catalog of PROGRAM LIBRARY

in the DARTMOUTH TIME-SHARING SYSTEM

Kiewit Computation Center
Hanover
New Hampshire
03755

Dartmouth College HANOVER · NEW HAMPSHIRE · 03755

Kiewit Computation Center

TECHNICAL MEMORANDUM TM010

TO: DTSS Users

FROM: R. Brough
R. Green
D. Mather

DATE: October 30, 1972

SUBJECT:

A USER'S GUIDE TO THE DTSS PROGRAM LIBRARY

ABSTRACT: This guide contains a list of all the catalogued programs in the Dartmouth Time-Sharing System's public library and directions for accessing them. All questions regarding library programs should be referred to the Program Librarian, Kiewit Computation Center, Hanover, New Hampshire 03755.

SUPERSEDES: July 1972 edition by R. Brough and D. Mather

NOTES: 1) All programs are written in Dartmouth Time-Sharing System BASIC, except where indicated in parentheses before the program's description. Members of the College community may obtain BASIC manuals at the Dartmouth Bookstore; mail orders should be sent to University Press of New England, Box 979, Hanover, New Hampshire 03755.

2) The library file NEWFILES*** contains a list of files which have been added to, deleted from, or renamed in the public program library in the past year (approximately). You may use it as a supplement to this catalog to keep your catalog current.

3) In some cases, special characters (such as &, #, @ and !) follow a program's description. These special characters are footnotes; look at the end of the category to find the explanation.

DTSS CATALOG CATEGORY NAME: DARTCAT***

CATALOG OF DTSS LIBRARY CATEGORIES

SUMMARY OF CATEGORY NAMES: ANTHRO***, BANKOP***, DARTINFO***, DECISION***, DEMONS***, DTSSINFO***, EARTHSCI***, ECONMTRC***, ENGINEER***, FINANCE***, FUNCTION***, GAMES***, GEOGRAPH***, GRAPHICS***, INVEST***, KIDCAT***, LAFFFPR***, LANGUAGE***, LINALG***, LOGIC***, MEDSCH***, MGTSCI***, NUMERIC***, NUMTHY***, OPTIMIZE***, PLOTAIDS***, PROBTHY***, SOCSCI***, STATIS***, TEXTCAT***, TOWNPR***, UTILITY***

The programs in the library have been grouped according to topics. You may use the computer to obtain a LIST of programs categorized under a particular topic. The following sequence shows you how to find out what programs are categorized under ANTHRO***.

You type:	OLD ANTHRO***
Computer responds:	READY
You type:	LIST

A complete listing of names of anthropology programs together with a description of each program will be printed on your terminal. To interrupt a listing, press the 'S' or 'ATTN' key. In place of ANTHRO***, you may substitute any of the category names listed above and described below.

To access a particular program, you follow much the same procedure. For example, in our listing of ANTHRO***, we notice that LIFEWAYS*** is one of the programs in the anthropology category. To access the program LIFEWAYS***, the following sequence of commands would be given:

You type:	OLD LIFEWAYS***
Computer responds:	READY
You type:	LIST

The computer will then begin typing information about the program LIFEWAYS***: the programmer's name, a description of the program, and, finally, instructions on how to use the program. When the instructions have all been typed, stop the listing by pressing the 'S' or 'ATTN' key. Wait for the 'READY' message, then follow the instructions.

The same procedure should be followed to access any file (or program) stored in the Dartmouth Time-Sharing program library. For example, SORT*** is another program you might like to use. Simply substitute SORT*** for LIFEWAYS*** in the above sequence of commands.

Some programs may be stored in a special compiled form to save

both your own time and the machine time it takes to run the programs. These programs may not be listed; instead, for instructions, type RUN instead of LIST. [The source code (the version of the program before it's compiled) for these programs is stored in sublibrary SCODELIB*** of the program library. For example, the source code for BRIDGE*** is SCODELIB***:BRIDGE.]

ANTHRO*** A collection of programs that deal with various physical, racial, and ethnic characteristics of modern and ancient cultures. Files include a population genetics exercise, ethnographic mapping, a folk tales content analyzer, and a variety of cultural comparison programs.

BANKOP*** A package of programs to aid in the operation of a bank. Includes loan-interest computations and accounting, collateral accounting systems, bond portfolio analysis, statement reconcilement, amortization schedules, and much more.

DARTINFO*** Programs which offer information about Dartmouth College such as enrollment patterns for year-round operation or a calendar of on-campus events.

DECISION*** A collection of files to aid in decision making. Includes programs in probability, statistics and game theory.

DEMONS*** A category for the new user, designed to demonstrate the wide range of programs capable under a time-sharing system. Among others, files include various games, formatted printouts, a BASIC language teaching program, and a psychoanalysis session for unsuspecting females.

DTSSINFO*** These programs give information on the Dartmouth Time-Sharing System. Included are frequently updated files with the latest news in computing, descriptions of DTSS rates, and instructions for the use of paper tapes, accessing files, etc.

EARTHSCI*** Catalog of earth science files covering geological and environmental problems. Included at the moment is a flood prediction program for the Connecticut River, a file containing data on 601 common minerals, and a program to compute dynamic computations with ocean station data.

ECONMTRC*** Programs that apply statistics to the analysis of economic problems. Included are a package of forecasting programs, an input-output analysis program (Leontief model), a multiple regression program for national income and several applicable statistics programs.

ENGINEER*** Catalog of files for applications in engineering

science. Program applications in this category range from Fourier analysis to the analysis of a complex water-pipe network.

FINANCE*** Programs to aid consumers and businesses in long or short range financial planning. Included in FINANCE*** are programs for examining leases and mortgages, interest rates, and financial statements projection.

FUNCTION*** A group of programs of common mathematical and physical functions. Areas covered in this category are the Bessel function, the Digamma function, and various trigonometric functions.

GAMES*** A fun-filled grab-bag of games to amuse and delight one and all, from the most inexperienced tenderfoot to the most sophisticated first class programmer. Play the computer in bridge, baseball, basketball, blackjack, football, golf, hangman, nim, poker, or a host of other entertaining diversions. Bring the Kids! Thrills and excitement for the whole family! (Rated G - Batteries not included.)

GEOGRAPH*** Catalog of geography programs. GEOGRAPH*** contains a series of teach programs on climate and Koppen classification primarily used in Geography 1, plus other climate programs and a program on rice production research.

GRAPHICS*** A collection of programs which produce graphic displays on various peripheral devices. This category includes a large number of programs for the Timeshare Devices, Inc. plotter (both in BASIC and FORTRAN), for the CALCOMP 565 digital plotter, for the Tektronix terminals, and for general graphic displays on standard teletypes. The programs are essentially 'ready-to-use' and do not require experience in programming for any of the graphic devices (user should read any Technical Memoranda on the device being used for basic hardware directions.) Uses of the programs range from drawing demonstration designs to graphing scatter plots or complicated input or output functions.

INVEST*** A collection of programs to aid individuals and businesses in investment analysis. The category contains a variety of programs including portfolio management for business and analysis of returns on stocks and bonds.

KIDCAT*** Catalog of programs for young people. Includes drill and practice programs in spelling and arithmetic.

LAFFFPR*** A system of files allowing the user to do research and test ideas on corporate financial data. Files include data on over ninety industrial companies for the last twenty years, and programs to access this data.

CATEGORY NAME: DARTCAT*** DTSS CATALOG

LANGUAGE*** A collection of teaching programs in a variety of languages. English, French, Spanish, German, Italian, Greek, and Latin. The programs primarily consist of grammar, spelling and vocabulary drills.

LINALG*** Programs dealing with problems in linear algebra. The category includes programs for solving combinations of linear equations, computing eigenvalues, and several programs on matrix algebra.

LOGIC*** Catalog of programs dealing with propositional logic. Included are programs to derive conclusions from given premises, set up truth tables of propositional statements and formulas, and a program to simulate the action of a Turing machine.

MEDSCH*** Programs for biological and medical analysis. Included in this group is a program for computing Cobalt-60 decay, a program to analyze concentrations of substances in blood plasma, and a teach program on body fluids.

MGTSCI*** Programs covering the subject of management science for business and industry. Programs on accounting models, organizational profitability and manufacturing decisions are included.

NUMERIC*** Programs for performing numerical analysis. Included in this category are various calculus programs for finding derivatives, solving differential equations, and performing integration, as well as programs for finding roots of an equation, and a program to interpolate functions.

NUMTHY*** Catalog of number theory programs. Pythagorean triples, Euclid's algorithm, searching for prime numbers, and arithmetic for very large numbers are examples of some of the areas covered in this section.

OPTIMIZE*** General purpose optimizing programs for functions of one or more variables. Programs range from mathematical maximization of functions to optimization of production programs.

PLOTAIDS*** The currently available plotting subroutines for a number of peripheral plotting devices such as the Timeshare Devices, Inc. plotter, the Calcomp 565 digital incremental plotter and the Tektronix terminals. These files are not programs but subprograms and subroutines that are called by or incorporated in an appropriate plotting program either written by the user or in the DTSS program library. (See GRAPHICS*** for 'ready-to-use' plotting programs.)

PROBTHY*** Catalog of probability theory programs. This group contains, among others, programs to compute probabilities according to binomial or Poisson distributions and programs dealing with Markov chains.

SOCSCI*** Catalog of social science programs. Programs to analyze two, three, and four variable tables as well as a population projection program can be found in this category.

STATIS*** A large collection of programs covering a broad range of statistical analysis. Sub-categories in this section are: STATISTICAL MEASURES, STATISTICAL PROBABILITIES, ONE AND TWO SAMPLE TESTS, PAIRED COMPARISONS, CONTINGENCY TABLES, ANALYSIS OF VARIANCE, CORRELATION ANALYSIS, REGRESSION ANALYSIS, and STATISTICAL SUBPROGRAMS.

TEXTCAT*** Catalog of programs which deal with text processing and manipulation.

TOWNPR*** A package of programs developed by Tuck School for assistance in community government. Sub-categories in this section are PAYROLL SYSTEM, WATER BILLING SYSTEM, PROPERTY TAX BILLING SYSTEM, PLANNING AND DECISION MAKING PROGRAMS, and COMMUNITY ENGINEERING PROGRAMS.

UTILITY*** A group of general purpose programs with a wide variety of uses. Programs for general sorting, adding comments to programs, setting up multiple terminal programs, and many other uses are included.

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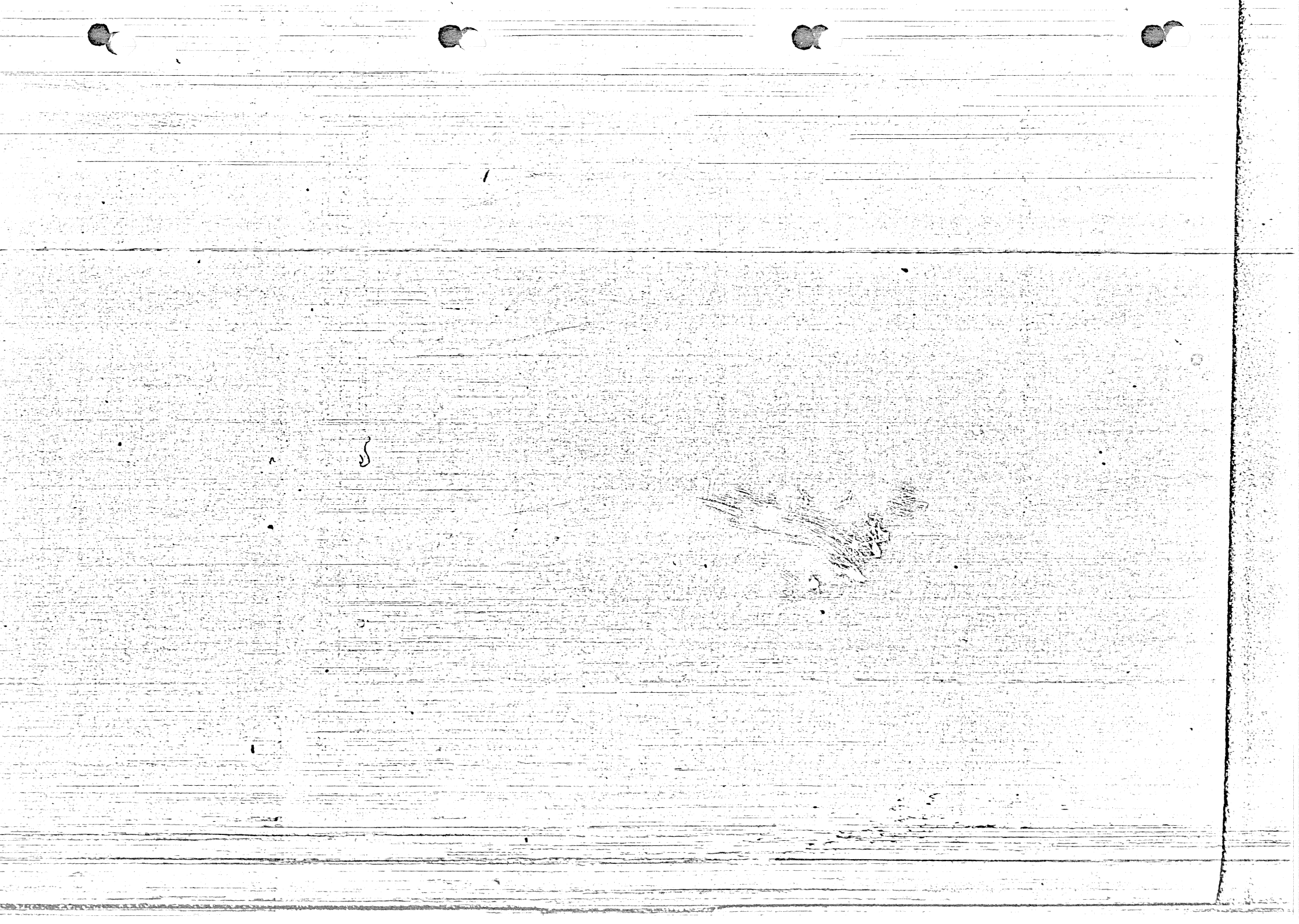
The file NEWFILES*** contains a list of all files which have been added to, deleted from, or renamed in the DTSS program library in about the past year. It may be used as a supplement to this catalog, to obtain an up to date guide to the library.



DTSS CATALOG

CATEGORY NAME: ANTHRO***

CATALOG OF ANTHROPOLOGY PROGRAMS

CONTENT*** This program allows the user to do content analysis of folk tales. It makes use of "General Inquirer" dictionaries for tagging purposes.,(Uses 18 files).

CONTENT1*** Users familiar with CONTENT*** may begin with CONTENT1***. (Uses 17 files).

CULTCOMP*** Print out of all characteristics for either one or two cultures from any of 1168 cultures recorded in the "Ethnographic Atlas." (Uses 6 files).

CULTPIK*** Works with the data from both the Murdock and Textor packages, working from the data back to the cultures; allows the user to identify those cultures which satisfy any selected set of characteristics. (Uses 19 files).

