THE AUTOMATED USE OF BIBLIOGRAPHIES FOR SOFTWARE MANAGEMENT

J. Fleming

AUGUST 1971

Prepared for

DEPUTY FOR COMMAND AND MANAGEMENT SYSTEMS
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
L. G. Hanscom Field, Bedford, Massachusetts

Approved for public release; distribution unlimited

Prepared by
THE MITRE CORPORATION
Bedford, Massachusetts

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FOREWORD

This report presents the results of analyses conducted by The MITRE Corporation, Bedford, Massachusetts under Contract F19(628)-71-C-0002. Dr. John B. Goodenough (ESD/MCDT-1) was the ESD project monitor.

REVIEW AND APPROVAL

This technical report has been reviewed and is approved.

EDMUND P. GAINES, JR., Colonel, USAF
Director, Systems Design & Development
Deputy for Command & Management Systems
ABSTRACT

The structure of bibliographies in computer-accessible form is described. Its design seeks to use the capability of an existing general-purpose text-processing system to query a file interactively in such a way as to increase the automation available to readers consulting a bibliography. Volume I contains an example of such a bibliography.
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SECTION I
INTRODUCTION

Historically, bibliographic entries have been constructed and consulted by the effort of humans, unaided by automation. Technological advances make it possible now, or in the near future, for both the construction and the consultation to be significantly less burdensome to the human.

The construction of an entry can be automated by the selection, with possible reformatting, of facts about a work published by an automated procedure from the medium (as, tapes) produced in order to effect its printing. Alternatively, the facts for an entry could be obtained from the publication itself by optical character reading, followed by the same necessary selection and reformatting.

The consultation of a bibliography can be automated by application of the search capabilities present in general-purpose text-processing systems or, alternatively, by use of systems specifically designed or adapted to bibliographic use.

A significant portion of the documents selected for the present purpose incorporate DOCUMENT CONTROL DATA - R&D, DD Form 1473. This fact and the availability of information required or permitted by it have influenced the information design of the bibliography in certain respects, which will be pointed out when data obtained from the form are described below.

An example of DD 1473 may be found in Appendix A.

The present experiment in partial automation of the processes of construction and consultation of a bibliography reflects a state in between the two polar conditions of manual and automated function described above.

The abstracting of facts about each document and their input to the file have necessarily been performed by the customary human effort, but these facts have been cast in such a form that the possibility of automated consultation of the bibliography has been provided for.
To date, the experimental work undertaken has reached only a partial state of completion. Facts about the works selected for the bibliography have not been consistently indexed because the design has been developing and changing during the time that the indexing was being performed. Works indexed earlier have not been reindexed as the design was altered. Rather the emphasis of the indexing effort up to now has been placed on completeness of the bibliographic file, that is, on entering all the documents selected into the file rather than making revisions so as to obtain a consistent indexing of a lesser number of documents.

The current state of the experimental bibliographic file is reflected in the computer listing of BIBTRANSLATORROUTINES which is found in Appendix A of (1). The development of the bibliography up to this time is described here.

A selection of roughly eighty documents dealing with the problem of moving a software system from one operating environment to another was made by H. A. Bayard, as described in (1).

In view of the availability of the MITRE general-purpose text-processing system with certain text-handling capabilities such as sorting and searching, it was decided to design a format for the bibliographic data which would be compatible with that system. To take advantage of the text-handling capabilities available, the design of the bibliography includes a citation index. The citation feature has so far been only partially implemented in the bibliography. For the same reason, and also because a substantial proportion of the documents have had key words assigned to them by their authors, a key-word feature has been included in the design of the bibliography.
SECTION II
STRUCTURE OF DATA

INTRODUCTION

Each bibliographic entry, enlarged from the content of a typical entry by the extensions indicated in the introduction, forms an integral unit called an item. Items are recognizable by a first line and a last line, lines IM and V, respectively, which are mandatory for compatibility with the text-processing system.

Each item comprises a number of elements, which are introduced by index labels or tags. Some elements may contain sub-elements. These structural units are described under TEXT FIELD, below.

The bibliographic entry contains a number of units of data which are considered compulsory if they are present in the source; i.e., the data are indexed in the file whenever the given document contains any such data. The motivation for these units lies in the purpose and resulting design of the bibliography rather than responding to any consideration of compatibility with a particular text-processing system. The compulsory units will be pointed out as they are individually described.

Data are input as cards of 80 columns, of which the first 72 contain text, that is, the bibliographic entry itself, and the remaining field of eight columns is reserved for other data, including codes used in editing, sorting, and searching operations. Without reformatting, each card image produces one printed line on the cathode ray tube display at the terminal presently in use. The codes are discussed first.

CODE FIELD

Each card is indexed with a numerical line-ending code in column 73. The codes in use are: 0 1 2 3 5. Each of these codes indicates how many of the blanks following the last non-blank character of the card so coded are significant. If that character is final in a data element, the proper code is 5. If it is final in a sub-element, the code is 3. If the character is a colon, the code is 2; if a hyphen it is 0. In all other cases, the code is 1.
Columns 74 and 75 contain an alphabetic category code. Category codes in use include: AC corporate author; AP personal author; C cites; I identification; IM identification (mandatory first line of each item); K key words; P facts of publication; T title; V mandatory last line of each item (the line is otherwise blank). When one line is inadequate to contain the desired information, the data are continued on the following line, to which the same category code is assigned. As a minor exception, because certain routines in the MITRE text-processing system assume that the first line of an item carries a unique code, IM is a proper code for a first line of the identification element and I is used only for a continuation line. The content to which each of these codes relate is discussed below under TEXT FIELD.

