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W. R. CHURCH

Computer Center

NEWSLETTER

26 July 1972
Volume 4, Number 4

SOME OS/360 USE STATISTICS FOR MAY AND JUNE

	MAY	JUNE
Total jobs	29,800	18,236
QUICKRUN jobs	15,502	7,092
% Total jobs	52%	38.9%
% Total CPU time	5.3%	2.4%

Percentage of Total Jobs by Job Class

Class	Q	A	B	C	D	E	F	G	H	I	J	K	L	M	Ø
May	52.0	7.1	11.2	7.0	6.2	4.9	1.3	1.8	1.0	1.8	0.6	1.7	0.9	1.6	0.9
June	38.9	10.2	12.2	5.8	7.9	8.3	1.2	3.5	2.2	2.4	1.6	2.0	1.1	1.8	0.7

Where Q = QUICKRUN
       L = plotting
      M,Ø = special operator-classes

% Jobs by Programming Language

The pairs of numbers under each heading are (% of total jobs, % of total CPU time) in that category.

Language/System	All Jobs		QUICKRUN	
	May	June	May	June
WATFOR G	25.7, 0.7	21.2, 0.3	48.1, 12.4	51.4, 10.6
WATFOR C	1.0, 0.2	1.2, 0.1		
FORTRAN G	38.5, 55.7	40.2, 39.4	34.5, 63.4	37.1, 68.9
FORTRAN H	1.5, 18.7	3.1, 36.7		
COBOL	3.1, 0.3	3.2, 0.2		
GPSS	2.5, 1.0	3.3, 1.4	3.9, 6.5	6.9, 16.6
XPL	3.8, 3.8	2.6, 1.9		
PL/1	1.2, 1.0	2.7, 0.8		
CSMP	2.1, 1.6	1.8, 0.7		
BASIC	3.3, 0.5	0.9, 0.1	6.1, 8.3	2.2, 2.2
ALGOLX	1.0, 1.4	0.4, 0.2	1.4, 1.5	0.5, 0.8

FORMATION OF COMPUTER SCIENCE GROUP

During June, Provost M. U. Clauser announced the formation of an inter-disciplinary Computer Science Group of faculty members. Professor G. L. Barksdale (Mathematics) will serve as its Chairman. Its duties will be to recommend candidates and degree requirements, develop courses, approve theses and perform other duties in the area of supervising Computer Science curricula. The Computer Center looks forward to working closely with this group to continue to improve computer education at NPS.

NEW USERS

Each new student or faculty user of the Center should obtain a user number from the Information Services Office, In-147. This number remains valid as long as the user is at the School. We strongly recommend that each new user at the same time sign up for a free copy of the User's Manual which is a comprehensive guide to the services provided by the Center. New users should also be aware that a suggestion box is available in In-140, the dispatching area. All users are urged to place any suggestions, complaints or requests for information in this box. Any convenient piece of paper will do, e.g., a discarded punched card. Brief responses will be posted on the graffiti board above the box as soon as possible by the staff or by the User Service Committee of the Computer Council.

CP-67/CMS NOTES

Release 3.1 Running Now

Beginning this quarter, Release 3.1 of CP-67 was installed as the primary control program. CMS remains at Release 3.0 due to severe problems with the initial IBM release, particularly in the FORTRAN compiler.

Release 3.1 of CP-67 contains many enhancements aimed at increasing overall performance. Since we presently run on only 256K, some of these enhancements may not be fully realized. However, enough improvement is anticipated to warrant the change.

Work is underway incorporating fixes sent by IBM to cure the problems with CMS 3.1 and it is hoped that it will be available in the near future. The changes to both CP-67 and CMS 3.1 are transparent to the user. They are intended to increase efficiency internally and to add additional commands. Present users should not be directly affected.

General Users

Due to private space limitations, many of our users of CP-67/CMS are required to share common disk file storage as "general users." Some ground-rules for general users have been established and are repeated here for the benefit of new users:

1. Do not clutter a general user disk file with multiple copies of the same program; this is wasteful of space.

2. When finished with a program or file, erase it before logging off. ('Offline punch' it first, if you wish to save that file for future reference and it is comparatively small).

3. To save files from possible erasure by other users, consult the User's Manual (Section 4.12) for instructions on "Saving General User Files."

4. If you log on and find insufficient space, do not merely issue ERASE * * . First, issue a LISTF * * to find out which files already exist; then erase TEXT and LISTING files first and issue a STAT command to see how much space has been recovered. If this is sufficient, proceed as usual. If necessary to erase some FORTRAN or SYSIN files, do so by date, that is, oldest ones first. The general rule as always is to use common sense. The general user system can only work well if all persons cooperate.