EPOCH*** Exercise for Anthropology 1 on the chart, "Cultural Epochs of Western Europe." (Uses 1 file).

ETH-CODE*** Prints out portions of the "Ethnographic Atlas" selected by the user; the user is given the option to select the portions of interest to him, on the basis of the forty-eight major characteristics. (Uses 6 files).

ETH-DGRE*** Print out of mercator map with cultures randomly selected from 1168 cultures in the "Ethnographic Atlas" to fill 30 degree cells observing the "3 degree rule." (Uses 2 files).

ETH-INFO*** Information on any of 861 cultures: geographical coordinates, population, date of population estimate, and date of ethnography. (Uses 2 files).

ETH-RAND*** Alternative method to "ETH-DGRE***" for obtaining a random sample of cultures observing the "3 degree rule"; coordinates are randomly selected and the closest culture determined. (Uses 1 file).

ETHATLAS*** Scans complete version of "Ethnographic Atlas" to compare any two characteristics on a presence or absence basis and computes degrees and significance of association. (Uses 2 files).

FOSSIL*** Exercise for Anthropology 1 on the chart, "Principal Fossil Finds of Man in the Pleistocene." (Uses 1 file).

GENETICS*** Exercise for Anthropology 1 on population genetics and the "Hardy-Weinberg Law." (Uses 3 files).

CATEGORY NAME: ANTHRO***

DTSS CATALOG

KINTYPE*** This program enables the user to learn about different kinship systems and social organizations as though he were conducting research in the field. Cross cousin terminology is the major consideration. (Uses 17 files).

LIFEWAYS*** Program of interest to anyone; it presents 13 "ways of life" which the user ranks. The computer decides in which culture the user would be most at home and prints out a chart with rankings of the user, all the program's users, and those of five countries. (Uses 2 files).

PEASLIS*** This program provides the user with some basic insight into decision making practiced by many peasant entrepreneurs the world around. Elementary descriptive tools, Game Theory, and Decision Theory will be employed.

POLYCOMP*** Either one or two groups of cultures (e.g., political units) are compared on the basis of the 92 characteristics in the "Ethnographic Atlas"; the user has the option to see the cross cultural comparisons within a group; the user may then repeat the process, assigning his own weightings to the 92 characteristics. (Uses 17 files).

RACECHEK*** Nine most widely used diagnostic indicators of "racial differences" have been employed. Data on the frequencies of occurrence of the various indicators among four widely recognized racial groups have been amassed and stored in this program. These data will be used to determine the probable racial group to which the user belongs. (Uses 2 files).

RACEMYTH*** This program is designed to provide the user with information on the distribution of several physical characteristics which have often been used as indicators of racial differences. (Uses 4 files).

TEX-CODE*** Prints out portions of Robert B. Textor's 536 finished characteristics from "A Cross Cultural Survey." The user selects the portions he wishes to see from the 44 divisions for the finished characteristics. (Uses 6 files).

TEXTOR*** Reproduces Robert B. Textor's "A Cross-Culture Survey." The dichotomy for any pair of 536 finished characteristics is printed out from the sample of 400 cultures. Sentences are then printed out based on significance of association. The cultures in each cell may be listed. (Uses 12 files).

CATALOG OF BANK OPERATIONS PROGRAMS

LOAN PROGRAMS

ACCRUAL*** Computes and prints the accrued interest on installment loans for inclusion in a bank's operating statements at the end of each month. The user enters the amounts of unearned interest, by month of maturity, for a five year period. The program computes for each month the portion of unearned interest which will be earned during the current month. &

BLEND*** Computes new monthly payment when a loan is given an extended maturity and/or a further advance is made, if the old loan is to remain at the original interest rate and the new financing is to be subject to the current interest rate (uses 1 file).

DEMLOANS*** A completely computerized demand loans accounting system. The program stores all pertinent information about a bank's demand loans in data files saved under the user's number. Features of the system allow the user to update the data, record payments, make rate changes, obtain up-to-date summary statistics, calculate quarterly interest due, print statements ready for mailing, delete closed accounts, forecast monthly interest income, and print alphabetical lists of accounts. (Uses 19 files). &

INTEREST*** Calculates the effective interest rate for a loan for any schedule of payments and for any compounding period. Included is the option to compound over the shortest period between payments which is needed to comply with Regulation Z (Truth in Lending) of the Federal Reserve System (uses 1 file). &

INSTALL*** Calculates the monthly payments schedule for an installment loan and prints it in a ledger format. The program determines the monthly payment to be made by the borrower and prorates it among three uses: principal repayment, insurance expense reimbursement, and interest payment. Interest and insurance are amortized over the life of the loan according to the sum of the months digits method. The residual of the monthly payment is then used for principal repayment. &

INSTALL1*** Identical to INSTALL*** except that it prints the loan payments schedule in a form which could be provided to the borrower. The program prints only the balance remaining, the payoff balance, and the interest paid for each month. &

RATESEN*** Determines the profitability of installment loans to

a bank. The user enters information about the terms of a loan and various costs incurred by the bank. The program then provides information about the annual and net yields realized by the bank.

SAVINGS BANK PROGRAMS

SBANKTAX*** Computes taxes for savings banks under the 1969 Tax Reform Act. The program will predict taxes into the future for as many years as the user is able to supply projections as to income and asset structure. The program can also be used to determine the after tax return of individual investment opportunities. (Uses 1 file).

SFUNDANA*** Does a sources and uses of funds analysis. It allows the user to do an analysis of the current period's figures with any period that is stored in the historical data file. In addition, it allows the user to apply either rates of cost or return to the different accounts and determines the overall cost rate on the sources of funds and the overall return rate on the uses of funds. Finally, the program allows the user to update the historical data file with the current figures.

SFUNDBUI*** This program builds the files DATA1 and DATA2 which are necessary for running SFUNDANA***.

SINVEST*** Program designed to compute the after tax return on different types of investments or sources of income to a savings bank. It takes into consideration the effect of the method of determining bad debt deductions that the bank uses. The results, however, are only approximate since the overall income structure of the bank is not considered. For more accuracy, use SBANKTAX*** and compare pre-investment and post-investment tax liabilities.

PLANNING AND DECISION MAKING PROGRAMS

BANKPROJ*** Projects balance sheet and income statement entries for a bank into the future. A sum of least squares method computes the projections using data from five previous years. For each projected year the program provides a breakdown of earning assets, earning assets maturing for the year, and loan-deposit and deposit-capital ratios. Before the projections for each year are made, the user is given the opportunity to change key information used to make projections. &

BONDATA*** Prepares five reports to assist in analyzing the composition of a bank's investment portfolio. The reports provide

portfolio breakdowns by years of maturity, bond type, Moody's rating, coupon income, and individual issue maturity. The user may select any one report or any combination of reports. &

RESERVE*** Calculates the reserve position of a bank. The user may have only the required reserve amount calculated and printed, or he may obtain a complete statement of the bank's reserve position at a given time within a reserve period. &

SWITCH*** Assists the user in determining whether to switch from a bond currently held to another bond which could be purchased by giving the net effect of the contemplated switch. Both the net return after recovery of a loss and the terminal cash value of the switch are determined. &

INFORMATION SYSTEMS

BANKINF*** An information storage, retrieval, and manipulation language for use in analyzing the financial records of a bank. (Easily adaptable to governments or corporations.) Amounts in bank general ledger accounts for several previous periods are stored in files. The BANKINF*** system allows the user to retrieve any of the stored information, print it on the terminal, plot it on the terminal, write it into a file, or manipulate it in a number of different ways. Possible manipulations of data include addition, subtraction, multiplication, division, averaging, taking first differences, projection, correlation, and regression. (Uses 4 files). &

CAL3*** A credit analysis language designed to enable the user to retrieve, manipulate, and analyze financial data of a corporation. The system also allows the user to project pro-forma model he supplies. (Uses 8 files). @

CAL3SORT*** Allows the user to modify the language of the CAL3*** system. (Uses 3 files).

GAMES

TUCKBANK*** A game designed to simulate the operation of up to four banks competing in a single market. Each bank operates mostly against the economic environment, but several key categories of loans and deposits are competitive. Decisions are made quarterly, and the game can be run for as long as 20 quarters. Each quarter's play contains three distinct parts: the division input by the players, a second round of decisions

CATALOG OF FILES CONTAINING INFORMATION ABOUT DARTMOUTH

PATTERNS*** Generates all possible enrollment patterns under the Dartmouth plan of year-round operation given the number of terms the pattern is to extend (11 is standard) and which terms the user wants to be on and off campus.

WHATS-UP*** (Compiled) Lists forthcoming events at the College. The program is modeled after the Dartmouth College Weekly Calendar which is distributed to members of the College community; copies of the Calendar may be obtained from the Summer Programs Office, 4 Parkhurst Hall. %

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% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for BRIDGE***, type

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OLD SCODELIB***:BRIDGE
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DTSS CATALOG CATEGORY NAME: DECISION***

CATALOG OF DECISION ANALYSIS FILES

DACOTA*** Computes the probabilities of the Basic Joint Statements in an up to 5 statement problem.

DADCD1*** Given the reward matrix for two hypotheses, this program helps you to decide whether to act in accordance with the truth of either hypothesis or to call for a test to decide between them.

D CD2*** Helps you to decide upon the appropriate testing procedure for a damaged machine when two tests are available.

DAHTST*** Tests up to 5 different statistical hypotheses of multinomial or Markovian types given a particular sequence of discrete data. User may enter data as a random string file, a terminal-format file, or direct input.

DAMAXS*** Fits appropriate probability distributions to given observations of a random variable defined in the range 0 to positive infinity, then compares the probabilities of the best distributions of each type considered as an exhaustive set of statistical hypotheses. The user may input data directly or store it in a file under his user number before running DAMAXS***. A Psi measure of goodness of fit is provided on request for each hypothesis. This measure has a Chi-Square limiting distribution. (This program is chained to by DAPRIOR***. It chains to DAPSIT*** for each Psi test requested.)

D RIOR*** Asks for your personal judgement about an uncertain quantity and interprets it as a probability distribution. Limited to single-humped P.D.F. This program prints a graph of the empirical curve on the terminal. It then chains to the program DAMAXS*** if the user wants to fit a well-known P.D.F. to his curve. See DAMAXS*** for further details.

GAMEMAT*** Solves a game theory matrix for a 2-person game. The program will print the matrix, give the game value, and identify the most effective strategy (as decimal parts of 1.0) for each player.

SDT-NORM*** Computes the optimal sample size and various expectations of information for two-action problems in which the value and sampling cost functions are linear, with the former dependent on the mean of a normal data-generating process and the latter dependent on the sample size. (See Pratt, Raiffa, and Schlaifer, "Introduction to Statistical Design Theory", McGraw-Hill, Chapter 16, for details.)

WALDS*** Computes the important characteristics of Walds sequential test procedure.

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Related programs may be found in ENGINEER***, PROBTHY***, and STATIS*** (Catalogs of Engineering, Probability Theory, and Statistics files.)

DTSS CATALOG CATEGORY NAME: DEMONS***

CATALOG OF DEMONSTRATION FILES

ACCELER*** Calculates the time in seconds it takes a vehicle to accelerate from zero to sixty miles per hour given its curb weight, brake horsepower at maximum torque, and rear axle ratio.

AMAZING*** Constructs a maze of any dimensions the user wishes (up to 23 by 25). Each maze is unique and guaranteed to have only one solution.

ANNUITY*** How long before YOU go broke??? This program will figure out how long your money will last depending on the interest and withdrawal rates of your savings plan.

BASICT*** First program in a series of 9 Basic and 11 Basic Teach system programs that introduce the language BASIC to the novice programmer. No previous programming knowledge is assumed. If the user has some knowledge of BASIC he may want to start with one of the more advanced programs. For more information on this series list BASICT***.

BANNER*** Produces an uncensored banner with letters and symbols up to 6-1/2" high. Three different styles are available: Block, Western, and Standard. Symbols can be formed out of words, letters, or cut out to produce a "stencil effect". Indulge your creative instincts! (Uses 2 files)

CAN-AM*** This program allows you to become one of the big time car drivers at the annual Hanover Can-Am meet. You are allowed to control your speed as you race your way around a winding course. You may race the computer's choice of opponents or, if the program run is initiated as a multiple-terminal setup, you may race your friends.

DATE*** (COMPILED) A scintillating semi-serious survey of Smithies and other Seven Sisterites, conducted clandestinely by a chauvinistically cheeky computer. Questions cover all areas of interest and are followed by a fairly detailed analysis. (Note: takes approximately twenty minutes to complete.) (Uses 8 files.) %

FACTOR*** A famous theorem states that every number can be expressed as the product of prime numbers (a prime number is divisible only by itself and 1) and that this prime factorization is unique for that number. This program will find the prime factors for any number.

J.F.K.*** Utilizing symbols such as :,',/, and assorted letters, this program will print out a bust portrait of John Fitzgerald Kennedy.

JULIAN*** Computes the Julian date and the day of the week for any date back to an epoch in the very distant past. (The algorithm takes into account the occurrence of leap years and ommission of a February 29 in years divisible evenly by 100 but not by 400.)

LETTER*** This program is oriented toward those Dartmouth residents who are too lazy to answer their own mail. The user supplies a few key phrases on the weather and his (or her!) last weekend, and the computer puts them together in a literary masterpiece.

LIFEWAYS*** Program of interest to anyone. It presents thirteen ways of life which the user ranks. The computer decides in which culture the user would be most at home, and prints out a chart with rankings of the user, all other users, and those of five countries. (Uses 2 files).

MAGICSQ*** (ALGOL) A Magic Square is a square matrix in which the sum totals of the diagonals, rows, and columns are equal. This program will generate Magic Squares of order greater than two.

NIM*** In this computerized version of an ancient Sumerian game, you are pitted aginst the computer in a game of wits. The object is to remove the last stick from among a pile of three. Warning - this is not an easy game to win!!!

PALNDROM*** Allows the user to experiment with a proposed procedure for finding a palindrome, a number which is equal to itself when its digits are transposed. (Uses 3 files).

POPULA*** Among the many applications of the compound interest formula is that of population projection. It is not entirely accurate in that it assumes a steady increase each year, but it is useful for showing roughly how an area will increase. This program will generate data for any number of years at any requested intervals.

SNOOPY*** Prints a picture of SNOOPY in his classic punting pose followed by the inscription 'PUNT' in large block letters. Makes a handsome wall hanging, a precious souvenir, or a memorable gift to that 'special' friend. (Uses 1 file).

TORO*** This program generates a realistic (?) bullfight in which you are the matador. You choose which cape swirls to make, and when the bull should be killed. The bulls are ferocious and you will be lucky to make it out alive!

XMAS*** This program prints out a copy of "The Twelve Days of Christmas" (adorned with appropriate holiday symbols) suitable

as an unusual Christmas card or as sheet music for a sing-along.