The presence of the line-ending codes and the line category codes permits compacting of the file so as to eliminate nonsignificant blanks. Sometimes such compacting properly results in combining two adjacent lines which are of the same coded category. The same facility would allow conversion of all items from card-image to sequential format, should such conversion be desired in the future.

Card columns 77-80 constitute the field for line numbers of a file. These line numbers are not contained in the internal representation of the file but are supplied during output to the display terminal.

TEXT FIELD

The nature of the individual bibliographic data indexed in the text field of the card is indicated by a preceding index label or tag. (The text field is left-justified.) Brevity in the tags is obtained by the use of standard American English abbreviations from American Heritage Dictionary of the English Language, William Morris, editor (New York: American Heritage Publishing Co., Inc. and Houghton Mifflin Company, 1970). Their status as abbreviations indicates that their mnemonic value has been established and eliminates any need to provide glosses for the tags used in the file. Tags are punctuated by following colons, separated from the index elements they label by two blanks.

Identification Data

For each item, the identification element (tag I.D.:) contains compulsory facts about the document being indexed which may be useful in locating a desired item within the file (see 1 below) or in obtaining a needed document from the author, the agency responsible for its distribution, or a library or other holder of a pertinent collection of documents (see 2 below).
Typically, the identification element contains several of these additional facts about a work which can contribute to serving the needs of the user of the bibliography. These facts are treated as sub-elements in the file.

1. A code devised by the late H. P. Luhn (2, p. 231) was adopted for local use in identifying this selection of documents because it is intrinsically more meaningful than a serial accession number. It also permits the ordering of the items in much the same sequence as a typical alphabetically ordered bibliography by a sort operation on only 11 character positions. For a file of moderate size, such as this one, a sort on even as few as six character positions produces a useful result. This capability effects a saving when compared with the amount of running time and program complexity which would be required to sort on the name of the author and the title of the document.

A description of the structure of the Luhn code follows:

a. The first six characters identify the (senior) author or editor:

(1) For a person: characters 1-4 are the first four letters of his name, 5 and 6 are his (first) two initials. The hyphen is used as a filler character. SNOWAB would be used for A. B. Snow, DOE-J- for John Doe.

(2) For a corporate or institutional source or the like (where a personal author is not credited): the first character is -; characters 2-6 are alphabetic characters representing the name of the organization. The criteria for the selection of codes were accepted usage and mnemonic value. A valuable guide to usage was found in Ellen T. Crowley and Robert C. Thomas, editors, Acronyms and Initialisms Dictionary, third edition (Detroit, Mich.: Gale Research Company, 1970), Appendix
B contains a list of some shorter versions of corporate names which appear in the experimental bibliographic file in (1).

(3) For the name of the publication in which the paper or article was published (when neither a personal nor a corporate author is credited): the first character is +. +ELECN may be used for Electronic News.

b. Characters 7 and 8 of the Luhn code are numeric; they represent the final two digits of the year of publication. 70 is used for 1970; -- for an undated document.

c. Characters 9-11 are alphabetic, representing the initial letters of each of the first three substantive words of the title. CNT is used for "A Cooperative Network of Time-Sharing Computers: Preliminary Study."

2. Identification numbers assigned by other holders of the document follow the Luhn code. The AD number assigned by the Defense Documentation Center forms the first sub-element for those documents to which an AD number has been assigned, since it is a primary identifier in the MITRE library. The MD number, if one has been assigned by the MITRE library, follows the AD number. The remaining sub-elements are any identification numbers found in blocks 9a and 9b of a DD 1473 for the given document or appearing within the document proper, or on a microfiche made from it (where the microform served as the source document). No identification associated with the document has been intentionally omitted from the identification element.

The category code for the first line of the mandatory identification element is IM; if there are continuation lines, they are coded I.

Title Data

The title element (tag TITLE:) contains the full title of the document, omitting any initial non-meaningful words, such as articles, or phrases, such as "On the." "A Cooperative Network of Time-Sharing
Computers: Preliminary Study" appears as TITLE: COOPERATIVE NETWORK OF TIME-SHARING COMPUTERS: PRELIMINARY STUDY. The line category code for the compulsory title element is T.

Author Data

The compulsory author element (tag AUTH.:) may represent either a personal or a corporate author. In the absence of an author, the name of an editor may appear among the bibliographic facts for the document. In such a case, an editor element (tag EDIT.:) takes the place of an author element. Except for the difference in the tag, editor elements are constructed according to the pattern for author elements.

The names of authors other than the senior author are treated as sub-elements, comprising, together with the name of the senior author, the author element. The names of all personal authors are inverted, not just that of the senior author, so that one author's name will appear in the same arrangement wherever it is found.

The surname of each personal author is followed by the given names or initials shown on the document, without punctuation. AUTH.: ROBERTS L G  MCCAFFREY EDWIN  MARILL T  JONES JOHN B III LT is an example.

A corporate author is treated as the author element only in the absence of a personal author. Corporate authors are often identified by block 1 of DD 1473. Frequently, the title page of the document or block 1 names a sub-unit of the corporate agency, in which event the sub-unit is treated as a sub-element. AUTH.: MASSACHUSETTS INSTITUTE OF TECHNOLOGY  LINCOLN LABORATORY is an example.

A personal author is distinguished from a corporate author by the line-category codes, AP and AC, respectively.

Facts of Publication

The facts of publication are treated as a series of compulsory elements, each with its index tag.

For an article (whose title appears in the T line of the item) in a periodical: TITLE: is followed by the name of the periodical; VOL.: by two numeric characters indicating the arabic number of the volume containing the article and by the issue number if this is necessary or useful, the two numbers being separated by a period; PP.: introduces the two four-digit inclusive page numbers separated
by a hyphen; DATED: is followed by the date of publication in the format YY.MM.DD with six, four, or only two digits. In the date format scheme, YY indicates the year, MM the month, and DD the day of the month. Numerics are right-justified, with leading zeroes included where required. TITLE: IBM SYSTEMS JOURNAL VOL.: 06.06 PP.: 0267-0302 DATED: 67 is an example.