3

Pack/Unpack Commands for CMS

Disk file storage space under CP-67/CMS is rather limited. General users must share 10 cylinders of 2311 disk while private users are ordinarily given only 5 cylinders. To make the most of a user's disk space, two new commands have been added to CMS.

The PACK command enables a user to take a file with a file type such as FORTRAN, SYSIN, FILE, LISTING, etc. and to compress the file by removing all extraneous blanks. The file which is PACK'ed is replaced by a file with the same file name but a file type of PACKED. This new file will be smaller than the original and may be OFFLINE PUNCH'ed if desired.

To reverse the process, the UNPACK command restores a PACK'ed file to its original state with all blanks reinserted exactly as before the PACK command was issued. Details on how to use these two new commands can be found as addenda to the "CP-67/CMS Users' Guide" at each terminal.

SPSS: STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES

The Computer Center has acquired the Statistical Package for the Social Sciences (SPSS) from the National Opinion Research Center of the University of Chicago. The aim of this package is to provide the social scientist (psychologist, educator, political scientist, etc.) with a convenient, easy-to-use system for analyzing questionnaire data. However, SPSS is not restricted to this kind of data, but is rich in various methods of analyzing and presenting any data.

SPSS is relatively machine-independent in that it presumes no computer programming experience. All actions are prompted by plain-language commands. The kinds of analyses available are one-way description, cross-tabulation, scale analysis, parametric and non-parametric correlation analysis, regression analysis, and factor analysis.

The full description of SPSS commands in text book format is contained in a paper back volume entitled "SPSS: Statistical Package for the Social Sciences" by Nie, Bent, and Hull, McGraw-Hill, 1970. This publication is available through the bookstore. A reference copy is available in In-162. As a companion users' guide to the Computer Center's version of SPSS, a Technical Note (0211-19), "Directions for Using SPSS" has been prepared. Copies are available from the Information Service Office, In-147.

SNAP/IEDA STATISTICAL PACKAGE

SNAP/IEDA is a statistical package of a more general nature than SPSS. SNAP was obtained from Princeton University where it is used in Professor John Tukey's class, Introduction to Exploratory Data Analysis. SNAP, like SPSS, does not presume programming experience but utilizes a set of simple commands with options to perform the required analysis.

SNAP has many features which make it appealing. A user can generate his own data from many common probability distributions, perform transformations, and submit the data to many of the classical statistical techniques for analysis. For the user who has data already available, SNAP is a fast, easy and efficient way of performing initial data analysis.

The documentation on how to use SNAP appears as Technical Note 0211-020. It will be available from the Information Services Office, In-147, in August.

INFORMATION SERVICES NOTES

Project Numbers

All Fiscal Year '72 project numbers (second accounting field on OS JOB cards) were cancelled on 1 July. Most users with continuing individual projects (those numbered less than 1000) have applied for and been given renewals. If you require renewal of such a project number or are about to begin a new individual project, please come to In-147 for an application form.

All class project numbers also expired at the end of last quarter. Any attempt to use an old number will result in a job failure. The valid sequence of class project numbers for Quarter I will be in the range 1000 through 1199.

User Manual Updates

Update packages 14 and 15 to the User's Manual were distributed to all registered holders during June. These changes included a complete re-write of Chapter 3 (Introduction to Batch Usage), a new Table of Contents and a new Index. Anyone with a User's Manual who failed to receive these important updates should call at the Information Services Office, In-147.

CP/CMS User's Guide

An interim User's Guide for CP/CMS has been issued as a Technical Memorandum by the Center. It includes basic information on typing conventions, the Editor, FORTRAN, ALGOL-W, PL/1 and sample terminal sessions. A copy has been made available at each terminal attached to the system. The information in this guide is intended to supplement the introductory material given in Chapter 4 of the User's Manual.

5

FORTRAN NOTE

FORTRAN programmers are urged to take special care to be sure not to omit the "m_2" parameter in DO statements, particularly when "m_3" is defaulted. This sort of error typically results either from a keypunching mistake or from "beginner's confusion". As a recent example, a user programmed,

$$D\emptyset\ 1 \quad I = N$$
(instead of the correct)
$$D\emptyset\ 1 \quad I = N,L$$

The error was <u>not</u> recognized by the compiler, and the statement was compiled as if it were an arithmetic assignment, viz.

$$D\emptyset 1I = N$$

In this case, diagnosis was particularly difficult since the user had other variables beginning with the letters "$D\emptyset$" in his code. The root cause of the eventual "OC5" abnormal termination was revealed only after exhaustive line-by-line examination of the object program.