YOUGUESS*** Computer randomly selects a number between 0 and 100, inclusive, then asks user to guess the number in 7 tries or less. In the process of guessing, user should discover that the "binary search" method is the most efficient way of locating the unknown number.

* *

% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for BRIDGE***, type

OLD SCODELIB***:BRIDGE

DTSS CATALOG CATEGORY NAME: DTSSINFO***

CATALOG OF DTSS INFORMATION FILES

ACCESS*** Explains how to save files with selected accesses and/or passwords with full explanation of accesses. (LIST)

BULBOARD*** (Compiled) Provides a "bulletin board" which you may use to tell other users about files which are of general interest. Records these notices in the file DATALIB***:BULLDATA. (Uses 1 file.) %

DATALIB***:BULLDATA This is the "bulletin board" file used by the program BULBOARD***, which users may RUN to advertise programs and other files which are of general interest. You may call up "OLD DATALIB***:BULLDATA" and LIST it to learn about programs others have already posted on the bulletin board.

CCNEWS*** Items of general interest. Contains lecture series announcements, new software developments, etc. (LIST)

COUNCIL*** Minutes of the most recent computing council meeting. (LIST)

DOCUMENT*** Computer-related publications available from Kiewit and elsewhere. (LIST)

ETHICS*** A code of ethics for use of the Dartmouth Time-Sharing System. (LIST)

TRATE*** Information to help evaluate Kiewit flat rate plans. (RUN)

GEFORT*** Notes on use of system GEFORT on the DTSS. (LIST)

NEWFILES*** Contains a list of files added to the program library in about the past year as well as information regarding files deleted from the library and files renamed during the same time period. (LIST)

PAPRTAPE*** Instructions on punching and reading paper tapes. (LIST)

PERFORM*** Prints an analysis of malfunctions which have occurred on the DTSS since October 1, 1970. The user chooses the span of time in which he is interested, and the program prints statistics and textual descriptions for all malfunctions that occurred during that time period. (RUN)

PLANS*** Description of Kiewit's flat rate plans. (RUN)

PLOTLIB***:NEWS For general information on new developments re-

garding routines available for plotting on various devices, including the Timeshare Devices, Inc. plotter, the Tektronix terminal, and standard terminals, type OLD PLOTLIB***:NEWS, and when the computer responds READY, type LIST.

RATES*** Schedule of rates for use of the DTSS. (LIST)

SUBLIBS*** Sublibraries in the public program library. (LIST)

SUGGEST*** (Compiled) Program allows you to make suggestions, comments, or ask questions. Your input is saved for review by a Kiewit staff member, and if you wish, a reply will be saved in your user number (uses 1 file). %

USE*** (Compiled) Prints a summary of current system statistics, including number of users, running programs, background programs waiting to run and to use printer. Statistics are updated at least every half hour; program may take several seconds to run if it has not been run recently. %

* *

Further information about the DTSS is available on-line through the EXPLAIN command. You can obtain explanations of the system commands, sources of information at Kiewit, a history of the Computer Center, and a list of phone numbers to call for access to the system, to list a few topics. Type

EXPLAIN TOPICS

for a complete list of topics about which information is available.

% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for BRIDGE***, type

OLD SCODELIB***:BRIDGE

DTSS CATALOG CATEGORY NAME: EARTHSCI***

CATALOG OF EARTH SCIENCE PROGRAMS

FLOOD*** Given information on the rainfall pattern, the program predicts the speed of the flood crest passage down the Connecticut River.

OCEAN*** This program performs dynamic computations for measured ocean station data. It uses as data depth, temperature, and salinity. It interpolates temperature, salinity, and density and calculates sp. volume anomalies, change in pressure and dynamic depth change.

MINERAL*** This program contains data on the hardness, specific gravity, crystalline structure, and optical properties of 601 minerals. It can be used as a reference tool (listing out properties for minerals) or it can search through its files, matching minerals to data supplied by the user. (Uses 2 files).

DTSS CATALOG CATEGORY NAME: ECONMTRC***

CATALOG OF ECONOMETRICS PROGRAMS

FORECASTING PROGRAMS

FCST1*** Analyzes data containing no trend component or a linear trend, with no seasonal pattern, or with a constant or multiplicative seasonal pattern. The user specifies the model to be fitted to the data. If the user specifies no trend, a simple average is used for forecasting. If a trend is specified, linear regression is used. The test section of the program uses only part of the data to initialize the model and then forecasts several periods ahead, so that the quality of fit of the model can be observed. Then the forecast section of the program uses all the data to initialize and forecasts values for several periods beyond. @

FCST2*** Uses exponential smoothing to analyze data containing no trend, with additive seasonal, multiplicative seasonal, or no seasonal pattern. In the test section of the program, the model specified by the user is initialized on only part of the data and later periods are forecast. Statistics are given for the accuracy of forecasts made 1 period ahead, 2 periods ahead, 3 periods ahead, etc. In the forecast section of the program the model is initialized using all the data, and several periods beyond the end of the data are forecast. (Uses 1 file.) @

FCST3*** Similar to FCST2***, except it is designed for data that contain a linear trend, with or without a seasonal pattern. Also, the user has a choice of three smoothing models: the smoothed trend model, second order exponential smoothing, and double exponential smoothing. (Uses 1 file.) @

FCST4*** Similar to FCST2***, except it is designed for data containing a multiplicative trend component, with or without a seasonal pattern. (Uses 1 file.) @

FCSTEST*** Generates artificial data with various trend and seasonal patterns, with or without an error term, for use in studying the operation of the forecasting programs. @

FCSTHEIL*** This program is designed to use the output from one of the 'FCST' programs. Using the set of actual forecast values for a time-series, it computes the actual forecast changes. Then it constructs a prediction/realization diagram. It regresses the actual changes on the predicted changes and then contructs a corrected prediction/realization diagram. @

CATEGORY NAME: ECONMTRC*** DTSS CATALOG

ECONOMICS PROGRAMS

IN-OUT*** Is a program for input/output analysis (Leontief Model). A hypothetical economy is divided into three industries: agriculture, industry, and services, and is analyzed as to the interindustry flows of goods and services over a period of time. The analysis is based upon the data for a past period and can be used to predict future flows under different conditions of consumer demand.

MACRO*** A multiple regression program for national income and product accounts. Twenty-one years of data for 28 accounts are stored in MACRO***. The accounts may be manipulated by the use of simple arithmetic operations, taking logs, lagging, or taking first differences. The program will then perform multiple regressions, using as variables the accounts specified by the user. Complete instructions are contained in the file DATALIB***:MACROINS (uses 1 file besides the instruction file).

* *

For programs on regression see the category STATIS***.

A complete user's guide is found in MANUALS FOR COMPUTER PROGRAMS IN FINANCE AND INVESTMENTS, which is available for purchase from the Research Secretary, Amos Tuck School of Business Administration, Hanover, New Hampshire 03755.

@ A user's guide is also available for purchase from the Research Secretary, Amos Tuck School, Hanover, New Hampshire 03755.

DTSS CATALOG CATEGORY NAME: ENGINEER***

CATALOG OF ENGINEERING FILES

DISTILL*** Simulates a binary batch distillation in a packed tower. Holdup is neglected and the relative volatility is constant. The vapor boil-up rate is constant both with respect to time and position in the column. The liquid rate is independent of the distillate draw-off rate. All constants are set by the user.

E179S1*** An example used in Frankel's Engineering 179 text to demonstrate a simulation of a relatively simple system with six levels and six rates and only one feedback loop.

FALSE*** This is a false position subroutine; designed to be merged with a BASIC program and called by it. The subroutine is useful in obtaining implicit solutions to equations that are difficult to evaluate directly.

FOURIER*** Calculates and saves in a file the Fourier coefficients of any given function X(t). This file can be used as input to RESPONSE***. The user also has the options of printing out the coefficients and the frequency spectrum at the terminal.

FSMMIN*** Determines the classes of equivalent states of any specified finite state Mealy Machine; in addition, a minimal equivalence machine is computed using the equivalence classes as states. All parameters are input in a conversational mode during the program run.

FSMSIM*** This program simulates the input/output behavior of a finite-state Mealy machine with initial state. The output of current state information is optional.

NETWORK*** This program solves the flow of water through a network of pipes by the Hardy Cross method. (Uses 1 file)

PERFGAS*** The program finds properties of 14 common gases, treated as though they were perfect gases. The user inputs two known properties of a gas and the program solves for others. (Uses 1 file)

RESPONSE*** Computes the Fourier coefficients of the periodic response of a system to a given periodic input. The input function is specified in a terminal-format file consisting of Fourier coefficients in the format that is generated by the program FOURIER***. The system is defined by its frequency response. To plot the output from this program, use PLOTSKI***.

STIRTANK*** Simulates the transient behavior of a stirred tank

reactor. In this case the reaction is the liquid-phase hydrogenation of benzene to cyclohexane.

VERNQ2*** Simulates the effect of allowed temperature-rise policies on the river temperature rise and the % of the heat load that must be disposed of by cooling towers.

DTSS CATALOG CATEGORY NAME: FINANCE***

CATALOG OF FINANCIAL PLANNING PROGRAMS

LEASE PROGRAMS

LESSEE*** Uses the Bower-Williamson method of analysis to compare alternatives of leasing a piece of equipment outright. The method calculates two cost differences between owning and leasing. The first, the financial advantage, is simply the difference between the amount of debt capacity used up by the loan and that used up by the discounted present value of all cash flow advantages including depreciation tax benefits. # &

LESSIM*** Calculates the rate of return which the lessor receives for investing in an asset and then leasing it to someone else. Unlike LESSOR***, this program recognizes that the rental payments from the lessee and the salvage value of the asset are uncertain. Using an estimate of the chance of default or discontinuance in any year and an estimate of the possible variation of actual salvage, the program simulates the experience of the lessor. The user specifies the number of trials. The output indicates the lessor's expected return, the possibility of loss, and the distribution of random outcomes. # &

LESSOR*** Calculates the rate of return which the lessor receives for investing in an asset and then leasing it to someone else; i. e., the interest rate which discounts all of the net cash flows back to the initial investment the lessor must make. By comparing this after tax rate of return with the returns expected from alternative investments, the lessor can determine the desirability of the lease. This rate of return is calculated from the lessor's cash flows, which depend on lease receipts and tax payments. # &

MORTGAGE PROGRAMS

MORTCAN*** Identical to MORTGAGE*** except interest is compounded semi-annually, to fit the usual practice for Canadian residential mortgages. # &

MORTCOST*** Provides quick comparisons of different mortgage terms. The user specifies any number of amounts to be borrowed, interest rates and mortgage lives. The program computes and prints monthly payments and total interest for all possible combinations of the input data. # &

MORTGAGE*** Computes and prints the interest rate, life, amount

to be borrowed, or the monthly payment for a mortgage. The user supplies any three of these data. After seeing the results, the user may change any part of the data, or may ask for a monthly or annual mortgage table. The program assumes payments are made monthly and that interest is compounded monthly (uses 1 file). # &

FINANCIAL PROJECTION PROGRAMS

MATRIX*** Prints the contents of the input file for OPTION***.

MODEL*** Creates an input file for OPTION*** from data statements. The program contains a complete set of sample data.

OPTION*** Similar to PROJECT***, but allows the user much greater flexibility in the manipulation of relationships between accounts. The user must obtain the complete user's guide before he can use this system. The user provides five years of historical data and the program projects five more years. Historical regression and proportion coefficients may be computed for use in projections. &

PROJECT*** Projects financial statements of a company for five years into the future. Input consists of the most recent year's balances for 27 key accounts. Output is written into a file saved by the user. An additional file may be specified to receive the output in the format required to project the statements for five more years. The user must obtain a complete user's guide before he can run PROJECT***. (Uses 1 file). # &

REPORT*** Computes and prints financial statements based on the account manipulations performed by OPTION***. Statements available are the income statement, balance sheet, and cash flow statement. &

SPREAD*** Uses the output from PROJECT*** and prints one of five financial statements: balance sheet, income statement, funds flow statement, balance sheet items as a per cent of total assets, and accounts as a per cent of sales. # &

RISK*** A risk analysis program based on Hertz simulation model described in Jan.-Feb. 1964 "Harvard Business Review" article. The user may design his own model to project a set of cash flows. He may supply one value for each factor in his model or may supply a number of possible values for each factor and the per cent chance of the actual value lying between data pairs. RISK*** uses this information with a random number to calculate a value for a particular factor and repeats the process to calculate several sets of cash flows and rate of return and a net

present value for each set of cash flows. The program prints histograms which show how many sets of flows have generated rates of return or net present values which fall within certain intervals. #

LOAN PROGRAMS

NOMTOEFF*** Computes effective annual rates of interest. The user supplies nominal annual interest rates and compounding periods. The effective annual rates are then computed and printed.

* *

For more information on the investment of capital, see the category INVEST***.

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& A complete user's guide is part of TIME-SHARING APPLICATIONS IN COMMERCIAL BANKING, also available for purchase from the Research Secretary, Amos Tuck School, Hanover, New Hampshire 03755.

DTSS CATALOG

CATEGORY NAME: FUNCTION***

CATALOG OF MATHEMATICAL FUNCTIONS

BESSEL*** Bessel functions are used for calculating certain solutions to Bessel's differential equation. This subroutine, which has to be incorporated into a larger program, defines a function for calculating Bessel functions of the first kind (J) of any order for any real argument.

DEBYE*** Debye and Einstein functions are used in energy calculations for specific substances. Given two of the three values (temperature, specific heat, and theta) the program will calculate the third, and in addition, the normalized energy function at the given temperature.

DGMINV*** This program finds the value of Z to make D(Z)=0, where D(Z) is the Digamma function of Z, (Z>0). This is the inverse of the program DIGAMMA***.

DIGAMMA*** Finds the Digamma function of any positive number.

FNCTS*** Given a real number, or a complex number of the form X+I*Y, this program can compute the sin, cos, tan, sinh, cosh, and tanh functions of the number.

SUBSLIB***:AIRY A BASIC subprogram to generate the values of the airy functions AI(X) and BI(X) and their derivatives to five-place accuracy or better for any real argument X. A power series expansion is used unless the absolute value of X is large enough that an asymptotic expansion is more efficient in achieving the desired accuracy.

DTSS CATALOG CATEGORY NAME: GAMES***

CATALOG OF GAMES FILES

1QUEEN*** The program plays a two-person game based on the movement of a chess queen. The user places the queen on the upper or left-hand edge of the board and the program and user take turns moving the queen. The object is to move the piece to the lower right-hand corner.

AUTOBRID*** This program is based on the game Autobridge, designed to teach better bridge according to Goren. The program deals a hand and instructs the user on proper bidding and play. (Uses 2 files)

BANDIT*** The program simulates the action of a slot machine. The user places his bet and 'pulls the handle' by hitting 'RETURN'. The game is over when the user's balance reaches 0.