For a book (no example occurs in the experimental file), PUB.: is followed by the name of the publishing agency, which may include, besides publishing firms, societies, institutions of learning, and the like. PLACE: is followed by the name of the country or state and the name of the city where the book was published. PUB.: MACMILLAN CO. PLACE: NEW YORK NEW YORK DATED: 55 is an example.

For a paper or monograph published under the name of one or more personal authors, a corporate agency such as is cited in block 1 of DD 1473 is considered as a kind of "publisher." Its name and geographical location are shown, together with the date, found in block 6. AUTH.: SIGNATRON, INC. PLACE: MASSACHUSETTS LEXINGTON 02173 DATED: 68.06 is an example. The geographical location is shown with the units arranged in order of decreasing size, as here state before city, and with the zone improvement plan (ZIP) code last. Street addresses have been included for possible convenience of readers. In a larger file considerations of space would probably preclude their inclusion.

The tag AUTH.: has been used for publisher-like information because the same agencies (an example from the experimental file is System Development Corporation) may appear in block 1 of DD Form 1473, both in the presence and in the absence of a personal author. The use of the same tag in both instances may simplify the framing of a computer search query seeking a report of work done under the auspices of the agency, whether a personal author is credited or not. These two functions sharing the code AUTH.: are distinguished by their category codes.

For a monograph published without designation of a personal author, the name of the "originating activity (corporate author)" has been omitted from the facts of publication, since it already appears as corporate author in a line coded "AC." Its dual status as author and "publisher" is implicit in the absence from the bibliographic record of a personal author. Accordingly, the repetition of its name in a "p" line is unnecessary. The facts of publication may be limited to "PLACE:" and "DATED:" in such cases.

The line-category code for the elements together comprising the facts of publication is P.
Citation Data

Most of the publications upon which the bibliographic entries in this file are based contain either a bibliography or a list of references (both are present in at least one document).

For each item the citation element (tag CITES:) contains an alphabetically ordered list of identifiers of documents cited by the document being indexed. The identifier listed is the Luhn code, which is constructed entirely from the information provided in the citing document, even though this information may be incomplete. The document whose own bibliographic entry begins I.D.: MONDLF67VCS contains the citation line CITES: FELDJA64FSC  FELDJA66FSC  FLOYRW61DLS, which represents the three documents the author Lee F. Mondshein cited in his bibliography or list of references.

For the optional citation element, the line-category code is C.

While the design contemplates that the list of cited documents will be alphabetically ordered, many deviations from that sequence may be found in the file.

The text-processing system at present contains no facility for sorting at the hierarchical depth at which these identifiers are located. Editing capabilities do exist which will permit ordering of these sub-elements by on-line procedures.

Key Words

For those documents incorporating a DD 1473, the author usually provides a list of key words in block 14.

For the key words element (tag KEY WD.), the individual key words are treated as sub-elements.

The line-category code for the optional key words element is K.

Last Line

In order to be compatible with the text-processing system, each item must have a uniquely coded last line. In the experimental file, the mandatory item terminator (tag null) contains a null element. An advantage is thus obtained that the text field contains a blank line which serves the human user by visually separating each two adjacent items.

The line-category code for the mandatory terminator line is V.
GENERAL

The elements of the bibliography are those usual in technical writing in the United States except for the citation and key words elements. Background information regarding the inclusion of both is provided in Section I, INTRODUCTION.

As an interim procedure for elements such as the citation element and the key words element, which are optional elements since some documents lack them, the tag appears in the experimental file with a null element as an indication to the indexer that the element is, in fact, lacking in a given document.

When the file has been completely indexed, these tags will have served their purpose and the line where each appears will be deleted.

The presence of the line-category codes described above makes it possible for the MITRE text-processing system to operate on a properly configured text field. The most pertinent operations are searching and sorting.

A listing of one possible arrangement of the experimental file is found in (I). The last few items are credited to corporate authors, in the absence of a personal author. In other respects, the file shows the same sequence as an alphabetically ordered bibliography.

The uses which have been made of the text-processing system to bring the experimental file to its present state include: use of the editor to correct errors in keypunching by substituting or permuting characters and to correct errors in indexing by inserting lines with tags and elements or with tags and null elements; and use of the sorting capability to order the Luhn codes of the citing papers, and hence the items representing them, in alphabetical sequence.
SECTION III

AUTOMATED USE OF A BIBLIOGRAPHY

With a body of bibliographic information available in such a form as has been described in Section II, a user can repeatedly search that file up to a point where he is satisfied that he has found almost all the references pertinent to his need.

A description of one possible path his efforts might take follows.

He looks at a listing of the bibliographic file (henceforth BIB) and notices that Gardner has an item whose title contains the word "list-processing." He queries the file BIB for all occurrences of LIST* on T or K lines, so as to learn whether there are other papers in the file which have a similar word in their titles or as one of their key words. A full explanation of how queries are entered and choices made about presentation of the responses to those queries may be found in (3).

Next he looks for the particular list-processor LISP* in lines of the same categories.

Then he follows up whether Gardner's paper has been cited by any other paper in the file BIB by searching for occurrences of GARD on C lines.

After that he investigates whether colleagues of Gardner might be represented by papers having a bearing on his although not citing his paper. He can explore this possibility by searching for occurrences of both UNIVERSITY OF CALIFORNIA and LOS ANGELES in AC or P.