I/O BLOCKING FOR EFFICIENCY

Some users require the use of files containing large amounts of data on magnetic disk or the data cell unit. OS/MVT job control language for such applications is discussed in Section 3.6 (and following) of the User's Manual. Processing of data in blocked, rather than unblocked form, is generally more efficient. Furthermore, the larger the block-size (in general) the faster the processing, when the processing is sequential.

For example, a job which used the standard IBM SORT program to sort 2834 records of 133 characters on three fields was run two times on the Stanford System 360. The first execution was with unblocked input and output. The second job was identical except that the 133 character records were blocked in groups of 20 (BLKSIZE=2660). As the following figures show, the difference in execution time can be significant, particularly with large data files.

	LRECL	BLKSIZE	RECFM	CPU TIME	EXECUTION TIME
SORT 1	133	133	F	.11 Sec.	2.96 Mins.
SORT 2	133	2660	FB	.06 Sec.	.89 Mins.

SUBROUTINE LIBRARY CHANGES

The following routine has been added to the Source Library and to a concatenation to FORTLIB:

M2-BCNV　　　Data Format Conversion

(This routine facilitates data conversions, e.g., an integer to equivalent literal representation.)

The following subroutines in SSPLIB (the CP/CMS library of precompiled routines) have been revised or corrected:

G3-AUTO　　　Autocovariance, Time Series Analysis
F2-DALMAT　　Eigenvalues/Vectors of Arbitrary Complex Matrix
F4-GELG　　　General Simultaneous Linear Equations by Gaussian Elimination
J5-PLOTP　　　Plot on Printer, Multiple Curves
J5-UTPLOT　　Plot on Printer, Single or Double Precision

(The last two above have been revised so that plots go to FT08F001, which can be printed on the high-speed printer, rather than to the user's terminal).

The following routines have been deleted from the Source Library and added to USAL (Unmaintained Specific Applications Library) which is maintained as punched card decks by Mr. Robert Walton, In-151, X2606.

DO-MINSIM　　Unconstrained Function Minimization, Nelder and Mead
E2-LSQPOL　　Least Squares Polynominal Fitting
F2-EIG3　　　Eigenvalues of Arbitrary Real Matrix, Laguerre-Parlett
HO-CONSIM　　Constrained Minimization of Objective Function, Nelder-Mead-Box
J5-METMAP　　Contour Plot on Printer, Half-Inch Grid
J5-MTMPII　　Contour Plot on Printer, Inch Grid
J5-STPLOT　　Multiple Curves Plot on Printer
T4-DSMIS　　　Symbolic Matrix Interpretive System

RECENT ADDITIONS TO COMPUTER CENTER LIBRARY (In-162)

Author	Title
Afifi-Azen	Statistical Analysis, a Computer Oriented Approach
American National Standards Institute, Inc.	American National Standard COBOL
AMR	AMR's Guide to Computer and Software Security
Arnold	Modern Data Processing
Arno Press	The Computer and Invasion of Privacy
Arno Press	Government Dossier; An Inventory of Government Information About Individuals
Beckenbach & Thompkins	Concepts of Communication
Caffrey	Computers on Campus

Author	Title
Clynes	Biomedical Engineering Systems
Cocke	Programming Languages & Their Compilers
Cuttle & Robinson	Executive Programs and Operating Systems
Davenport	Modern Data Communication - Concepts, Language, and Media
Dickman	Personnel Implications for Business Data Processing
Emshoff	Design and Use of Computer Simulation Models
Faden	Computer Programs Directory 1971
Foster	Computer Architecture
Foster	Automatic Syntactic Analysis
Galler	A View of Programming Languages
Gerbner	The Analysis of Communication Content
Gildersleeve	Design of Sequential File Systems
Green & Parslow	Computer Graphics in Management
Greenberg	Integer Programming
Greenspan	Computing Methods in Reactor Physics
Hartman, Matthes and Proeme	Management Information Systems Handbook
Henley	Computer-Based Library and Information Systems
Hodge & Hodgson	Management and the Computer in Information and Control Systems
Hunter	METALOGIC - An Introduction to the Metatheory of Standard First Order Logic
Infotech	Giant Computers, Int'l Computer State of the Art Report 2
Infotech	The Fourth Generation, Int'l Computer State of the Art Report 1
Infotech	Real Time, Int'l Computer State of the Art Report 3
Lee	Computer Semantics
Lyon	An Introduction to Data Base Design
Mackay	Bio-medical Telemetry (Second Edition)
Maisel & Gnugnoli	Simulation of Discrete Stochastic Systems
Martin-Norman	The Computerized Society
McKeever	Management Report Systems
Michie	Machine Intelligence (Volume 6)