BASEBALL*** The program simulates a baseball game in the 1967 World Series between the Cardinals and the Red Sox. The user controls the pitcher, batter, and the runners on base. (Uses 1 file)

BASKETBL*** A game of basketball between Dartmouth and an opponent of the user's choice. The user is the Dartmouth captain and he controls the type of shot and defense.

BATNUM*** This is a game based on the game of Nim. The user inputs such parameters as pile size and minimum and maximum draw and plays against the computer.

BLACK1*** The program simulates a game of Blackjack with the program as the dealer. Las Vegas rules are used. (Uses 1 file)

BLACK2*** (ALGOL) A witty (?) Blackjack game with the computer dealing. Rules are according to Hoyle. To use type "RUN ALGOL".

BLACK3*** Multiple terminal Blackjack game. For two to ten players at different terminals. Be sure to LIST this program for instructions.

BRIDGE*** (compiled) A program for one to four users who wish to play contract bridge. The program will bid and play any hands necessary to fill out the table. (Uses 1 file).

CHECKERS*** Plays a game of checkers. User specifies how well the computer may play by telling it how many moves to look ahead. User may also have the board displayed at any time, change the computer's look-ahead during the game, or return to a previous board situation while playing. Written in Honeywell 635 machine

language and therefore not easily exportable to other systems.

CHESS*** Plays a game of chess. At present this is an experimental version and has some shortcomings. Written in Honeywell 635 machine language and therefore not easily exported to other systems.

DIGITS*** The user inputs a set of thirty numbers (0, 1 or 2) that he has generated himself. The program, using pattern recognition techniques, attempts to guess the next number in the input.

FOOTBALL*** A football game between two users. The users choose the names of their teams and call offensive and defensive plays as the situation requires. Be sure to LIST this program for instructions.

FTBALL*** Dartmouth Championship football. The user chooses an opponent and then acts as quarterback and calls the plays for Dartmouth.

GOLFHCC*** Simulates playing 9 holes on the Hanover Country Club course. You choose your clubs and new ball position is figured using accuracy percentages and approximate distances. (Uses 2 files)

GOMOKU*** Plays a game similar to tick-tack-toe on a 9 X 9 board. The objective is to get five marks in a row and to prevent the program from doing so. The program outputs to either a terminal or a T. D. I. plotter (uses 3 files for T. D. I. output; 1 file for output to the terminal).

HANGMAN*** The program plays a game of Hangman with the user. The program picks the words and the user tries to guess them. (Uses 1 file)

HORSERAC*** "A day at the races". Several persons may bet. The computer simulates a horse race by printing out the positions of the horses.

LEARN21*** The program learns to play a variation on the game of Nim. Starting with no strategy at all, the program, by increasing the probability of making winning moves, learns to play a perfect game.

LEM*** Simulates a lunar landing; the objective is to pilot a lunar lander to a soft landing in a series of thrusts or burns which decrease the rate of descent. (Uses 2 files)

LEMT*** Same as LEM*** but designed for use with Tektronix

T4002 and T4020 terminals (uses 4 files).

NIM*** This is the game of Nim. The user inputs the number of piles and their sizes and then plays against the program.

POKER*** The program generates a poker game for two to five users. It shuffles and deals the cards and keeps track of each player's winnings. LIST this program for instructions.

QUBIC*** Plays 3-dimensional tick-tack-toe on a 4 X 4 X 4 board with the user. The user can win if he plays correctly.

ROULETTE*** The program simulates a game of Roulette with European rules. The user may bet up to $10000 on red/black, odd/even, a column or a number.

SALVO*** (ALGOL) Plays a game of naval war with the user. The program and user trade shots at each other's ships until one or the other's ships are destroyed. To use, type "RUN ALGOL". (Uses 1 file)

SALVO42*** The program mediates between two users who wish to play the game of Salvo. It keeps track of the location of the ships and the number of shots due to each player. LIST this program for instructions.

SLALOM*** Program simulates a slalom course with from 1 to 25 gates; user picks the number of gates and has some control over his speed (uses 1 file).

SPIEL*** The program acts as an intermediary between two users who wish to play the game of Kriegspiel, a variation of chess where neither player can see his opponent's pieces. The program keeps track of the pieces and the board, checks the legality of moves and decides who has won. LIST this program for instructions (uses 1 file).

STCKMRKT*** The program simulates a stockmarket. The user controls the buying and selling of various stocks. The program has little in common with Wall Street. (Uses 1 file)

TICTAC*** A simple tick-tack-toe game. Uses simple heuristics that allow either the user or the program to move first. It is possible for the user to win if he moves first.

* *

A Tektronix T4002 terminal is located in Wilder Hall; see Prof. John Merrill for permission to use this terminal.

% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for BRIDGE***, type

```
OLD SCODELIB***:BRIDGE
```

DTSS CATALOG

CATEGORY NAME: GEOGRAPH***

CATALOG OF GEOGRAPHY FILES

CLIMAT-1*** This is the first of a series of five chatty teaching programs on climate classification. This program uses data from a well-known (to Dartmouth students) location and introduces the use of Koppen symbols for climate classification. The succeeding programs (CLIMAT-2*** thru CLIMAT-5***) are progressively more difficult.

CLIMAT-2*** The second of a series of five programs designed to teach climate classification thru the use of Koppen symbols. (See description of CLIMAT-1***)

CLIMAT-3*** The third of a series of five programs designed to teach climate classification thru the use of Koppen symbols. (See description of CLIMAT-1***)

CLIMAT-4*** The fourth of a series of five programs designed to teach climate classification thru the use of Koppen symbols. (See description of CLIMAT-1***)

CLIMAT-5*** The last of a series of five programs designed to teach climate classification thru the use of Koppen symbols. (See description of CLIMAT-1***)

COMPMAP*** Produces three kinds of "maps" at the option of the user: (1) a spatial arrangement of statistical data printed on a terminal; (2) a symbol map if used with a Hewlett-Packard 7200A plotter; and (3) a choropleth map printed on a terminal and shaded according to data intervals specified by the user. The data for the maps are contained in three files set up by the user. Sample data files for the New England states are available (uses 4 files).

CONVERT*** Converts geographical measurements from one scale to another. It converts temperature data in the Kelvin, Centigrade or Fahrenheit scales. It handles millimeters, kilometers, inches, feet, and miles for length measurements. For area or density per unit area data, it converts acres, square miles, hectares, or square kilometers.

KOPPEN*** Given monthly data on temperature and rainfall for a given place, this program will give the Koppen climate classification letters.

MACLIM*** Calculates the annual water need and warmth and moisture indices according to Malmstrom climatic classification described in JOURNAL OF GEOGRAPHY, Sept. 1969. User also has the option of having a tabular print-out of the water budget on a monthly basis and, if a Hewlett-Packard 7200A plotter is coupled

to the teletype, a graph of the water budget.

PEMI*** Helps plan hiking trips in the Pemigewasset Wilderness of the White Mountains. The program draws a map showing placement of various mountains in the area and assigns numbers to points on the map. You input points defining your hike and the program prints the time it will take to hike the route described. Data are based on AMC information. (Uses 1 file).

RICEGROW*** (Compiled) This program takes factors involved in the growth and production of either native strains or improved strains of rice at the International Rice Research Institute and performs a cost-yield analysis. The computations take into account such factors as variety of rice, market value of each variety, cost, amount & time of application of seed, fertilizers & insecticides equipment, animal and labor costs of cropland preparation and seedbed preparation, and size of farms. The data are averaged for the years 1967-1969 and the user may change any data he desires. %

THORNY*** This program, given latitude and monthly data on rainfall and temperature for any location, predicts the climate for that place.

* *

% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for BRIDGE***, type

OLD SCODELIB***:BRIDGE

DTSS CATALOG CATEGORY NAME: GRAPHICS***

CATALOG OF GRAPHIC DISPLAY FILES

For subprograms and subroutines used by plotting programs in general, LIST the file PLOTAIDS***.

PROGRAMS FOR GRAPHIC DISPLAY ON ANY TERMINAL

GRAPH*** Plots the graph of a function. The X-axis is drawn in, and if X=0 in the given range, the Y-axis is also drawn in. User specifies the function in a 'DEF' statement and the minimum and maximum of the range, the spacing on the X-axis, and any undefined points in 'DATA' statements.

HISTGRAM*** Prints a histogram of a set of numbers. Allows up to 1000 entries. User specifies the size of the interval for grouping entries.

PLOT-IT*** A program to plot points in two or three dimensions, on a terminal or on the high speed printer (when run in Background). The user may use the full width of the paper on the printer. Scales are set automatically to include all the points to be plotted, but the user may alter the scales. #

PLOTDATA*** Plots a maximum of 100 data points on the same set of coordinate axes on the terminal. The coordinates are input, in any order, during the program run.

BASIC PROGRAMS FOR THE TIMESHARE DEVICES PLOTTER For general information on how to use the T.D.I. plotter and programming for it, see Technical Memorandum TM014 "USE OF THE TIMESHARE DEVICES PLOTTER" available at Kiewit. Programs in these categories do not require experience in programming for the plotter.

NOTE Each of the following BASIC programs uses at least one file, "PLOTLIB***:TDI". This file contains the subprograms used by these programs to communicate with the T.D.I. plotter. This file is stored in compiled form; the source code is saved in the sublibrary "SCODELIB***" (i.e., OLD SCODELIB***:TDI). In addition, those programs marked with a dollar sign ($) use the data file "PLOTLIB***:LABELS", which contains the characters used by the labeling subprogram, and those programs marked with an exclamation point (!) use the subprogram file SUBSLIB***:TEXTSUB (see category TEXTCAT***).

CARTPLOT*** Draws the graph of a function specified by the user in a function definition statement. The user specifies the minimum and maximum of the range and the program determines the minimum and maximum Y-values and scales the graph. The user may include axes in the plot.

ELBOW*** Draws a sheet metal pattern for a segmented elbow in a duct of circular cross section. The user specifies the angle of the bend, the number of segments, and the diameters of the two end openings. The program determines the simplest and most economical way of laying out the pattern.

EVOLVE*** Draws a pattern that evolves from a circle into a rosette.

FASTA*** Draws any one of four pictures specified by the user during the program run. Various pictures of Snoopy and one of Little Annie Fanny are available with the titles "SNOOPY", "DOG", "DOGFIGHT", and "FANNY". (Uses 4 data files for the pictures.) !

GOMOKU*** Plays a game like tick-tack-toe on a 9 by 9 board. The objective is to get five marks in a row. The board is plotted on the T.D.I. plotter as you play. If a plotter is not available, the board can also be printed on a terminal. $!

LINPROG*** Aids in linear programming by allowing the user to construct and plot polygonal regions in the plane and to evaluate linear functionals on these regions. !

MERCATOR*** Draws a mercator projection on the plotter. The user specifies the minimum and maximum latitudes for the projection, how many degrees of longitude should be included, and how many degrees are to be between each line.

PINBALL*** Simulates a game of pinball on the TDI Plotter. $

PLOTSKI*** Graphs functions defined by their Fourier coefficients. PLOTSKI*** can be used in conjunction with RESPONSE*** and FOURIER*** to plot the output of a system defined by its frequency response. FOURIER*** produces the Fourier coefficients of a periodic (input) function defined in multiple line DEF statements. These coefficients, together with the frequency response of the system, can be used in the program RESPONSE*** to compute the Fourier coefficients of the output function of the system. Several sets of coefficients may be stored in a file, and the program allows the user to plot them separately. (Sample data file for demonstration is PLOTSKID***.) $!

POTSHOT*** Plays a game of two adversaries hurling simulated

projectiles at each other. At the start of the game the participants specify their positions and the size of the hill separating them. The program draws the terrain and for each shot plots the trajectory of the missle. !

SADDLE*** Draws a three dimensional perspective drawing of the graph of the function Z = -X*Y.

SCATPLOT*** Plots data points in a scatter diagram and finds the best least squares approximation of a line through the data. Then the program seeks out the point with the greatest standard deviation, and the user may delete it from the distribution and draw the new line. This is repeated until the user does not want a point removed. Axes may be included in the plot. $!

SINE*** Draws the graph of a sine curve.

SMOOTH*** A demonstration program which plots a complicated function with about 50% noise superimposed upon it. Then it uses a smoothing technique to replace the graph with a smooth curve. The smoothing may be done as many times as the user desires.

SPIRO*** A plotting program which simulates the action of the toy 'SUPER-SPIROGRAPH'. The program will produce an almost infinite variety of spiral designs depending on the variables input by the user. !

SQSPIRAL*** Draws a square spiral oriented at an angle specified by input parameters typed in by the user. As sides of squares get larger, variations in the linearity of the X-Y recorder will appear. Also, corners will start rounding off.

STAR*** Draws an N-pointed star (N is specified by the user).

FORTRAN PROGRAMS FOR THE TIMESHARE DEVICES PLOTTER For information on how to use the T.D.I. plotter see Technical Memorandum TM014. Before running any program in the Fortran group, the user should type "SYSTEM FORTRAN". These programs must be 'joined' with one of the Fortran Driver programs for the plotter. 'LIST' the desired program to find out the exact procedure.

FCARTPLT*** (Fortran version of CARTPLOT***) Draws the graph of a function defined by the user before the program run. The user specifies the minimum and maximum of the range of the function and the program determines the minimum and maximum Y-values and scales the plot. Axes (ruled or unruled) may be included in the graph. (Uses 1 file).

FELBOW*** (Fortran version of ELBOW***) Lays out a sheet metal pattern for an elbow in a duct of circular cross section. The user specifies the angle, the number of segments, and the diameters of the ends. (Uses 1 file).

FSADDLE*** Draws the graph of the function Z = -X*Y as a three-dimensional perspective drawing. (Uses 1 file).

FSCATPLT*** (Fortran version of SCATPLOT***) Plots data points in a scatter diagram and finds the best least squares approximation of a line through the data. Then the program seeks out the point with the greatest standard deviation and the user has the option of deleting it from the distribution and redrawing the line. This is repeated until the user does not want a point removed. The coordinates of the data points are read in from a separate file saved by the user. Axes, ruled or unruled, may be included in the plot. (Uses 1 file).

FSINE*** (Fortran version of SINE***) Draws the graph of a sine wave function. (Uses 1 file).

FSMOOTH*** (Fortran version of SMOOTH***) Plots a complicated unknown function with about 50% noise superimposed upon it. Then the program uses a smoothing technique to replace the data with a smooth curve. The smoothing may be done as many times as the user desires. (Uses 1 file).

FSTAR*** (Fortran version of STAR***) A demonstration program which draws an N-pointed star shaped pattern. The user specifies N. (Uses 1 file).

FSURFACE*** Plots a function of Z in terms of X and Y as a three-dimensional perspective view of a surface. (Uses 1 file).

BASIC PROGRAMS FOR THE CALCOMP DIGITAL PLOTTER For information on how to use the Calcomp 565 Digital Incremental Plotter, see Technical Memorandum TM007, "PROGRAMMING FOR THE CALCOMP PLOTTER" available at Kiewit.