After any of the searches suggested above, the nature of the response obtained might lead him to follow a different path from that indicated.
SECTION IV
POTENTIAL EXTENSIONS OF BIBLIOGRAPHIC TECHNIQUES

An extension of the citation feature represented in the experimental bibliographic file would be to represent the cited documents as items with their own independent entries derived from the list of references contained in the citing document which referred to them (provided they are not already present in the file as citing documents).

For example, say that citing paper a cites papers p and q. The item for a contains an identification line I.D.: A . . . and a citation line CITES: P Q . . . in the present file. If neither p nor q is in the file now, when the extension is implemented, two items will be added: I.D.: P . . . CITED BY: A . . . and I.D.: Q . . . CITED BY: A . . .

An investigation of "the feasibility of analyzing relationships between citing and cited publications into a fairly small number of categories of probable value to physicists . . . through inspection of actual papers and their bibliographies in physics journals" is reported in (4). Four major groups containing 29 categories were identified.

Group One (eight categories) describes the "citing article's . . . relation to science in general," such as description of observed phenomena or hypothesis or theory. Group Two (three categories) described the citing publication's "administration or associative relation to science in general," such as review article or bibliography. Since Groups One and Two deal with the citing article only, they need be listed only once for each citing article.

Group Three (seven categories) describes a "continuity relationship between the cited paper and the citing paper which is independent of the . . . contribution," such as shared authorship or continuation. Group Four (eleven categories) indicates a "disposition relationship" between the citing paper and the cited paper, such as "changed the scope of applicability (plus or minus)" or "questioned (expressed doubt)." The categories of these two groups, since they involve the cited paper as well as the citing paper, may differ for each paper cited by a single citing paper.
A certain amount of adaptation would be necessary in order to apply this scheme, which was elaborated on documentation in the physics discipline, to the topic of software management, as follows:

Group One  Original Intellectual Intent of the Citing Paper

1. Description (as, of a software implementation)
2. Definition (as, of a software concept)
3. Evaluation (as, of a software design)
4. Recommendation (as, for an application of software)

Group Two  Contribution of Citing Paper other than Original Intellectual Intent

5. Review article
6. Bibliography
7. Data cumulation

Group Three  Identity of Continuity Relationship of Citing Paper to Cited Paper

8. One or more authors in common
9. Same text
10. Abstract or condensation
11. Erratum
12. Continuation
13. Precursor
14. Inclusion

Group Four  Disposition of the Intellectual Intent of the Cited Paper in the Citing Paper

15. Noted only
16. Distinguished
17. Reviewed or compared
18. Applied
19. Improved or modified
20. Replaced
21. Changed the precision (plus or minus)
22. Changed the scope of applicability (plus or minus)
23. Questioned
24. Affirmed
25. Refuted
While there seems to be little doubt that indicators of categories such as are listed above would benefit citation users materially, Lipetz observes that "analysis of actual publications for the purpose of determining relationships according to the scheme described . . . is neither simple nor rapid." A trial application with a voluntarily cooperating group of citation users would be necessary to determine its desirability in a given setting.

Selecting key words from an unrestricted vocabulary has the disadvantage that an author assigning key words to a work he has written (or an editor or indexer doing so in his stead) and an index user who has a current need for such a publication may not share a common understanding of the interpretation and scope of the key words which the author has assigned.

The use of any restricted list of terms (thesaurus) known to both the author and the prospective user has the advantage that key words selected from such a list convey meaning not only because the selected term is present in the list but also because other terms are also present which were not selected. When the reader consults the list of terms and then attempts to match his selection of likely terms against an index of documents, he can profit by the sort of negative information described above, as well as profiting by the positive information.

When the document has been indexed from a free and unrestricted vocabulary of terms, the reader has only the positive information to guide his selection of potentially interesting documents.

Other things being equal, a hierarchically structured thesaurus can express precision of meaning more concisely than a non-hierarchical one. A hierarchical thesaurus suitable for providing key words for documents having such subject matter as the question of moving a software system from one operating environment to another is (5). Its title page states, "This book is a major revision of an earlier title . . .; this revision was prepared in joint operation with the United States Department of Defense."

An appropriate extension of the work already performed under the present project would be the assignment of key words from (4) to the documents indexed in the file of (1). Either indexers or users might assign these key words. An indexer would reflect his total understanding of a document in a single effort.

If the cooperative effort of users were enlisted, a list of descriptors for a document might be gradually built up by soliciting a report of the reader's experience with the document. If he had a
current interest in topics a and b which lead him to consult a certain document, he might report that he found useful information about b but nothing regarding a. Accordingly, key word b can be assigned to the document.

The response of a user who failed to find any useful information in the same document can be of equal value to the response of the more successful user in the construction of the wanted list of key words for the document. If he were interested in topics b and c but reported that he found no useful information in the document, which instead deals with d and e, key words d and e can be assigned. At this point three key words which will be of value to potential users of the document will have been associated with the document.

In time a state can be reached where, for most of the documents in the file, users need not be asked to recommend key words for assignment to documents in the collection which they consult. Their suggestions for deletions of key words will always be of value, of course.

J. Fleming
Intelligence and Information Systems

JF: dmk
APPENDIX A
A SAMPLE BIBLIOGRAPHY ON TECHNIQUES
FOR SOFTWARE TRANSFER
SECTION I
INTRODUCTION

This bibliography represents a collection of documents pertaining to software transferability; in particular to software transferability as it relates to Air Force Systems problems.

The problem of moving a software system from one operating environment to another has primarily been dealt with in two ways;

1. On the administrative level: by providing similar operating environments, by constraining programmer behavior to increase the possibility of easy transfer of software, etc.

2. By providing automatic and semi-automatic techniques which aid in the translation of software systems which work in one environment to software systems which work in a second.