Distribution
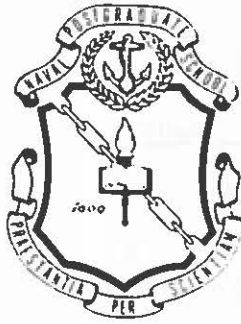List 4
Less F, F2, F3, F5
All Students
2 copies to B-3
50 copies to B-2

W. R. CHURCH
Computer Center
NEWSLETTER

September 29, 1972
Volume 4, Number 5

TABLE OF CONTENTS   PAGE

SOME OS/360 USE STATISTICS FOR JULY AND AUGUST

	July	August
Total Number of Jobs	16,934	26,648
QUICKRUN Jobs	6,802	13,337
% of Total Jobs	40.2%	50%
% of Total CPU Time	1.6%	2.8%

Percentage of Total Jobs by Job Class

Class	Q	A	B	C	D	E	F	G	H	I	J	K	Other
July	40.2	10.9	12.3	3.7	6.8	7.1	1.5	4.4	2.5	3.4	1.8	1.2	3.5
August	50.0	8.1	10.4	5.2	5.8	4.5	2.3	2.9	2.3	2.9	0.9	0.7	3.3

Distribution of Jobs by Programming Language

| | All Jobs | | | | QUICKRUN (Q) | | | |
| | July | | August | | July | | August | |
Language	(1)*	(2)*	(1)*	(2)*	(3)*	(4)*	(3)*	(4)*
WATFOR	17.3	0.3	23.5	0.2	37.3	12.2	45.0	7.5
FORTRAN G	43.5	50.2	39.1	54.2	36.2	72.7	30.4	71.7
FORTRAN H	2.8	28.7	1.9	23.4				
LISP	2.2	0.1	2.9	0.1	5.3	1.9	5.8	4.2
PL/1	1.6	0.5	0.8	0.4				
COBOL	0.8	0.1	0.7	0.3				
GPSS	0.1	0.1	1.0	2.0			0.3	1.1
XPL	3.9	0.3	7.4	0.5	9.1	5.4	14.1	12.9
CSMP	2.2	3.8	1.3	3.5				
SAMOS	3.8	0.1	0.2	0.0	9.3	7.6	0.3	0.7
ALGOLX	0.2	.0	0.5	.0	0.4	0.2	1.0	0.8
BASIC	0.1	.0			0.2	0.1	.0	.0
SMIS					0.7		1.3	.3

*(1) % of All Jobs
*(2) % of All OS CPU Time
*(3) % of QUICKRUN Jobs
*(4) % of QUICKRUN CPU Time

TURN AROUND TIME - % OF JOBS RETURNED WITHIN INDICATED LIMIT

| August Data | | Class | |
Limit	All Jobs	A	B
≤ 5 Min	62	48	36
≤ 10 Min	71	68	56
≤ 20 Min	80	83	75
≤ 1 Hr	90	94	94

ANNOUNCING IMSL

The Computer Center recently acquired the International Mathematical and Statistical Library (IMSL), produced by the corporation of the same name. Subroutines in this library duplicate almost all of the functions in the present Source Library of Fortran and Assembler Language programs, the bulk of which is made up of IBM's Scientific Subroutine Library (SSP). However, some IMSL routines have been found to execute up to ten times faster than their SSP counterparts. One goal of IMSL designers has been

to produce routines that actually utilize state-of-the art mathematical and statistical methods.

Restrictions on Usage

The contents of IMSL are proprietary routines. Under the licensing agreement, the code may not be distributed to or used by a non-NPS user and should not be copied for use on a non-NPS computer system.

Documentation

A copy of the complete IMSL reference manual can be consulted in the Consultant's Room (In-146) or the Computer Center Library (In-162). A backup copy is maintained by the User Services Manager (In-133). This manual contains mathematical descriptions, references, and programming notes for each routine.

Copies of case studies which demonstrate the superiority of IMSL routines have been made and added to the reference manuals. The following areas are covered so far: polynomial regression, solution of linear algebraic equations, nonparametric sign test, inverse normal special function, and eigenanalysis.