EASYPLOT*** Reads pairs of data points from a file and plots them on the Calcomp plotter. Options include square or diamond shaped data points, ruled axes, points connected with lines, and labeling of portions of the graph. (Uses 2 files).

BASIC PROGRAMS FOR THE TEKTRONIX TERMINALS

For information on the use of Tektronix terminals there is a preliminary Technical Memorandum available at Wilder Hall for "USE OF THE TEKTRONIX TERMINALS".

CRYSTALT*** An interactive program which explores models of crystal growth. (Uses 3 files).

LEMT*** Lunar landing simulation. The user is the pilot of a lunar module trying to land his craft on the surface of the moon. The user inputs the amount of fuel to be burned in each second of his descent. Display consists of graphs for altitude, vertical velocity, and amount of fuel remaining. (Uses 4 files).

POTSHOTT*** Plays the game of Potshot on the Tektronix terminal. Players take turns hurling simulated projectiles at each other over a hill. The program draws the terrain and for each shot it plots the trajectory of the missle. (Uses 3 files).

SPACRVT*** An interactive program which explores space-filling curves. (Uses 3 files).

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A user's guide is part of MANUALS FOR COMPUTER PROGRAMS IN FINANCE AND INVESTMENTS, which is available for purchase from the Research Secretary, Amos Tuck School of Business Administration, Hanover, N. H. 03755.

$ This program uses the file PLOTLIB***:LABELS.

! This program uses the file SUBSLIB***:TEXTSUB.

DISS CATALOG CATEGORY NAME: INVEST***

CATALOG OF INVESTMENT ANALYSIS PROGRAMS

PORTFOLIO SELECTION PROGRAMS

BACKFILE*** Reads data statements containing prices and dividends of securities and writes the data into a random access file for use in BACKUP***. The program contains data for 65 stocks for the period 1960-1970. (See user's guide for list of securities.) #

BACKUP*** Consists of four subroutines which may be used independently or sequentially. Subroutine one computes period returns from data obtained from BACKFILE***. Subroutine two computes A's, B's, and Q's for use in SHARPE*** and SHARPLIN***. Subroutine three computes average returns and the variance-covariance matrix for use in MARKOW***. Subroutine four computes the return and variance of an individual portfolio specified by the user. #

COMPORT*** Evaluates portfolios by means of statistical measures. It calculates arithmetic mean and standard deviation, mean and standard deviation of logs, and the geometric mean of the period returns. Statistics are provided under two assumptions for portfolio composition: Buy and Hold, and Constant Proportions. #

COMPORTX*** Accesses the periodic returns generated by BACKUP*** and any of the files STWT1, STWT2, and STWT3 (generated by MARKOWX***, SHARPEX***, and SHARPLNX*** respectively). The output consists of average returns and standard deviations for the efficient portfolios contained in the STWT file. Results are given for both the Buy and Hold and the Constant Proportion strategies. #

MARKOW*** Provides efficient portfolios using the full variance-covariance model developed by Harry M. Markowitz. Data may be obtained from BACKUP***. The "lending" and "borrowing" portfolios will be determined, so the user must input current lending and borrowing rates. The program provides a series of efficient portfolios beginning with the slope of the E, V curve at approximately zero and continuing until the slope has been increased to infinity (chains to PLOTX*** if plot is desired). #

MARKOWX*** Is identical to MARKOW*** except the results are recorded in a random access file, STWT1, which must be saved by the user before he runs the program (chains to PLOTX*** if plot is desired). #

PLOTX*** A plotting routine for SHARPE***, SHARPEX***, MARKOW***, and MARKOWX***. This program is chained to when plots are requested. #

RNDPORT*** Selects portfolios at random from a given set of securities and calculates statistical measures for comparison with other portfolios. The list of securities used as input may be partitioned, so that portfolios can be drawn with a specified number of securities from each group. Statistics are computed based on the Buy and Hold, or Constant Proportions assumptions. #

RNDPORTX*** Uses the period returns from BACKUP*** to select 100 random portfolios for each of ten portfolio sizes: 1, 2, 3, 5, 7, 10, 12, 15, 18, and 20 securities each. In this way, RNDPORTX*** approximates the results of MARKOW*** and SHARPE***, which usually select a portfolio of one security as the one with highest return and highest risk and proceed to add additional securities to reduce the risk and the return. Output consists of average returns and standard deviations for each portfolio size under the alternate assumptions of Buy and Hold and Constant Proportions. #

SHARPE*** Selects portfolios using the Sharpe diagonal model. Using data from BACKUP***, the program determines the composition of a number of portfolios in the "Efficient Set" beginning with the slope of the return/variance curve (E, V curve) at zero and continuing until that slope has been increased to infinity (chains to PLOTX*** when plot is desired). #

SHARPEX*** Is identical to SHARPE*** except the results are recorded in a random access file, STWT2, which must be saved by the user before he runs the program (chains to PLOTX*** when plot is desired). #

SHARPLIN*** Uses the Sharpe linear model to determine the composition of a number of efficient portfolios. Data can be obtained from BACKUP***. The program iterates over a range of risk levels from 0 to 1, which are input by the user. The model performs best when portfolios contain at least 20 securities. #

SHARPLNX*** Is identical to SHARPLIN*** except the results are recorded in a random access file, STWT3, which must be saved by the user before he runs the program. #

STOCKS AND BONDS ANALYSIS

BONDPR*** Computes the price and accrued interest for a bond given the annual coupon in dollars, the redemption value, the maturity, and the yield. # &

BONDYD*** Computes the before and after tax yield to maturity of a bond given the annual coupon, the redemption value, the

maturity, and the price. The user specifies tax rates for interest receipts (T1) and capital gains (T2). Premium on purchase is amortized over the maturity and deducted at rate T1. Discount at purchase is taxed at maturity at rate T2. # &

BONDSW*** Calculates the effect of a bond switch - a bondholder sells a bond and purchases another, expecting that a change in yield spread will make the switch profitable. The user supplies information about the bonds, tax rates, yield forecasts, and re-investment rates. The program calculates terminal values for three alternatives: keeping the old bond, making a pure tax switch (selling and re-purchasing the same issue), and selling the old bond and purchasing a new one. #

D REC*** Prints tables of depreciation for an asset. The tables may be printed on an annual or monthly basis. Four depreciation methods are used: (1) straight line, (2) double declining balance, (3) sum of the years digits, and (4) 150% declining balance. # &

NICKMOL*** Calculates the intrinsic value of a stock, which is the discounted present value of the stream of dividends the shareholder expects to receive. The program uses the method of Nicholas Molodovsky (see various articles in the FINANCIAL ANALYSTS JOURNAL). The user must input current earnings per share, earnings growth rates, dividend payout rates, discount rates, and either a long term growth rate or a price/earnings ratio forecast. The program will also calculate the required length of time a growth rate must persist, or the price/earnings ratio that must be achieved at a future point, to make the intrinsic value equal to the current market price. #

PV-ROR*** Calculates the present value and internal rate (or rates) of return for one or more sets of cash flows. The program is general, and can be used for any problem involving discounted cash flows. A plot and a table of present value versus cost of capital may be printed if desired. # &

RETURN*** Computes annual rates of return compounded for an investment given the closing price for each year of data. Annual returns are computed FROM every year starting with the base year TO every year up to the last year in the data. Arithmetic average rates of return are computed for various holding periods starting with the same year. Also average rates of return, standard deviations, and coefficients of variation are computed for each possible holding period length within the years of data supplied. # &

FUNDS ANALYSIS
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COMFUND*** Simulates long-run quarterly performance of shares of the common fund (chains to SIMPLOT*** and uses user-saved file ENDFUND). $

INSURE*** Is a conversational program designed to determine the insurance needs of a prospect assuming he were to die tomorrow. To run this program, the user need only know the details of the prospect's present financial condition and his insurance objectives.

RETIRE*** Retirement planning program; computes expected TIAA and CREF accounts at retirement given a male's present accumulation in his TIAA and CREF accounts, monthly contributions, and investment proceeds. Calculates initial TIAA and CREF pensions based on age of individual and his wife, and on pension plan chosen. Forecasts salary just before retirement, total expected pension as a percentage of this salary, with capability for projecting pension, holding TIAA pension constant but reflecting investment performance of CREF pension. (Uses 1 file). #

RETIREX*** Is like RETIRE***, but handles pension contributions which are a function of salary portions as well as of age. (Uses 1 file). #

SIMFUND*** Simulates future performance of an investment fund. The user specifies the expected annual rate of return, the standard deviation of return, and rates of addition and withdrawal of funds. The program assumes the fund begins with $100 and compounds this forward for 60 years. An empty file named ENDFUND must be saved before running (chains to SIMPLOT***). #

SIMFUND1*** Simulates long run annual performance of funds, and differs from SIMFUND*** by offering more flexibility in INPUT statements (chains to SIMPLOT*** and uses user-saved file ENDFUND). $

SIMPLOT*** A histogram plotting routine for SIMFUND***, SIMFUND1***, and COMFUND***. SIMPLOT*** is chained to when a histogram of simulated fond values is called for in one of these 3 programs. SIMPLOT*** may also be run independently, using ENDFUND for input data. #

* *

For more information on financial planning, refer to category FINANCE***.

A complete user's guide is part of MANUALS FOR COMPUTER PROGRAMS IN FINANCE AND INVESTMENTS, which is available for purchase from the Research Secretary, Amos Tuck School of Business Administration, Hanover, New Hampshire 03755.

& A complete user's guide is part of TIME-SHARING APPLICATIONS IN COMMERCIAL BANKING, which is also available from the Research Secretary, Amos Tuck School (see above).

$ Complete instructions for using this program may be found in Appendix 2 of "Performance Measurement and Investment Objectives for Educational Endowment Funds," by J. P. Williamson; available for purchase from Money Market Reports, P. O. Box 618, Naugatuck, Connecticut 06770

DTSS CATALOG CATEGORY NAME: KIDCAT***

CATALOG OF PROGRAMS OF INTEREST TO YOUNG PEOPLE

123*** A pictorial counting drill for non-readers. Children count stars printed by the program and learn to count from one to ten.

BETWEEN*** An alphabet program for kindergarten children or non-readers. Children are asked to name the letter which lies between two other letters of the alphabet picked at random by the program.

DAYS*** Drills user on order and spelling of the days of the week. Three types of questions are asked for each day, and the days and questions are chosen at random (uses 1 file).

MATHDICE*** Pictorial drill on addition facts using printed dice. Good for beginning addition since the answer can be derived by counting the spots on the dice as well as by knowledge of math facts or number concepts.

MATHFACT*** Drill on the elementary math facts. The student has a choice of addition, subtraction, multiplication, and division facts. He may also determine the number of the various types of problems he wishes to try.

MONTHS*** Like DAYS*** (see above), but also asks questions about events occurring in particular months (uses 1 file).

SPELLING*** A tachistoscopic spelling program. The program prints a word at random and then covers it over with print; the user is asked to type in the word he saw. The user may specify the level of difficulty and number of words he wishes to work with (uses 1 file).

SPELPLUR*** A program to teach children the plural forms of various nouns with both regular and irregular plurals (uses 1 file).

DTSS CATALOG CATEGORY NAME: LAFFFPR***

CATALOG OF LAFFF FILES

LAFALONG*** (Compiled) This interactive program is the heart of the LAFFF system (see description below) (uses 4 files). @ %

LAFBAL*** Computes and prints balance sheet for any number of consecutive years for any company in the LAFFF system or for any company in the user's files so long as the user's file contains 72 facts per year (uses 1 file). @

LAFCALC*** Computes and prints up to 10 ratios entered by the user for any number of consecutive years for up to 25 companies in the LAFFF library files (uses 2 files).

LAFCASH*** Computes and prints cash flow for any number of consecutive years for any company in the LAFFF library files or for any company in the user's files (uses 1 file). @

LAFDATA*** Prints 72 financial facts for any number of consecutive years for any company in the LAFFF library files or for any company in the user's files (uses 1 file). @

LAFINC*** Computes and prints the income statement for any number of consecutive years for any company in the LAFFF library files or for any company in the user's files so long as the user's file contains 72 facts per year (uses 1 file). @

LAFGRO*** Computes and prints the growth rates and the percentage change in the latest three years of a number of financial facts for any number of consecutive years for any company in the user's files so long as the user's file contains 72 facts per year (uses 1 file).

LAFOWN*** This program allows the user to extract and save his own personal data bank from the LAFFF library data files (uses 2 files). @

LAFRATIO*** Computes and prints a given set of ratios for any number of consecutive years for any company in the LAFFF library files or for any company in the user's files so long as the user's file contains 72 facts per year (uses 1 file).

LAFREG*** Draws from the LAFFF library files to build either a time series or cross sectional random access file which may be used as the data file for TUCKREG***. Almost any combination of companies, years, and facts may be used (uses 2 files). @

LAFTICKR*** Produces a list of companies currently available

as part of the LAFFF system and a list of facts stored for these companies (uses 2 files). @

OTHER DATA BASES

DATALIB***:STATINF Together with file DATALIB***:STIND (see below), this file provides data on financing and expenditures of state governments for the 50 states & the District of Columbia. 22 facts are provided for years 1959, 1961, 1963 and 1965. These 2 data files can be used with LAFALONG*** in place of the LAFFF library files. DATALIB***:STATINF is a random access numeric file and should be used as the file containing the data base when used with LAFALONG***.

DATALIB***:STIND A terminal-format file; can be used as the index file for LAFALONG***; should be used with DATALIB***:STATINF (see above)..

* *

LAFFF (Language for the Aid of Financial Fact Finders) is a system which permits a user to do research and test ideas on corporate financial data. It consists of data files containing 72 financial facts for each of twenty years for 95 industrial corporations. With these data a user can project financial statements, analyze past financing decisions, test hypotheses about corporate asset structure, examine how investors have been rewarded on their stockholdings, and do other work which requires a financial data base. The data which are part of the LAFFF system in the library are taken from the Standard and Poors annual COMPUSTAT tape; these tapes are available from Investors Management Sciences, Inc., 835 E. 18th Ave., Denver, Colorado 80218. The financial data base on the Dartmouth Time-Sharing System is proprietary and is therefore not distributed as part of the library. However, a user may access these data files through his own program while using the DTSS, rather than using the programs above which are part of the LAFFF system.

@ A user's manual which gives information on the LAFFF system is available for purchase from the Research Secretary, Amos Tuck School of Business Administration, Dartmouth College, Hanover, New Hampshire 03755.

% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled

file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for LAFALONG***, type

```
OLD SCODELIB***:LAFALONG
```

DTSS CATALOG CATEGORY NAME: LANGUAGE***

CATALOG OF LANGUAGE FILES

GENERAL

ESPERO*** Introduces the language Esperanto. Gives a description of the language and some introductory exercises in a delightful conversational mode. Whole exercise takes about 15-20 minutes.

VOCDRILL*** Skeleton program for vocabulary or other drill. Sample data are provided.

ENGLISH

SPELL*** Program that attempts to correct any English word in which the combination 'ei' or 'ie' appears incorrectly. User inputs word, spelled correctly or incorrectly.