The articles mentioned here deal with the second approach: what automatic and semi-automatic aids exist for translation of software systems; what techniques and theory exist which, when applied to language and language processor design, simplify the problem of software transferability; and what techniques and theory exist which might be applicable to the design of automatic and semi-automatic transfer aids. Since JOVIAL is the official Air Force command and control language, special emphasis was given to collecting documents concerning systems written in it and concerning the transferability of JOVIAL systems.
SECTION II
SOURCES.

The documents were collected as the result of searches of several different sources:

1. Computerized search from the Defense Documentation Center for Scientific and Technical Information at Cameron Station, Alexandria, Virginia, with the following keywords:

   SEMANTICS OF PROGRAMMING LANGUAGES
   JOVIAL
   EXTENDIBLE LANGUAGES
   INTERPRETER ROUTINES
   TRANSLATOR ROUTINES
   TRANSLATING and COMPUTERS
   COMPILERS
   SIMULATION ROUTINES and COMPUTERS

2. Manual searches at MITRE of:

   Computing Reviews: The Association for Computing Machinery (from January 1965)

   Computer and Control Abstracts: The Institute of Electrical and Electronics Engineers Inc. (from January 1969)

   Scientific and Technical Aerospace Reports: National Aeronautics and Space Administration (from January 1969)


While the manual searches were duplicated in part by the computerized search, relevant documents were found by both techniques which were not found by the other method. This was due to the fact that the computerized search had available to it documents from a longer time span, and that the manual searches were not limited to the keywords mentioned above.
SECTION III

STRUCTURE

The bibliography is maintained as a file in SHOEBOX—an on-line interactive text processing system developed at MITRE. As a result, the bibliography can be randomly browsed through or computer searched for specific requests by the SHOEBOX user. The listing of the bibliography in this document is a printing of the SHOEBOX file.

Each line in the file consists of a text portion (the first 72 characters on the line) and a three character code portion. The first character of the code portion, a number, is for SHOEBOX's use and should be ignored. The second and third characters of the code portion of a line identify the kind of information found on the line. In this file the following codes and meanings are used:

'IM' 'I' identification information; also indicates the first line of an item in the bibliography
'T' title information
'AP' 'AC' author information
'P' publication information
'C' citation information
'K' keyword information
'\(\text{V}\)' indicates the end of an item in the bibliography

Each item in the bibliography consists of six sections:

1. Identification section—The identification numbers associated with a document are maintained on the 'IM' and 'I' lines of an item. The identification numbers associated with a document consist of, at minimum, the Luhn code* of

the document. In addition, if available, the AD number and the MD number (MITRE document number) of the document are given. Finally, if any other identification numbers are attached to the document, they are also present.

2. Title section--The title of the document is found on the 'T' lines of an item.

3. Author section--If there is an individual author, then his name appears on the 'AP' lines of an item. If there is no individual author, then, when available, the corporate author of the document appears on the 'AC' lines of an item.

4. Publication section--Information about publication of the document is found on the 'P' lines of an item. If there is a corporate author which was responsible for publication of the document, the name will only appear in the author section.

5. Citation section--The Luhn code of each document cited by the report is given. This information is found on 'C' lines.

6. Keyword section--Keywords, if any, which were found in the document are listed. The 'K' lines of an item contain the keywords.

A more detailed description of the format of items in the bibliography can be found in Volume II.

H. A. Bayard
Intelligence and Information Systems

J. Fleming
Intelligence and Information Systems

HAB/JF: dmk
A listing of the file BIBTRANSLATORROUTINES
LISTING OF FILE + BIBTRANSLATOR Routines DATE 11AUG71

I.D.: BAERJE68GMC AD 678753 MD 57971 REPORT NO. 68-46
TITLE: GRAPH MODELS OF COMPUTATIONS IN COMPUTER SYSTEMS
AUTH.: BAER JEAN-LOUP E
PUB.: UNIVERSITY OF CALIFORNIA LOS ANGELES DEPARTMENT OF ENGINEERING
DATED: 68.10 PLACE: CALIFORNIA LOS ANGELES

CITES: ASCHR—- ADKIM—- AOK—- ANDEDW— BAERJ—- LDP
HAERJ68CAE BARTG—- BAIKJ62KMB 8GVEDP68MAC BARN—- IIC
RUSSB—-2PVS COFFEG67PP CHENY66SPC CLINCT64MFP C00PDC66CPG
CRITA65GMM COTTAL65CIF CURTWA63MCS DUERA65OMD EISNH—- GNA
ESTRG—-67MMM ELMASE64AGA ELMASE67EDP ESTRG—-63AAC ESTRG—-67SCC
ESTRG—-600CS FLOYK67NA— FULKDE62ECP GERW666HS GIFFB—- 60ASP
GLUSE65ISD GOSE6A66PP GRAHRL66BCP HELJ—-61SAM HELDM—-3AD—
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MURTJC66HPI MAYBJ64MTS NIEVJ—-64PMI PAKO66CCU PRITA66GGE
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RUSSEC—-APA ROY—-662CCG SAATT66L1ET SCHW6644PP SENZ065COA
SCHWES61ASP SCHWJ—-66LPC SHERG67SPM SMI67GAS SCHEAL67ATC
STAUD67U1P SCHWJ66GP TONGFM65ABU THRJF67CPA THORJ63PO
TURN63AIY VAN RS63MCP WARR537BM WIESJO64SPS

KEY WD.:: DIRECTED GRAPH MODELS OF COMPUTATIONAL TASKS A PRIORI
SCHEDULING COMPUTERS PARALLEL PROCESSING
I.D.: CULIK-67WTG AD 683105 FTD-HT-23-613-66
TITLE: WELL TRANSLATABLE GRAMMARS AND ALGOL-LIKE LANGUAGES
TRANSLATED FROM RUSSIAN
AUTH.: CULIK K
TITLE: NAUCHNO-TEKHNICHESKAYA INFORMATSIYA SERIYA 2 INFORMATSIONNYE
PROTsesSspy I SYSTEMy VOL.: 03 PP.: 0021-0023
CITES:
5C
5V