A user may obtain a computer-output listing of the short description and the Fortran or assembler language code of any routine in IMSL by submitting a regular OS job of the following form:

```
//    (Standard Job Card--see Chapter 3 of User's Manual)
//    EXEC   IMSLU
//SOURCE   DD   DSN=SYS3.IMSLP(XXXXXX),DISP=SHR,LABEL=(,,,IN)
//SYSIN    DD   *
LIST       PUNCH      DOUBLE
/*                    (ORANGE)
```

Where XXXXXX is the subprogram name as listed in the IMSL Directory. (Do not use secondary entry-point names). Explanation of control card keywords:

LIST   (Punched starting in Column 1) prints a listing of the entire subprogram on the line printer.

PUNCH   (Punched starting in Column 10) punches the entire subprogram on punched cards (source images). Omit if not desired.

DOUBLE (Punched starting in Column 20) converts a typical routine to double precision and lists or punches the result. (Some routines exist only in single or double precision versions. This information is contained in the IMSL Directory).

Copies of Directory

A user will automatically obtain a computer-produced copy of the directory to IMSL appended to the usual Source Library directory when

he submits a job of the following form:

```
//   (Standard OS job card--see Chapter 3 of User's Manual)
//     EXEC    LIBDIR
/*
```

Use of IMSL--Without Obtaining a Source Deck

At a date to be announced later, any user at NPS will be able to access pre-compiled modules of IMSL routines. Until that time, users must obtain punched source decks using the method documented above. It may be desirable to discard the comment card program description in most cases before compiling the resulting deck.

At present, no members of IMSL have been added to the CP/CMS pre-compiled library (SSPLIB).

CP/CMS PRIVATE USER SPACE

Disk space is presently available to accommodate five to ten more private users who have the convenience of their own storage areas at all times. Anyone interested in such an allocation should apply at In-147. Interactive applications will have the highest priority and, in general, the Center would prefer to make small allocations (5 or 10 cylinders) to a greater number of customers rather than large allocations to a few.

INFORMATION SERVICES NOTES

User's Manual Updates

Update packets 16 and 17 were published and distributed in July and August. If you hold a Manual and have not received copies of either or both of these updates, please ask for them in In-147. These updates concerned changes due to the installation of the Data Cell drive, use of the keypunch, CP/CMS diagnostic procedures, FORMAC and WATFOR.

Project Numbers

Fifty-seven class project numbers in the range of 1000-1056 were assigned during Quarter I. These numbers became invalid on 22 September and jobs attempting to utilize them will be rejected. Instructors who will need class project numbers for Quarter II should contact the Information Services Office, In-147, X2731.

ØS JCL NOTES

Fortran Output

Even when you write your own Job Control Language (JCL) around a
Fortran program, and do not use "WRITE(6,XX) etc." statements for out-
put, you **must** include a DD card with a data definition name of "FT06F001
in your execution step. Failure to satisfy this requirement typically
results in an "OC4" (protection exception) abnormal termination.

Partitioned Data Sets

A member of a partitioned data set, (e.g. Source Library) when
accessed as input to a FORTRAN program (e.g. as SYSIN data set), may be
read only if the label parameter is coded "LABEL=(,,,IN)" on the DD card.
When such a member is created as output from a FORTRAN program the label
parameter must read LABEL=(,,,ØUT).

Using Multiple File Magnetic Tapes

Frequently, magnetic tape users are required to process multi-file
tapes. When standard (previously published) JCL is used, each time a
new file is accessed the operator must type in a reply at the console to
OK the use of the file. For the following JCL example, the need for
operator intervention after the first file is accessed is eliminated.
No further intervention is required in accessing the subsequent two files:

```
//GØ.FT02F001  DD DSN=XXX ,UNIT=2400,VØL=SER=NPSIII,
// DISP=(OLD,PASS),LABEL=(1,SL),DCB=...
//GØ.FT02F002  DD DSN=XXX3,UNIT=AFF=FT02F001,VØL=SER=*.GØ.FT02F001,
// DISP=(ØLD,PASS),LABEL=(3,SL),DCB=...
//GØ.FT02F003 DD DSN=XXX5,UNIT=AFF=FT02F001,VØL=SER=*.GØ.FT02F001,
// DISP=(ØLD,PASS),LABEL=(5,SL),DCB=...
```

Note: The above example would apply to a tape used in the GØ step (execu-
tion step) of a FORTRAN program. The first, third, and fifth files on the
tape are to be accessed in that order. Notice the UNIT and VØL parameters
are fully defined in the first DD card and on subsequent DD cards these
parameters refer to the first DD card.