FRENCH

FRENCH*** French-English drill. You may use one of three available data files (French vocabulary, verbs, or expressions similar in pronunciation) or your own data. Files used: FRENCH2***, FRENCH3***, and FRENCH4***.

GERMAN

GADJEC*** (compiled) Tests knowledge of German adjective endings. %

GPREPOS*** Tests for proper use of the dative or accusative after the prepositions 'an', 'auf', 'hinter', 'neben', 'in', 'u:ber', 'unter', 'vor', and 'zwischen'.

GVOCAB*** (compiled) Two-level German vocabulary test; user may specify basic or advanced levels and in which language the word is given. The computer will pick words in random order and test the user on the translation and (if desired) the gender and plural of the German word. Several choices exist to allow for various translations. %

GREEK

GRROOT*** Tests knowledge of English translation of 20 Greek roots. Similar to matching test.

ITALIAN

ITVOC*** Italian vocabulary drill. Forty Italian words are tested. User may supply alternate data.

LATIN

LATREV*** Multiple choice Latin quiz. Covers material through lesson 5, 9, 13, 17, 21, or 37 of Wheelock's Latin Grammar. (Uses six files).

LATVERB*** Drill on principle parts and meanings of Latin verbs found in Wheelock. (Uses one file)

LATVOC*** Latin-English vocabulary drill based on vocabulary from Wheelock. (Uses one file)

LATVOCAB*** English-Latin vocabulary drill based on vocabulary from Wheelock. (Uses one file)

SPANISH

CARLOS*** (compiled) Driver program for Spanish grammar drills. 15 lessons are available (uses 15 files, DATALIB***: CARLOS01 through DATALIB***:CARLOS15).

PEPE*** Vocabulary drills in Spanish. 25 lessons taken from the Kensington word list, Books 3 and 4. (files DATALIB***:PEPE-A through DATALIB***:PEPE-Y)

SPWORDS*** English-Spanish vocabulary drill based on words from Kensington, page 72.

* *

Additional information can be obtained through Dartmouth's Publications "CARLOS, Computer-Assisted Instruction in Spanish" by Prof. Ronald C. Turner. This booklet is available from the Documents Center,

Kiewit basement, phone (603) 646-2643.

% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for BRIDGE***, type

```
OLD SCODELIB***:BRIDGE
```

DTSS CATALOG CATEGORY NAME: LINALG***

CATALOG OF LINEAR ALGEBRA FILES

CDETER*** Evaluates complex determinants using the Crout method.

COMMAT*** Solves the equation A*X=B for X where A, X, and B are matrices with complex number entries.

COMPMAT*** Computes all the P-th compound matrices for a square matrix.

CROUT*** Solves sets of N linear equations in N unknowns using the Crout Algorithm.

PROVIDE*** Performs synthetic division. User's dividend must be a polynomial of degree <= 8 and divisor must be a polynomial of degree <= 7. Constant functions are allowed in either divisor or dividend or both.

EIGEN*** Finds the Eigenvalues of an N by N matrix A by solving the N-th degree polynomial implied by the equation DET (A - X * I) = 0 where I is the identity matrix. The possible values of X are the Eigenvalues. The program may be time consuming for large matrices because of the number of matrix inversions.

INVERS*** Inverts a matrix using the exchange method.

INVHIL*** Produces the inverse of a finite segment of the Hilbert matrix (subroutine).

MATEQ*** Solves the matrix equation A*X=B for X in terms of the known matrices A and B, using the matrix inversion method. Allows for varying one or more elements of matrices A and B (uses 1 file).

RATINV*** Inverts a matrix with rational coefficients. Intermediate results are reduced to lowest form to avoid exceeding machine's precision.

DTSS CATALOG CATEGORY NAME: LOGIC***

CATALOG OF LOGIC FILES

CONCLUDE*** Determines the strongest conclusion which follows as a logical consequence from a given set of statements of propositional logic and prints the truth table.

TRUTHTAB*** Computes and prints the standard 2-value ('T' or 'F') truth table for statements of propositional logic.

NTRUTH*** Computes N-valued truth tables for formulas of propositional logic. Truth values are printed as numbers (0,1,2,...) rather than 'T' or 'F' as in TRUTHTAB***. Program is set up for 3-valued truth tables but may be changed through DATA statements.

TURMUL*** Simulates the action of a Turing machine. The user specifies the internal configurations of the machine, the initial tape configuration, and the maximum number of steps to be computed in DATA statements.

WELLFM*** Checks whether a string of symbols employing propositional variables, parentheses, and connectives constitutes a well-formed formula of propositional logic.

DISS CATALOG CATEGORY NAME: MEDSCH***

CATALOG OF MEDICAL SCHOOL PROGRAMS

DEECAY*** Decays a cobalt-60 source given the Julian date & the 2 S.S.D's desired for the theratron and the Keleket. Prints out the radians per minute for the S.S.D's desired for field sizes of 4 X 4 to 40 X 40.

ELECTRO*** Analyzes data on concentrations of certain substances in blood plasma and suggests possible causes, effects of imbalances, and therapeutic measures. List ELECINFO*** for instructions. (Uses 20 files)

TEACH-1*** Teaching program on body fluids.

DTSS CATALOG CATEGORY NAME: MGTSCI***

CATALOG OF MANAGEMENT SCIENCE PROGRAMS

ACCOUNTING PROGRAMS

SALESX*** Provides a summary presentation of inventory turnover and profit margin information for each department of a firm. The user enters the sales, purchases, and beginning and ending inventories for each department. &

MANAGERIAL ECONOMICS PROGRAMS

KE-BUY*** A program designed to help a manufacturer decide whether to buy a certain component for his product, or make it in his own plant. The cost of buying the component is compared with the discounted stream of cash flows that would result if the necessary investments were made to produce the component.

PROFITS*** Similar to SALESX***. The user enters the sales, purchases, and beginning and ending inventories for each department of a firm. The program computes and prints information about inventory turnover and profitability for each department.

PRODUCTION PROGRAMS

ASSIGNMT*** Uses the Gilmore Algorithm described in the communications of ACM (Nov. 1960, pp. 605-606) to solve the classic assignment problem and compute a cost for the assignment.

M*** Analyzes a PERT-time network (for project planning). For each activity in the network the program determines the mean completion time, the earliest expected completion time, the variance associated with the completion time, the primary slack, and the secondary slack.

LAYOUT*** Uses the Vollmann-Ruml plant layout model to determine the optimum layout of a plant with several departments. The departments are assumed to be rectangular and laid out in neat rows. The user inputs a flow matrix for exchanges between departments, cost weightings, and starting solutions. One or more departments may be held in a fixed location.

TRANSPT*** An algorithm to solve the transportation problem. For example: if M factories supply N warehouses with a product, factory I (I = 1 to M) produces A(I) units and warehouse J (J = 1

to N) requires B(J) units, what shipping pattern minimizes total transportation costs? Many problems having nothing to do with transportation fit the same model and can be solved with this program.

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& A complete user's guide is part of TIME-SHARING APPLICATIONS IN COMMERCIAL BANKING, which is available for purchase from the Research Secretary, Amos Tuck School of Business, Hanover, N. H. 03755.

DTSS CATALOG CATEGORY NAME: NUMERIC***

CATALOG OF NUMERICAL ANALYSIS PROGRAMS

ALEQ*** Finds the 'root vector' for a set of N general simultaneous equations with N variables using the Newton-Rapson method. The user specifies the equations in a series of simple BASIC statements. The initial values of the variables, the tolerance, and the maximum number of iterations to be performed are input during the run of the program.

ALLROOTS*** This program computes integral and fractional powers of real numbers and complex numbers (numbers containing the square root of -1).

DIFEQ*** Solves a group of N First-order differential equations of the form:

DX(I) = G(I) for I = 1,2,3,...,N,

when the initial conditions are known, by the fourth order Runge Kutta method.

INTERP*** The user supplies a list of arguments and their corresponding function values, and the program interpolates the function value Y at a given point X, using the Aitken-Lagrange interpolation for a single valued function.

INTGRT*** Computes the integral of any function, over any interval, using Simpson's rule, a technique which breaks up a curve into pieces and approximates each section with a parabola. (Uses 1 file.)

LBSLIB***:INTGRT A BASIC subprogram which computes the integral of any function using Simpson's rule.

QUADROOT*** Computes roots, both imaginary and real, of any quadratic equation (an equation of the form a*X^2 + b*X + c = 0) using the quadratic formula, given values for A, B, and C. This program includes both a subprogram and a driver program.

ROMINT*** Computes the integral of a single-variable function using Romberg's technique, one of the fastest converging methods. The user can specify the degree of accuracy desired. This program includes both a subprogram and a driver program.

ROOTS*** Isolates and computes all real roots of the general nonlinear equation f(x) = 0 in the domain of x from A to B (determined by the user). The roots are computed by Newton's method of approximation or by Mueller's scheme of successive bisection and inverse parabolic interpolation.

RUNGE-1*** Provides an approximate solution to the initial value differential equation:

```
Y' = F(X,Y)
Y0 = Y(X0)
```

using the Runge Kutta method (second order accuracy). This program includes both a subprogram and a driver program.

RUNGE-2*** Gives an approximate solution to the second order differential equation:

```
P' = F(X, Y, P)
Y0 = Y(X0)
P0 = P(X0)
```

using the Runge Kutta method (second order accuracy). This program includes both a subprogram and a driver program.

RUNGE-4*** Provides an approximate solution to the initial value differential equation:

```
Y' = F(X, Y)
Y0 = Y(X0)
```

using a fourth order Runge Kutta method. This program includes both a subprogram and a driver program.

RUNGE-T*** Computes approximate values for a parametrized curve given the following information:

```
DX/DT = F(T,X,Y)
DY/DT = G(T,X,Y)
X(T0) = X0
Y(T0) = Y0
```

This program uses a second order Runge Kutta method, and includes both a subprogram and a driver program.

DTSS CATALOG CATEGORY NAME: NUMTHY***

CATALOG OF NUMBER THEORY FILES

4-SQRS*** Writes a number as the sum of 4 squares.

ARITHMET*** Program providing efficient arithmetic for large numbers (up to 300 digits). Operations are: addition, subtraction, multiplication, division (for quotient and remainder), and exponentiation.

CHINESE*** Solves N simultaneous congruences of the form

A * X congruent to B (mod M)

by applying the Chinese Remainder Theorem.

EUCLID*** Uses Euclid's Algorithm to find the greatest common divisor of two integers, together with the weighting factors by which the GCD is expressible as a linear combination of the two numbers.

FACTOR*** Factors a number into multiples of prime numbers.

HUGEPRIM*** Searches for primes in the range of 1000 when given up to 8 leading digits. For example, if you input 12345678, it will find all primes of the form 12345678***.

LEGENDRE*** Evaluates the Legendre symbol (A/P) where P is an odd prime and (A,P)=1. (Note: the Legendre symbol is defined to be 1 if A is a quadratic residue of P and -1 if A is a quadratic nonresidue of P.)

PALNDROM*** Allows the user to experiment with a proposed procedure for finding a palindrome, a number which is equal to itself when its digits are transposed. (Uses 3 files).

PYTHAG*** Generates 86 primitive triples (integers A, B, C, such that A*A + B*B = C*C and A, B, and C are relatively prime).

SIEVE*** Demonstrates sieving method of finding primes.

DTSS CATALOG CATEGORY NAME: OPTIMIZE***

CATALOG OF OPTIMIZATION PROGRAMS

DYNAMIC*** This is a general purpose dynamic programming program. It is limited to one state variable and is useful in solving sequential optimization problems.

FIB*** This program locates and evaluates the maximum (or minimum) of a unimodal function of one variable within a specified interval of that variable using the Fibonacci method.

HOOK*** Does a Hook-Jeeves pattern search as described in section 7-08 of Wilde and Beightler, "Foundations of Optimization", pp. 307-310.

INTLP*** Revised simplex linear programming algorithm designed for use with INTPRO***. It assumes upper bounds of 1. The program will print into the file F-LPSOLU the necessary initialization information for INTPRO*** initial solution. The program is not as efficient as REVSIMPX*** in solving linear programming problems, so it should be avoided unless the solution is to be used with INTPRO*** (uses 1 library file).

INTPRO*** An adaptation of E. Balas' partial enumeration algorithm for solving a pure 0-1 integer programming problem. The program is constructed to solve a minimization problem subject to greater than, or equal to, constraints. Speed of convergence can be accelerated if the user supplies a surrogate constraint and/or a good starting solution.

LINPROG*** Aids in linear programming. Plots and evaluates linear functionals on polygonal regions of plane. Designed for Timeshare Devices, Inc. plotter (uses 2 files).

LINQUAD*** A linear or quadratic programming algorithm that allows the user to minimize or maximize a function of N terms.

REVSIMPX*** A revised Simplex linear programming algorithm, which will handle problems too large for SIMPLEX***. A compact matrix is used for output (see user's guide). The program has an option for postoptimality analysis (uses 1 file). @

REVSIMUB*** Another version of REVSIMPX*** with an option for upper bounded variables. (Uses 1 file). @

SIMPLEX*** Uses a simple version of the Simplex method to solve small linear programming problems (limited to 60 activities, 30 constraints). The method is G. Hadley's two phase method described in his "Linear Programming", pp. 149-158. @

SIMREV*** Rearranges the data for a linear programming problem; it will accept data that are ready for use with SIMPLEX***, REVSIMPX***, or REVSIMUB*** and prepare a new file of data for use with any other of these programs (uses 1 file). @

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@ A user's guide is available for purchase from the Research Secretary, Amos Tuck School, Hanover, New Hampshire 03755.

CATALOG OF PLOTTING SUBPROGRAMS AND SUBROUTINES

These files are designed for use as subprograms in programs to produce graphic displays on any of a number of devices, such as a terminal, the Timeshare Devices Inc. plotter, the Tektronix terminals, and the Calcomp 565 digital plotter. Generally, the programs serve as an interface between the user's program and the plotting device, converting the user's computed coordinates into a format appropriate for the device being used. These routines are not complete programs in themselves; they must either be incorporated in or called by the user's program. For "READY-TO-USE" plotting programs, refer to category GRAPHICS***.

BASIC SUBPROGRAMS FOR THE TIMESHARE DEVICES PLOTTER

For details on the use of and the programming for the T.D.I. plotter, see Technical Memorandum TM014, "USE OF THE TIMESHARE DEVICES PLOTTER ON THE DTSS". For brief, on-line documentation, run PLOTLIB***:EXPLAIN. For more information about graphical displays on DTSS, list the file PLOTLIB***:NEWS.

PLOTLIB***:TDI (Compiled) This file contains all of the subprograms described in TM014, "USE OF THE TIMESHARE DEVICES PLOTTER ON THE DTSS". %

BASIC SUBPROGRAMS FOR PLOTTING ON THE TERMINAL

For details on the use of the subprograms for obtaining graphical output on the terminal, see Technical Memorandum TM039, "GRAPHICAL OUTPUT ON THE TERMINAL ON THE DTSS", which will not be available until late fall, 1972. In the meantime, list the file PLOTLIB***:NEWS for information about the use of these subprograms.