I.D.: DELLEGT65UMT
TITLE: USE OF MACROS IN TRANSLATION OF SYMBOLIC ASSEMBLY LANGUAGE OF
ONE COMPUTER TO ANOTHER
AUTH.: DELLERT GEORGE T JR
CITES: BRAUH63S17 STEVDF63EF7 MAGNRA64MP- BAKECL63ACM
MYLAWC65CSP MAGNRA65EUM
KEY WD.:
5C
5K
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I.D.: DILLR-67RSE MD 64076 TM-3567/000/00 (DRAFT)
TITLE: RESULTS OF THE SURVEY OF EXISTING AND AVAILABLE TEST AND
EVALUATION METHODS FOR NONFUNCTIONAL COMPUTER PROGRAMS
AUTH.: DILLER R FLEISHMAR T
AUTH.: SYSTEM DEVELOPMENT CORPORATION PLACE: CALIFORNIA SANTA
MONICA 2500 COLORADO AVE. DATED: 67.07.07
CITES: +ACM----JA- +ACM----CA- SIEGM----IRB CALIP-67SPE
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G0S0JAY62SCC -IBM----SJ- GINZMG--NTR +CAA-------- HILLJ668BP
J0SLEO66VBC STATN-64MEC IHREFC--CPP IHREFC--UCE TOTAJ67RRP
HAMMC-66CES +ACM----CP- JOSLE065ABK APPLCT65PMC +DATAM------
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+CB-------- -CDPS62P-- PATRRL-PLS WILLRC--CLS MOORW------
ABRAPH63QMI DOPPO-62TPU
KEY WD.:
5C
5K
5V

I.D.: FREDDS65AML
TITLE: ACROSS MACHINE LINES IN COBOL
AUTH.: FREDERICKS D S WARBURTON C R
CITES:
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5K
5V
I.D.: HAHNW-70STC M70-43
TITLE: SOFTWARE TRANSFER COST ESTIMATION TECHNIQUE
AUTH.: HAHN W STONE JR
AUTH.: MITRE CORPORATION WASHINGTON OPERATIONS
DATED: 70.07
CITES: -ESD--66AFA -DCA--69OCD BRANDH63MSD -ARMY--69CAS
-ESD--70WBC DELAWA66PCC FARRL-64FAC KAHNP69PC- LICHMA69WSE
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BEEMER69P- BRANRL67CAJ BRIGPL69PC- BUDDAE67AAS CARTWJ66PFC
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FREDD65AML FRTIBW67CGW FRY-JP68UGS GAINR65TLQ GALIMP67ERS
GILG6W69MCP GOSDJA68AIA GOSDJA68SC- GUTTN-68PCC HALPM65MII
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JONEM69CNO JONEM65EMD JONEM65HEI KEDEV-68CCE LABOD-66DEE
LABO-64ECP LAPALJ67TRM MANUB-64SCC MEALGH--PTS NELSE65RIM
PATRRL69IQ- PORTJD67ACE RAICE-67PAC RANFAM68ADC RANFAM68CFP
RATYM67AFC RUBERJ68CEP RUBIJ-66CAS SANDC66AWC TUCKS65ELS
WEINGF66DEC WEINGF65RMC WILLDA67CLM
KEY WD.: 5IM

I.D.: HAUEWC68TCP MD 56988 TM-3676/007/01
TITLE: TRANSFERABILITY OF COMPUTER PROGRAMS AT COMMAND CENTERS
AUTH.: HAUEISEN W C MATHUR R N ILGER H J LABOLLE V
AUTH.: SYSTEM DEVELOPMENT CORPORATION
PLACE: CALIFORNIA SANTA MONICA 2500 COLORADO AVE 90406
DATED: 68.01.16
CITES: BAERRE67RTA BEAUAA67RT4 BENSSG65CPA BOKED-67T
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DIFS-67RSE GAINR65SML HAUEWC68RNC -IBM----ISC IRBYLA67RCT
KLEIP66ARSB KLINJ-67DPS NEILG-67CMP NEILG-67SDR OLSEMA65PTP
OPPEDK66M-- -SAC--64DMC SEARLV67SEG SEARLV66SEN SEARLV66SMO
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-USAF--PTS -USAF--66SEM -USAF--5MP -USAF--65SPM -USAF--64SPD
WEINGF65RMC
KEY WD.: 5V
I.D.: HILLKH68SET
TITLE: SIMULATION, EMULATION, & TRANSLATION
AUTH.: HILL RICHARD H
TITLE: SIMULATION
VOL.: PP.: 0081-0084
DATED: 68.02
CITES:
KEY WD.: SOURCE COMPUTER TARGET COMPUTER HOST COMPUTER OBJECT
COMPUTER SOURCE LANGUAGE OBJECT LANGUAGE MACHINE CODE MACHINE-
LEVEL LANGUAGE HIGHER-LEVEL LANGUAGE

I.D.: HOLTAW70ECA
AD 704796 MD 63959
TITLE: EVENTS AND CONDITIONS AN APPROACH TO THE DESCRIPTION AND
ANALYSIS OF DYNAMIC SYSTEMS
AUTH.: HOLT ANATOL W COMMONER FREDERIC
AUTH.: MASSACHUSETTS COMPUTER ASSOCIATES, INC.
PLACE: MASSACHUSETTS WAKEFIELD LAKESIDE OFFICE PARK 01880
DATED: 70.04
CITES: HOLTAW68FRI HOLTAW65MMM PATISS69MCD PATISS69MDA
PATISS69NMA PATISS69MIC PATISS--CRD PETRCA--CA-- SHAPRM69HFS
KEY WD.: 3C 5C 5K 5V