In addition, the LABEL parameter can be coded to indicate the files
are to be used for input purposes only. This is accomplished by adding an
additional parameter of the form: LABEL=(1,SL,,IN).

PROGRAMMING CONSULTATION SERVICE

The primary duties of the programming consultant in In-146 are to
interpret diagnostic messages when such are not clear to users and to
assist them in their own diagnostic efforts, especially if they reach
an impasse. It would normally take hours of any consultant's time to
find the exact spots where logic errors occur in programs written by
others. Proper debugging procedures are discussed in your User's Manual,
Section 3.5 and Chapter 6. The Consultant also advises on the use of the

library subroutines and assists users in finding the documentation they need to solve their own problems.

MULTIPLE PRECISION PACKAGE

Technical Note 0211-21, Multiple Precision Arithmetic Package by Sharon D. Raney, was published by the Center in July. Copies are available from the Information Services Office, In-147. This Note describes a set of subroutines which enables a FORTRAN user to perform real arithmetic with an (almost) arbitrarily extended mantissa and an exponent within the limits of $10.**(\pm 4.4*10.**9)$. (The normal REAL*8 mantissa is the hexadecimal equivalent of 17 decimal digits and the range of valid exponents is approximately $10.**(-78)$ through $10.**75$.) This package was written by J. R. Ehrman of the Stanford Linear Accelerator Computer Center and was made available through the Share organization.

SUBROUTINE LIBRARY CHANGES

The following routine has been added to the Source Library and to a concatenation of FØRTLIB:

M2-TAPRD   Reads Magnetic Tape Records

The following routine has been added to the Source Library:

E1-INPØL1   Polynomial Interpolation in One or Two-Dimensional Table

The following routines will be removed from the Source Library on 13 October 1972 and added to USAL (Unmaintained Specific Applications Library) which is maintained as punched card decks by Mr. Robert Walton, In-151, X2606:

E1-INPØL   Two-way Table Interpolation of Evenly or Unevenly Spaced Points
V1-URN   Uniform Random Number Generator - Additive (REAL*4)
V2-DURN   Ditto (REAL*8)

RECENT ADDITIONS TO COMPUTER CENTER LIBRARY (In-162)

Books

Author	Title
Stroud	Approximate Calculation of Multiple Integrals
Peterson & Weldon	Error-Correcting Codes
Soucek	Minicomputers in Data Processing and Simulations

6

Author	Title
Organick	The Multics System
Westlake	Numerical Matrix Inversion and Solution of Linear Equations
Daniel, Wood	Fitting Equations to Data
Passen	Approaches to Business Data Processing Logic
Rustin	Debugging Techniques in Large Systems
A.U.C.C.	All About Used Computers
Martin	Future Developments in Telecommunications
I.E.E.E.	A Practical Guide to Minicomputer Applications
Cassel	Programming Language One
Stone	Introduction to Computer Organization and Data Structures

Defense Documentation Center (DDC)

AD Number	Title
742541	Standardized Job Control Language. User Reference Manual
741133	Fortran Compiler For The PDP-8 Computer
742755	New Approach to Programming Man-Machine Interfaces
739522	Bibliography of Fault Tolerant Computing
742278	Concurrent Compiling, Volume I, Representation of Algorithms as Cyclic Partial Ordering
742279	Concurrent Compiling, Volume II, Parallel Execution of Fortran DO Loops
740843	Efficient Data Transmission
742926	Checker-Playing Program
732412	Extended Applications of Management Information Systems in Government
692506	Study of Languages, Interactive Use of Computers in Instruction
733620	Role of Modern Algebra In Computing
730608	Survey of Simulation Languages and Programs
732921	Description of a Sparse Matrix Compiler With Applications
739872	Study of Factors Underlying Software Maintenance Problems, Final Report
741900	GPS and Decision Making: An Overview
743281	Multics--The First Seven Years
742391	Multi-Access Computing Research at Rand
739672	Progress in Picture Processing: 1969-1971
742323	Proceedings - 2nd Annual World-Wide Data Management System Symposium
740328	Bounds on Polynomial Evaluation Algorithms
739376	Generalized Compactifying Garbage Collector

Distribution
List 4
Less F, F2,   F5
All Students
2 copies to B-3
150 copies to B-2

7