PLOTLIB***:TTY (Compiled) This file contains all of the subprograms described in TM039 for obtaining graphical displays on the terminal. %

BASIC SUBPROGRAMS FOR THE TIME SHARE PERIPHERALS PLOTTER

The Technical Memorandum on the use of the Timeshare Devices (TDI) Plotter, TM014, also describes the available subprograms for the Time Share Peripherals (TSP) 212 Plotter.

PLOTLIB***:TSP (Compiled) This file contains the TSP

versions of the subprograms described in TM014, "USE OF THE TIMESHARE DEVICES PLOTTER ON THE DTSS". To use the TSP versions, the user merely has to change his LIBRARY statement. %

BASIC SUBPROGRAMS FOR THE TEKTRONIX TERMINAL

For details on the use of the Tektronix terminal, see the preliminary Technical Memorandum available at Wilder Hall for "USE OF TEKTRONIX TERMINALS". For documentation on the use of the subprograms for the Tektronix terminals, see TM014, "USE OF THE TIMESHARE DEVICES PLOTTER ON THE DTSS", which describes the available subprograms. The CALLs for the subprograms are identical in the TDI and Tektronix software. Only the LIBRARY instruction must be changed.

PLOTLIB***;TEK (Compiled) This file contains all of the subprograms described in TM014 for obtaining graphical displays on a Tektronix terminal. Some of the subprograms described are not yet implemented (as of 9/29/72). %

FORTRAN SUBPROGRAMS FOR THE TIMESHARE DEVICES PLOTTER

FDRIVER*** (FORTRAN) Contains the subroutines necessary to run FORTRAN plotting programs for the T.D.I. plotter. It contains three routines; TDSC scales the plot, TDPT directs the pen motions in plotting points, and TDND finalizes the plot, making sure all points have been output to the plotter. FDRIVER*** must be added to the end of a user's program (or library program) before it is run. This can easily be done with the "EDIT JOIN" command. (List FDRIVERX*** for a more complete explanation).

FDRIVERX*** Contains a description of and instructions for FDRIVER***.

F3D-1*** (FORTRAN) Contains the necessary subroutines for producing three-dimensional perspective drawings with FORTRAN programs on the T.D.I. plotter. Like FDRIVER*** it contains three subroutines: TDSC, TDPT, TDND. Points are specified by three coordinates X, Y, and Z. The parameters needed to scale the figure are the "center or sphere of interest" and the position of the observer. The sphere of interest is defined by the center (three coordinates) and the radius of the sphere. Points computed should lie within this sphere. The observer's position should be outside this sphere of interest and is specified by three coordinates. (LIST F3D-1X*** for further description).

F3D-1X*** Contains a description of and instructions for F3D-1***.

F3D-2*** (FORTRAN) Contains subroutines necessary for producing three-dimensional perspective drawings with FORTRAN programs on the T.D.I. plotter. It operates basically the same as F3D-1*** except the position of the observer is specified by: A (the angle between the line of sight and the X-Z plane), B (the angle between the line of sight and the X-Y plane), and R (the distance of the observer from the center of interest). Angles are expressed in degrees. Otherwise, the subroutines operate exactly the same as in F3D-1***. F3D-2*** must be added to the user's FORTRAN plotting program before running it. This can be done using the "EDIT JOIN" command.

SUBROUTINES FOR THE CALCOMP 565 DIGITAL PLOTTER

For details on the use of and programming for the Calcomp plotter see Technical Memorandum TM007 "CALCOMP PROGRAMMING IN BASIC." The subroutines are in the form of function definitions which cause appropriate characters to be sent to the plotter to correspond to plotter coordinates.

PLOT-B*** Contains the function definitions necessary for running the Calcomp plotter. It should be appended to the program initializing the plotter, scaling the plot, switching from terminal to plotter mode, moving the pen, etc. To utilize any of the functions one simply finds the value of the function given the appropriate parameters. The function will return a non-zero value and execute its function if no error is detected. If there is an error, the value of zero is returned, enabling the user's program to act accordingly.

FNL*** This is a separate function definition for the Calcomp plotter. It enables the user to draw letters on his plot of varying size and orientation. The string to be printed is L$ and the function takes 2 arguments: H (the height of the letters) and D (the angle of orientation of the string in degrees from the X axis). FNL*** should be added onto the end of the user's plotting program in addition to the other functions contained in PLOT-B***. FNL*** uses the data file .CH.*** for its character set.

.CH.*** A file containing data for the character set used by the function FNL*** for the Calcomp plotter.

3-DPLOT*** Contains function definitions similar to those in PLOT-B*** but designed for doing three-dimensional perspective plots. For details on the functions contained in 3-DPLOT*** and their operation LIST the file 3-DNOTES***.

3-DNOTES*** Contains detailed descriptions on the functions

CATEGORY NAME: PLOTAIDS*** DTSS CATALOG

contained in 3-DPLOT*** and their usage for the Calcomp plotter.

* *

The Technical Memoranda TM007 on Calcomp plotting and TM014 on use of the T. D. I. plotter are available from the Document Center, Kiewit Basement, phone (603) 646-2643.

T.D.I. plotters may be found in the physics building, Wilder Hall. Students taking physics courses and having work to do on the plotter have priority on these devices, but they may be used by others. A Calcomp digital plotter is located in the Engineering Lab (PDP-9 room) in the basement of Kiewit. Special permission must be obtained for access to this area. For permission see Eugene Fucci, 117 Kiewit. A Tektronix terminal may be found on the second floor of Wilder Hall. Users should obtain permission from Prof. John Merrill of the physics department to use this terminal.

% The source code for compiled files in the program library is stored in sublibrary SCODELIB***. For example, to obtain the source code (the file before it is compiled) of PLOTLIB***:TDI, type

OLD SCODELIB***:TDI

DTSS CATALOG CATEGORY NAME: PROBTHY***

CATALOG OF PROBABILITY THEORY FILES

BINOMC*** Computes binomial coefficients; that is, the number of ways N items can be divided with I items in each group.

BINOMD*** Predicts probabilities using binomial distribution; given the number of trials and the probability of success in each trial, the program computes the probability of exactly I successes (and the standard deviation of these probabilities) and the probability of I or more successes, for all I. The program will also print a histogram of the distribution, if desired.

BI PO*** Compares the exact binomial probabilities with the approximate values given by the normal Poisson distributions; the user supplies the number of trials N and the probability of success in each trial P.

BINORM*** Computes Pr(A <= X <= B), where X is the number of successes in N trials with probability P of success in each trial, using the normal approximation.

ECHAIN*** Computes basic quantities for an ergodic Markov chain: limiting probabilities, fundamental matrix, potential operator, mean first passage times, first passage times in equilibrium, variances of first passage times, limiting variances, and the transition matrix of the reverse chain.

ENTROPY*** Solves for the maximum entropy distribution associated with a given M-rowed constraint matrix of N variables; there are three options: (1) solves a general problem given the constraint matrix and associated means, (2) solves problem for N-state space given a mean and variance, and (3) adapts (1) or (2) for a given distribution.

HYPERG*** Prints a table of hypergeometric probabilities for a range of R (number of 'defectives' in sample), when sampling from a population of T items, D of which are defective.

PRBSTA*** Computes the probabilities of ten statements and their denials given the probabilities of any three.

SAMPLE*** A routine to draw samples from any one of 12 probability distributions. The user appends this subroutine to his program and specifies the distribution and appropriate parameters.

TCHAIN*** Computes basic quantities for a transient Markov chain: fundamental matrix (mean number of times in states), variance of fundamental matrix, mean and variance of times to absorption, and absorption probabilities.

DTSS CATALOG CATEGORY NAME: SOCSCI***

CATALOG OF SOCIAL SCIENCE PROGRAMS

2-X-2*** Calculates various percentages and statistics for 2-X-2 tables. Data are entered during the program run.

2222-*** Calculates and displays the decomposition of Q for a four variable table. The variables, A through P, are input during the program run.

2X2X2*** Calculates percentages, Yule's Q, and various confidence intervals for a dichotomized three variable table.

BEAU-Q*** A program which computes appropriate values of Yule's Q for from 2 to 10 variables. The user inputs the cell frequencies during the program run. A labeled table of the variables and categories may be printed if desired.

JOB-A*** An exercise designed to precede the reading of the Hodge-Treiman-Rossi, Hodge-Siegel-Rossi, and Hodge-Podge-Rossi papers in Sociology 5.

JOB-B*** Analyzes responses to the task assigned in JOB-A***.

LEO*** Performs analysis of multi-variate contingency tables, as described by Leo A. Goodman, "A General Model for the Analysis of Surveys", American Journal of Sociology (forthcoming). (Uses 1 file.)

MARGIN*** Calculates frequencies and percentages in each column of a file consisting of Hollerith card images (uses 1 file).

POPSIM*** Develops population projections. Total population, fraction babies, and fraction in the productive ages (15-60) are printed as a function of time. User may vary the birthrate or deathrate in the projections. Data are available in library files for the U. S. in 1960 and 1964, and for Japan, Sweden, and Puerto Rico. (Uses 6 files).

R-X-C*** Analyzes a table with R rows and C columns. Data are input during the program run.

R----*** Calculates the proportional distribution of a row (or column) of figures, and the confidence interval for each frequency.

STOVAR*** A series of subroutines which generates stochastic variates fitting specified continuous and discrete probability distributions. The subroutines must be merged with a program written by the user.

CATEGORY NAME: SOCSCI*** DTSS CATALOG

WORDS***. Writes the first draft of a report of 2x2x2 tables.

DTSS CATALOG CATEGORY NAME: STATIS***

CATALOG OF STATISTICS FILES

STATISTICAL MEASURES

GEOMEN*** Computes geometric mean and geometric standard deviation for a geometrically normal set of data.

GROUP*** Uses grouped data (up to 20 groups) to calculate various statistical measures; mean, median, variance, standard deviation, skewness, and coefficient of variability. Data are input during the program run.

SUPSTAT*** Computes the minimum, maximum, range, sum, mean, sum of squares, variance, standard deviation, standard error of mean, and coefficient of variation for one or more groups of data.

STATMEAS*** Computes 34 statistical measures on weighed or non-weighed data. Formulas from National Bureau of Standards Handbook 101.

STATISTICAL PROBABILITIES

CHI-PROB*** Computes upper tail probability of a chi-square distribution. For a given number of degrees of freedom, D, and a given value of chi-square, C, the program computes the probability that a chi-square variable with D degrees of freedom is greater than C (uses 1 file).

F-PROB*** Computes upper tail probability of an F distribution. For given numerator of degrees of freedom, N, denominator degrees of freedom, D, and F-value, F, the program computes the probability that an F variable with (N,D) degrees of freedom is greater than F (uses 1 file).

NOR-PROB*** Computes lower tail probability of a standard normal distribution. For a given normal value, Z, the program computes the probability that a standard normal variable is less than Z (uses 1 file).

T-PROB*** Computes one and two-tailed probabilities of a student-T distribution for a given number of degrees of freedom, D, and a given T-value, T. If T<0, the one-tailed probability is the probability that a T variable with D D. F. is less than T. If T>0, the one-tailed probability is the probability that a T variable with D D. F. is greater than T. The 2-tailed probability is the probability that the absolute value of a T variable with D D. F.

is greater than the absolute value of T (uses 1 file).

ONE SAMPLE TESTS

STAT06*** Calculates the sign test confidence interval using fractional counts.

STAT07*** Calculates the confidence limits for a set of data using the Wilcoxon signed rank sum procedure with fractional counts.

TWO SAMPLE TESTS

MANNWHIT*** Analyzes two groups of unpaired data by the Mann-Whitney U-test. This test is equivalent to the Wilcoxon two-sample rank sum test. The output for each group includes the sum of the ranks, the Mann-Whitney U-statistic, and the standardized deviate of the U-statistic. The two-tailed significance probability for large samples is also output (uses 1 file).

STAT08*** Compares two groups of data using the median test.

STAT-09*** Compares two groups of data using the Mann-Whitney two sample rank test with confidence intervals.

TWOSAMP*** Analyzes two groups of unpaired data by the two-sample student-T statistic, first assuming the population variances of the two groups are equal and then assuming they are unequal. An F-ratio of the sample variances of the 2 groups is computed as an aid in determining the proper T procedure. The output includes the mean, variance, and standard deviation of each group; the F-ratio of the group variances and corresponding significance probability; and for each T procedure, the mean difference, the variance, and the standard deviation of the mean difference, the T-ratio, the degrees of freedom, and the corresponding significance probability (uses 1 file).

PAIRED COMPARISONS

PAIRED-T*** This program considers two groups of data that occur together in N pairs (X,Y) where X is an observation from the 1st group and Y is an observation from the 2nd group; program computes the 1-sample student-T statistic applied to the N differences X-Y obtained from each pair. Output includes the observed T-

ratio on the N differences & the associated one and two-tailed significance probabilities, the mean, standard deviation, and standard error of the mean for each group and the mean, variance, and standard error of the mean of the differences (uses 1 file).

SIGNRANK*** Computes the Wilcoxon matched-pairs signed-rank statistic for two gropus of data that occur together in N pairs (X,Y), where X is an observation from the 1st group and Y is an observation from the 2nd group. The output includes the rank sum of the positive differences, the rank sum of the negative differences, the number of zero differences, the standardized deviate of the smallest rank sum and corresponding two-tailed significance probability (uses 1 file).

CONTINGENCY TABLES

BACT2L*** Performs a Bayesian analysis of a 2 level contingency table. Maximum dimensions for table are 10 X 10 (i.e., 10 attributes for each characteristic).

BACT3L*** Performs a Bayesian analysis of a 3 level contingency table. The user may ask for uniform priors or assign his own with this program. Input data are limited such that R1*R2*R3 = 125 where R1, R2, and R3 are the number of classifications for attributes A, B, and C, respectively.

STAT04*** Computes Chi Square statistics for 2 by 2 contingency tables. This program does not employ the Yates continuity correction which is known to be too conservative.

STAT05*** Computes Chi Square statistics for any number of M by N contingency tables.

ANALYSIS OF VARIANCE

ANOVAR*** Provides complete factorial analysis of variance for up to 14 factors. The analysis is performed by the use of three special operators. The analysis of most other designs can be derived by reducing them first to the factoral designs and then pooling certain components of the variance table.

FRIEDMAN*** Computes Friedman's 2-way analysis-of-variance statistic for a design of up to 50 treatments and 100 observations each. This is one of the most powerful non-parametric tests. For large designs the statistic has chi-square distribution, but for smaller problems, a special table should be used. The program

informs the user when this is necessary.

GRAECO*** Computes the analysis of variance table for a simple Graeco-Latin square design.

INCBLK*** Produces analysis of variance table for a balanced incomplete design and F-ratio for treatments. The sum-of-squares is adjusted because of incompleteness.