I.D.: IRBYLA67RCT
MD 64067 TM-WD-488/000/00
TITLE: RESULTS OF CONVERSION OF TWO OPERATIONAL PROGRAMS FROM J3 ON
THE CDC 1604 TO J5.2 ON THE IBM 360
AUTH.: IRBY LEILIA A
AUTH.: SYSTEM DEVELOPMENT CORPORATION
PLACE: VIRGINIA FALLS CHURCH 22041
DATED: 67.12.18
CITES:
KEY WD.: 5C 5K 5V
I.D.: JORRP-69FDB  AD 860063  MD 60718
TITLE: FORMAL DEFINITION OF BASEL PART 3: INTERPRETER
AUTH.: JORRAND PHILIPPE
AUTH.: MASSACHUSETTS COMPUTER ASSOCIATES, INC.
PLACE: MASSACHUSETTS WAKEFIELD LAKESIDE OFFICE PARK 01880
DATED: 69.08.15
CITES: HAMMMM--FDB  JORRP---FDB
KEY WD.: 5C 5K 5V

I.D.: KINGJC69PV- AD 699248  AFUSR-70-0039TR
TITLE: PROGRAM VERIFIER
AUTH.: KING JAMES C
AUTH.: CARNEGIE MELLON UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE
PLACE: PENNSYLVANIA PITTSBURGH 15213
DATED: 69.09
CITES:
KEY WD.: 5C 5K 5V

I.D.: KISEBR67SCT AD 684013  FTD-HT-23-506-68
TITLE: STANDARDIZATION OF COMPUTER TECHNOLOGY FACILITIES
FROM RUSSIAN
AUTH.: KISELEV B R
TITLE: STANDARTY I KACHESTVO
DATED: 67
VOL.: 10
PP.: 29
CITES:

I.D.: KLEIPE64RSB  MD 64066  TM-WD-423/000/00
TITLE: RESULTS OF A STUDY OF THE BIDIRECTIONAL TRANSFER OF
PROGRAMS BETWEEN THE IBM 7090 AND THE CDC 1604A
AUTH.: KLEIN P E
AUTH.: SYSTEM DEVELOPMENT CORPORATION
PLACE: CALIFORNIA SANTA MONICA 2500 COLORADO AVE
DATED: 64.08.12
CITES:
KEY WD.: 5C 5K 5V

35
I.Ü. PERSMH66GLB AD 635473 MD 45082 TM-555/005/00
TITLE: GRAMMAR AND LEXICON FOR BASIC JOVIAL
AUTH.: PERSTEIN M H
AUTH.: SYSTEM DEVELOPMENT CORPORATION PLACE: CALIFORNIA SANTA MONICA DATED: 66.05.10
CITES:

I.Ü. PERSMH68STD AD 666370 MD 54054 SP-2916/000/01
TITLE: SOME TECHNIQUES FOR DESCRIBING PROGRAMMING LANGUAGES
AUTH.: PERSTEIN MILLARD H
AUTH.: SYSTEM DEVELOPMENT CORPORATION PLACE: CALIFORNIA SANTA MONICA PP.: 0001-0028
CITES: ABKAPW66FSD BERKEC67CE- IVERKE64MSS NAURP-60RAL
PERSMH66CSO PERSMH66JGL PERSMH66NSD SMMJ66IDC6 SHAWCJ63SJ-
-USAS167PUS -USGPO61C1R

I.Ü. PLASJE66TS TSM AD 637956 MD 44176 CA-6607-1512
AFCRL-66-516
TITLE: TRANGEN SYSTEM ON THE M660 COMPUTER
AUTH.: PLASKOW JONATHAN E SCHUMAN STEPHEN A
AUTH.: MASSACHUSETTS COMPUTER ASSOCIATES, INC. PLACE: MASSACHUSETTS WAKEFIELD LAKESIDE OFFICE PARK 01880 DATED: 06.07.15
CITES: BEARD-66GPS BUMGLL--ORC CHEATE65NCT CHEATE65TTG
CHEATE65SC- CHRIC-65ESM EVANA-50AC6 EVANA-65SAP FELDJA66FSC
FLOYR61DLS FLOYRw63SAO LIETMP64MSC LONDR64CPD LONSET63EPA
MITCRW66ILN SHAPR-64GTC STRAC-65GPM TAYL--61BBA WILLH-66ADN
-COMPA66ST- -COMPA66T1-

TITLE: STRUCTURE, SPECIFICATION, AND EVALUATION OF TRANSLATORS AND TRANSLATOR WRITING SYSTEMS
AUTH.: PRESSER, LEON
PUB.: UNIVERSITY OF CALIFORNIA LOS ANGELES DEPARTMENT OF ENGINEERING
PLACE: CALIFORNIA LOS ANGELES 90024 DATED: 68.10

CITES: BAERJ-68GMC BOOKE-60USB BOVEDP68MAC BROORA60APP
BROORA60SPK BROORA61DMA BROORA62GTP BURKWH65UPL CARDAF68POL
CERFY-68MP- CHERET64AC- CHERET66TGG CHOMN-63FGP -CCCIT65CNN
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FELODA64FSC FELODA66FSC FELDJA-68TWS FLOYRW61DLS FLOYRW65SAO
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MARTDF66AAS MCCA6-62LP MCCRAM65TSD MCKEM66AQL METCH-64PCB
MRRCW63KTS NORTRE64FSL OPLEA-64MSC OPPEDK66MLS PRESL-67CWS
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SCHSRE64MSD SHAWA-66LNC SHAWC66SOE SIBLRA61SS- SQUIBE65RSC
SHUIRE66LAP STEETB66FLD TOLLJ-67FE- TURNR-63AIV WARSS-61SDG
WIRTI-66FGA ZEMAH-66SPL

