	2	760108	2	3	20	760518	40	44		HATCH	0	0	0	0	99	3			
7011	00008942	2	760109	2	3	20	770303	40	41		HATCH	0	0	0	0	99	3	760109	16	
7012	00008943	2	760109	2	3	20	770303	40	41		HATCH	0	0	0	0	99	3	760109	16	
7013	00008944	2	760112	2	3	23	760217	40	50		HATCH	0	0	0	0	99	3			
7014	00008947	2	760202	2	3	28	770426	40	48		HATCH	0	0	0	0	99	3			
7015	00008948	2	760204	2	3	28	760204	40	42		HATCH	0	0	0	0	99	3			
7016	00008949	2	760205	2	3	20	760607	40	45		HATCH	0	0	0	0	99	3	760205	16	
7017	00008952	2	760212	2	3	23	760305	40	50		HATCH	0	0	0	0	99	3			
7018	00008953	2	760220	2	3	28	760816	9	43		HATCH	0	0	0	0	99	3	760220	16	
7019	00008954	2	760225	2	3	20	0	0	0			0	0	0	0	16	3	760225	16	
7020	00008956	2	760227	2	3	20	761119	40	42		ECKERT	0	0	0	0	99	3			
7021	00008957	2	760301	2	3	28	0	0	0			0	0	0	0	0	3			
7022	00008958	2	760301	2	3	28	760308	40	42		HATCH	0	0	0	0	99	3			
7023	00008967	2	760318	2	3	28	760325	40	42		HATCH	0	0	0	0	99	3			
7024	00008968	2	760318	2	3	20	760617	40	43		HATCH	0	0	0	0	99	3			
7025	00008971	2	760324	1	3	19	760609	40	45		HATCH	0	0	0	0	99	3	760324	16	
7026	00008972	2	760330	2	3	19	760518	40	45		HATCH	0	0	0	0	99	3	760330	16	
7027	00008973	2	760330	2	3	28	761221	40	45		ECKERT	0	0	0	0	99	3	760330	22	ECKERT
7028	00008974	2	760330	2	3	28	761221	40	45		ECKERT	0	0	0	0	99	3	760330	16	

North Dakota Data Dump

THE COLORADO DATA

This data, taken from an on-line calendaring system, posed problems a magnitude of difficulty greater than the North Dakota data. The data entered for each case are extremely extensive. Some of it is coded. A good deal is in free-form description. Utilizing these data for statistical purposes turned out to be expensive and time-consuming. 14 tapes of data packed with the files of about 400,000 cases were originally included.

The first job in handling these data was to extract from each case the essential information wanted for the statistical analysis. This consisted of the A statements (see Figure 2), which gave basic information such as filing dates, disposition dates, type of disposition, etc. The C statement for Criminal cases specified the statute number of the change, and the pleas. The I statement gave the sentencing information, and the S records gave the calendar events, their dates and dispositions.

It was difficult to establish an accurate disposition date on many of the cases. The dates given in the A statement were frequently garbled and nonsensical. Therefore, the disposition date given in A was checked against the date of the last S calendar event statement. In case of disagreement, the date of the last S statement was used. All A records without S records following were deleted. The filing dates seemed to be consistent and accurate, by and large.

FILE: CASE

SYSTEM: DISTRICT COURT
— CIVIL
— DOMESTIC
— CRIMINAL

RECORDS:

A — BASIC INFORMATION
B — CRIMINAL & DOMESTIC NAME INFORMATION
B — CIVIL NAME INFORMATION
C — CHARGE INFORMATION
D — BOND INFORMATION
H — JUDGMENT & CLAIM INFORMATION
F — SOCIAL INFORMATION
H — REGISTER OF ACTIONS INFORMATION
I — JUDGMENT INFORMATION
L — JUDGMENT INFORMATION
L — JUDGEMENT INFORMATION
L — SATISFACTION INFORMATION
L — SATISFACTION INFORMATION
S — CALENDAR INFORMATION
Z — FEES & FINES

Colorado Data Structure

The filing, disposition, and pending data needed for the BACKLOG and Chi-Square statistics could now be extracted from the file. Some discrepancies were found between the data that were accumulated and the annual report data. The major discrepancy was in Criminal cases. This was cleared up when, in checking with the Colorado people, it was discovered that they counted total defendants, and this study counted cases.

The difficulty with the Colorado data came later in the analysis when preparations were made for a study of service times in Colorado's Criminal cases. The focus was those cases in which a trial was held. Given the wealth of data available concerning intermediate events interesting results were anticipated. Unfortunately the non-uniformity of coding between districts, inconsistencies, and missing data forced a less definitive study than was really wanted.

Colorado has adopted the strategy of gradually bringing its districts on-line. The time schedule so far has been:

Date On-Line	Court
2/74	Denver District
7/74	Jefferson
9/74	Adams
7/75	El Paso
9/75	Pueblo
11/75	Weld
1/76	Boulder
3/76	Larimer
9/76	Arapahoe

Because of the short span of data, the last two courts were eliminated from the study. Furthermore, for some reason, Criminal filings and dispositions in Weld were missing from March 1976 on so Weld was deleted from the data base as well.

In discussions with Colorado personnel, there was some question regarding the compatability of the coding for cases entered on the old batch system and on the new on-line system camp up were put into the system, the complete data integrity of those cases was in some dobt, and were discarded wherever higher-quality data was needed.

One conclusion apparent from using the Colorado data is that the statistical information desired must be coded and the codes strictly observed by all courts. Furthermore, this information must be entered at strictly prescribed places in the format so it can be extracted by a computer program. Enforcing this not only calls for persuasion, but also for a sophisticated system of internal edits. For instance, a good deal of missing data could have been automatically detected. In the study of Criminal cases substantial portion of the cases had to be deleted because there was no C statement present in the case file. This meant there was no statute number listed as the charge offense. This could have been prevented by an edit that allowed no further information to be added to the file unless the C statement was present.