LATSQR*** Computes analysis of variance table for a simple Latin square design.

ONEWAY*** Analyzes a completely randomized design (one-way classification) by analysis of variance and the Kruskal-Wallis rank test. The output includes: the analysis of variance table; the observed F-ratio and corresponding significance probability; the Kruskal-Wallis H statistic and corresponding significance probability; and a table of treatment means, within-treatment standard deviations, and standard errors of each treatment mean (uses 1 file).

RANBLK*** Analyzes a randomized complete block design with no replications. The output includes the analysis of variance table, F ratios with corresponding significance probabilities, the outcome of Tukey's test for non-additivity, and the treatment and block means (uses 1 file).

YOUDEN*** Computes analysis of variance table and F-ratio treatments for a Youden square design. Sum-of-squares for treatments is adjusted because of incompleteness.

CORRELATION ANALYSIS

CORMAT*** Computes the correlation matrix for N series of data. Limited to 25 series, but may be easily modified to accept more. There need not be a fixed number of data in each series.

CORREL*** Computes the Pearson product-moment correlation coefficient, R, of two groups of data occurring together in pairs (X, Y), where X is an observation from the first group and Y is an observation from the second group.

PATH*** Interactive path analysis. User supplies matrix of zero-order product-moment correlation coefficients. He defines the paths, may ask for correlation among paths, and may review causal diagram specified.

SPEARMAN*** Computes the Spearman rank correlation coefficient

of two groups of data occurring together in pairs (X, Y), where X is an observation from the first group and Y is an observation from the second group.

REGRESSION ANALYSIS

LINFIT*** Computes best linear fit for a set of up to 60 independent variables to a dependent variable. (The program may be easily modified for more than 20 variables). The program also gives the correlations between the independent and dependent variables.

LSCF*** Least squares polynomial curve fit subroutine. Result is stored in a vector.

MADREG*** A MAD (Mean Absolute Deviation) Regression program. Data must be in the same form as for the general regression program TUCKREG***. (See REGPREP*** for data preparation instructions). (Uses 1 file).

MULTREG*** Computes one or more multiple linear regressions on a batch of data. 211 is maximum number of data sets; 17 is maximum number of variables. Output is more elaborate (and longer) than that of STEPREG***. User may specify whether or not variance-covariance matrix and/or residuals are to be printed out.

PLR*** A program designed to estimate linear relationships between (a) one variable and time; or (b) two variables, where the user believes that the data-generating source changes over time. The method is called Piecewise Linear Regression. See the article "Piecewise Regression" by professors V. E. McGee and W. . Carleton, JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION, September, 1970. #

PMLR*** This program works with a N-by-M data matrix, being N observations on M variables. The first variable is the dependent variable (Y) and the others are regressors. Instead of performing one overall regression analysis of the data, PMLR*** hierarchically develops 'piecewise' solutions (different regression regimes) and performs statistical tests to enable the user to decide which set of regimes best describes the data.

REGPREP*** Will write data into a random access file for use in the general regression program TUCKREG*** or the MAD regression program MADREG***.

SIMPREG*** Performs simple linear regression analysis on

CATEGORY NAME: STATIS*** DTSS CATALOG

N sets of paired observations (X, Y), where X is the independent variable and Y is the dependent variable. The output includes the least squares estimates of the slope and intercept of the regression equation Y = A + B*X, the analysis of variance table with the appropriate F value, the coefficient of determination, and optional output of predicted values and residuals (uses file SUBSLIB**;STATSUB).

STAT-9*** Computes slope, means, Y-intercept, standard deviations, sum-of-squares, and F-ratio for a linear regression with several Y values for each X value.

TAT22*** (Compiled) Multiple regression package. Can handle very large data sets because it uses data files. Includes a set of linear transformation options. (Uses 1 file). %

STEPREG*** Performs one multiple linear regression according to Efroymson's algorithm. Must be altered for more than 8 independent variables, 7 dependent variables, or 50 data sets.

TRNSFORM*** Will transform data in a file - such as an input file for TUCKREG***. Seventeen different transformations are available. For example, you may add a constant to a variable, take logarithms, multiply one variable by another, or lag a variable any number of periods (has 5 sample data files). #

TUCKREG*** A general program designed to compute one or more simple or multiple linear regressions. The program can provide all statistical measures commonly used with regression analysis. #

SCELLANEOUS PROGRAMS

FACTANAL*** Complete factor analysis of a design of up to 50 variables. Options include correlation matrix, principal components analysis, varimax rotation, principal components and varimax factor score coefficients, & factor scores for each observation.

NORDEV*** A subroutine which generates random normal deviates (i.e., with mean 0 and variance 1). One value is returned each time the subroutine is called.

PHICOE*** Computes the value of the Phi coefficient and the number of cases for data on two variables.

STATISTICAL SUBPROGRAMS

DTSS CATALOG CATEGORY NAME: STATIS***

SUBSLIB***:STATSUB (Compiled) A BASIC "LIBRARY" of subprograms for computing exact probabilites for various probability distributions. Included are routines for computing probability of desired F-value, chi-square, T-value, and normal value. For instructions on how to use the subprograms in this file, type OLD SCODELIB***:STATSUB, and when the computer responds READY, type LIST. %

* *

For other probability programs, see category PROBTHY***.

A complete user's guide is found in MANUALS FOR COMPUTER PROGRAMS IN FINANCE AND INVESTMENTS, which is available for purchase from the Research Secretary, Amos Tuck School of Business Administration, Hanover, N. H. 03755.

% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file. For example, to access the source code for SUBSLIB***:STATSUB, type

OLD SCODELIB***:STATSUB

CATALOG OF TEXT AND STRING PROCESSING PROGRAMS

RUNOFF*** (Compiled) A publications formatting routine for the printing of textual files on the DTSS. Control words, or commands, inserted throughout the text determine the output format, including such items as page size, line width, titles, page numbering, and paragraphing. %

SUBSLIB***:TEXTSUB (Compiled) This is a BASIC "LIBRARY" file of subprograms for handling text and string manipulations, such as replacing all lowercase letters in a string with their uppercase equivalents, or deleting spaces or control characters from a string, or prompting a user to answer a question with either "YES" or "NO". (LIST the file SCODELIB***:TEXTSUB for instructions.) %

SUBSLIB***:VAL (Compiled) This is a BASIC subprogram which can be used in place of the function VAL(A$) to convert a string into the number which is represented by that string. % (LIST the file SCODELIB***:VAL for instructions.)

TYPIST*** Reformats textual data in the format of a typical typewritten page. The program mimics the actions of a human typist, preparing a finished document from source documents which may contain partially filled or overfilled lines or pages.

* *

Documentation on RUNOFF*** is found in Technical Memorandum TM005, available from the Kiewit Document Center, phone (603) 646-2643.

Documentation on TYPIST*** is available as TM033; TM033 may also be obtained from the Document Center.

% Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for RUNOFF***, type

OLD SCODELIB***:RUNOFF

TAXMCHG***, & TAXNCHG***), and 2 statement printing programs (TAXBAL*** & TAXSTAT***). The programs TAXACCT***, TAXNCHG***, and TAXADEL*** chain to the program SQUEEZE***, which deletes zeroed entries from the user's system files. The user must create 4 files before running these programs. A user's manual may be purchased from the Research Secretary, Amos Tuck School of Business Administration, Hanover, N. H. 03755. (The Property Tax Billing System consists of 14 program files and 1 subprogram, UCASE, in SUBSLIB***:TEXTSUB.)

PLANNING AND DECISION MAKING PROGRAMS

EACHSAL*** Allows the user to examine the salary structure for a school system and analyze the effects of various changes on the school's budget. The user may alter the base salary, the step and track increments, and the teaching staff. Data may be entered in DATA statements or user-prepared files. Sample data are provided. Uses the subprogram UCASE in SUBSLIB***:TEXTSUB.

BONDPAY*** Calculates the investment schedule that meets a community's growth projections. The user enters statistics such as base year, school taxes, the population estimates, assessment and growth estimates and the pay options he desires in DATA statements. Sample data are provided.

CASHFLOW*** Projects the monthly cash needs of a town given, in DATA statements, as many revenue accounts and expense accounts for previous years as are available. Sample data are provided.

COMMUNITY ENGINEERING PROGRAMS

PAVEMENT*** Allows the user to calculate the cost and the number of tons of paving material needed to pave a road, or roads, with asphalt. The program is designed to handle paving with either 1/2 inch or 3/4 inch stone mix. It allows the user to make changes in pavement thickness and stone mix used to facilitate comparisons. All data are input from the terminal.

VERTICAL*** Calculates the height at specified intervals of a vertical curve which connects adjacent segments of differing gradients. May be used to determine the curve of a road. If desired, the program will plot points along the gradient line on the terminal. All data are input from the terminal.

SURVEY*** Handles the mechanical computations used to determine the error of closure in a closed traverse and, at the

user's option, performs the task of balancing the survey. Data may be entered in a data file, in DATA statements, or as input from a terminal. Uses the subprogram UCASE in SUBSLIB***:TEXTSUB.

INFORMATION SYSTEMS

DATALIB***:STATINF Together with file DATALIB***:STIND, this file provides data on financing and expenditures of state governments for the 50 states and the District of Columbia for use with LAFALONG***. (LAFALONG*** is the main program of the LAFFF System; it manipulates and analyzes in conversational mode a two- or three-dimensional data base; see category LAFFFPR*** for more information.) 22 facts are provided for years '59, '61, '63, & '65. DATALIB***:STATINF is a random access numeric file and should be used as the file containing the data base when used with LAFALONG***.

DATALIB***:STIND A terminal-format file; can be used as the index file for LAFALONG***; should be used with DATALIB***:STATINF (see above).

* *

The above programs have been developed under a Title One grant to Dartmouth College. The programs are untested and are made available to you for your suggestions and comments on program modifications. Please address correspondence to:

Prof. Richard S. Bower
Amos Tuck School of Business Administration
Hanover, New Hampshire 03755

CATALOG OF UTILITY FILES

ALTSORT*** Produces an alter deck suitable for GMAP assemblies.

BLOCK*** Produces a listing of BEGIN-END pairs and comments in the user's ALGOL program. The program gives the line numbers of the BEGIN statement, the END statement, the delimiter following the END, the start of the comment (either ' or COMMENT) and the delimiter ending the comment. Any mismatched BEGIN's will be listed before termination; a mismatched END will be printed and the program halted.

CATLIST*** Types a list of file names based on the user's current catalog. File names are grouped into 4 categories: files unchanged, files unsaved or purged, files created, and files changed since the last run of CATLIST***. The program also gives file type, length, and date last modified. Files within each category are sorted alphabetically or by date last modified.

CHARS*** Prints a table of the ASCII character set for different terminals. For each ASCII character, the program prints its octal and decimal representations, the character(s) one must type to transmit that character from the particular terminal, and the character the terminal types when it receives that ASCII character. Terminals included are Model 33, 35, and 37 Teletypes, IBM 2741, Novar, Datapoint, Friden, and Tektronix terminals.

CGRADE*** A cumulative grade program. The program will handle up to 12 grades for 150 students. Grades are standardized, weighted, and a weighted average is computed. Grades are entered in DATA statements.

COMMENT*** Aligns programming comments in 'BASIC' programs. User may specify alignment column, add comments or blank lines, or replace existing comments. COMMENT*** also neatens the user's program by indenting the body of FOR-NEXT loops, subprograms, and function definitions.

FLOW*** A flowcharting program which will print out a diagram of a BASIC program, including lines indicating all possible transfers of control. References all GOTO, GOSUB, IF...THEN, ON...GOTO, and FOR...NEXT instructions. May be RUN at a terminal or in BACKGROUND; user may specify a specific block of lines to be flowcharted. (Uses 2 files.)

FORMLET*** A do-it-yourself form letter writing routine. The user may make the letter as long as he wants and the program will page it, insert inside business addresses if desired, single, double, or triple space the text, etc. The user sets up three

files of his own before running the program. (Uses 1 file).

FORMOUT*** Allows the use of certain control characters for purposes of formatting output on a terminal. Available options make it possible to have reverse line feeds, to jump to the beginning of a new page, or to restart at the top of the current column on the current page. The user must change the 'PRINT' statements in his program to 'PRINT#' statements and then chain to FORMOUT***.

GRADER*** Computes term averages for individual students and class average.

INCTAX*** This program helps the user complete form 1040 and Schedules A and B of his 1971 federal income tax return. He must have with him all the information he would normally need to complete his return, such as his W-2 form and dividend income statements; in addition, he must complete any other necessary schedules besides A and B before running the program. INCTAX*** does all the necessary calculations given the appropriate entries for the forms; it calculates the user's tax if he itemizes deductions or if his adjusted gross income is $10000 or more (otherwise, the user looks up his tax in the booklet tables). The program prints out a summary of the entries on form 1040 and Schedules A and B (if applicable). (Uses 3 files). @

LISPTR*** Allows user to trace functions in DTSS LISP programs. Uses 1 file: the instruction file, LISPTR-I***.

MOT-BAS*** Heading for multiple terminal DTSS BASIC programs.

MOT-EXAM*** (FORTRAN) Multiple terminal DTSS FORTRAN program which demonstrates use of MOT-FOR***.

MOT-FOR*** (FORTRAN) 4 subroutines to be appended to multiple terminal FORTRAN programs.

PARITY*** Restores files read from paper tape using 'direct' mode to normal terminal-format. Checks parity of file characters if desired and replaces bad characters with a character the user specifies.

PILOT*** (compiled) Simulates Pilot Language for interactive conversational programs. (Uses 1 file.) %

RANDOM*** Subroutine to randomly order integers from 1 to N. Result is stored in a vector.

RUNTIMES*** Calculates run-time for user's routine.

SIGNUP*** Prints a signup sheet with varying time increments.

SKIMEET*** Calculates the results of ski meets. Output format is arranged for direct printing onto HECTO or MIMEO masters.

SORT*** BASIC interface between the user and the DTSS module SYSTEM SORT which will sort and/or merge terminal-format, random access string, or random access numeric files on fields specified by the user. All files must be of the same type. (Uses 1 file).

TAPESIGN*** Punches messages up to about 550 characters long on paper tape. Contains options for punching and automatically labeling paper tapes of up to 10 programs, for duplication of messages, and for punching stenciled messages.

TEACH*** Sample TEACH test program.

TS-GECOS*** Formats a Time-Sharing FORTRAN file for GECOS running.

* *

Documentation on PILOT*** is available as TM031 from the Kiewit Document Center, Kiewit basement, phone (603) 646-2643.

Documentation on SORT*** is available as TM034, also available from the Kiewit Document Center.

* Source code for compiled files is stored in sublibrary SCODELIB*** of the public program library. The uncompiled file has the same name as the compiled file in the main program library. For example, to access the uncompiled file for PILOT***, type

OLD SCODELIB***:PILOT

@ INCTAX*** is revised at the beginning of each new year to handle tax returns for the previous year.

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