KEY WD.: TRANSLATORS TRANSLATOR WRITING SYSTEMS TRANSLATOR SPECIFICATION TRANSLATOR EVALUATION TRANSLATOR MEASUREMENT COMPILERS INTERPRETERS META COMPILERS PRECEDENCE GRAMMARS
PRECEDENCE LANGUAGES

I.D.: RUBERJ68CEP AD 669096 MD 55002 ESD-TR-68-150 LOGICON
REPORT NO. CS-6813-R0106
TITLE: COMPARATIVE EVALUATION OF PL/I
AUTH.: RUBEY RAYMOND J ET AL
AUTH.: LOGICON, INCORPORATED PLACE: CALIFORNIA SAN PEDRO
DATED: 68.04

CITES:
KEY WD.: PL/I EVALUATION PROGRAMMING LANGUAGE EVALUATION
PROGRAMMING LANGUAGE COMPARISON FORTRAN : PL/I COMPARISON JOVIAL :
PL/I COMPARISON COBOL : PL/I COMPARISON BENCHMARK COMPUTER
PROGRAMS

39
I.D.: ZEPWE69JSS AD 852934 MD 59441 RADC-TR-69-106
TITLE: JOVIAL SORT AND SEARCH ROUTINES FOR THE DM-1 SYSTEM
AUTH.: ZEPKA WILLIAM E
AUTH.: ROME AIR DEVELOPMENT CENTER (EMIIL) PLACE: NEW YORK
GRAFISS AIR FORCE BASE 13440 DATED: 69.05
CITES: GUTLC63SC —SDC—66JTM —UNIVA65RJL
KEY WO.: PROGRAMMING (COMPUTER) SORTING SEARCHING

I.D.: SHAPKM69RA- AD 697026 CA-6908-2331 RADC TR-69-313,
VOL. II
TITLE: KEPRESENTATION OF ALGORITHMS
AUTH.: SHAPIRO ROBERT M SAINT HARRY
AUTH.: APPLIED DATA RESEARCH, INC. CORPORATE RESEARCH CENTER
PLACE: NEW YORK NEW YORK 450 SEVENTH AVE. 10001 DATED: 69.09
CITES:

I.D.: SHAWCJ60JMP MD 15433 TM555 PART 1
TITLE: JOVIAL MANUAL: PART 1 COMPUTERS, PROGRAMMING LANGUAGES AND
JOVIAL
AUTH.: SHAW C J
AUTH.: SYSTEM DEVELOPMENT CORPORATION PLACE: CALIFORNIA SANTA
MONICA 2500 COLORADO AVE. DATED: 60.12.20
CITES:

I.D.: SHAWCJ61BJP MD 15435 FM-5477
TITLE: BASIC JOVIAL PRIMER
AUTH.: SHAW C J
AUTH.: SYSTEM DEVELOPMENT CORPORATION PLACE: CALIFORNIA SANTA
MONICA 2500 COLORADO AVE. DATED: 61.05.05
CITES:
I.D.: -ESD--70UMJ AD 711370 ESD-TR-70-278
TITLE: USER'S MANUAL JOVIAL COMPILER VALIDATION SYSTEM
AUTH.: ELECTRONIC SYSTEMS DIVISION DIRECTORATE OF SYSTEMS DESIGN & DEVELOPMENT
PLACE: MASSACHUSETTS BEDFORD L G HANSCOM FIELD
DATED: 70.07

CITES:
KEY WD.: JOVIAL J-3 (J3) COMPILER VALIDATION

I.D.: -FOCP68JPL AD 672933 FOCCPAC TECH NOTE 3 128365
TITLE: JOVIAL PROCEDURE LIBRARY
AUTH.: PACIFIC FLEET FLEET OPERATIONS CONTROL CENTER
PLACE: CALIFORNIA SAN FRANCISCO DATED: 68.04

CITES:
APPENDIX B

EXAMPLE OF DOCUMENT CONTROL DATA - R & D,
DD FORM 1473
A compiler generation system is described which is rigorously based and which allows formal specification both of the source (procedure oriented) languages and of the object (machine oriented) languages. An intermediate or "buffer" language, BASE, is interposed, reducing the required transformation techniques described. The system, so far, includes those elements in BASE necessary to produce ALGOL, FORTRAN, and JOVIAL compilers.

This paper was presented at the 1967 Spring Joint Computer Conference.
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## APPENDIX C

### IDENTIFIERS FOR CORPORATE NAMES

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<tr>
<td>AFSCF</td>
<td>Air Force Satellite Control Facility, Computer Program Integration Contractor</td>
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<td>American Institute of Chemical Engineers</td>
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<td>API</td>
<td>American Petroleum Institute</td>
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<td>ARMY</td>
<td>U.S. Army</td>
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<td>AUERG</td>
<td>Auerbach Corporation</td>
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<td>Computer Bulletin</td>
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REFERENCES


4. Ben-Ami Lipetz, "Improvement of the Selectivity of Citation Indexes to Science Literature Through Inclusion of Citation Relationship Indicators," American Documentation, April 1965, pp. 81-90.

The structure of bibliographies in computer-accessible form is described. Its design seeks to use the capability of an existing general-purpose text-processing system to query a file interactively in such a way as to increase the automation available to readers consulting a bibliography. A bibliography on software transferability was compiled for automated access with the MITRE test-processing system, SHOEBOX. Sources and formats are described, followed by the bibliography itself.
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