

H.G. Kolisky

JUL 14 1960

Program Preparation for STRETCH

General

The purpose of these notes is to indicate the procedure to be followed that will enable programs to be written and run on STRETCH during the time the computer is being checked out in the South Road Lab. It is not intended that this procedure be used by Los Alamos personnel or by members of Department 271 except in emergencies.))

Program Card Deck

Since the 7503 Card Reader operates in the column binary mode, it is impractical to consider hand punching cards in binary. Therefore program decks should be prepared according to the conventions of the Strap symbolic assembly program. A pad of Strap program sheets is enclosed.

For those who insist on hand punching cards in binary, a special octal-hex sheet is enclosed. If the first 24 bits in each half word are represented by octal digits and the last 8 bits in each half word are represented by hex digits then they may be written in the spaces provided on the sheet. Then each column of the card to be punched is indicated by the numbers 1, 2, 3, etc. up to 80 which will be found under the appropriate boxes on the sheets. Above each of these column numbers will be found the row numbers 12, 11, 0, 1 and so on up to 9. For example, the first octal digit of the first word is to be punched in rows 12, 11 and 0 of column 1. Similarly the second hex digit of the seventh half word will be punched in rows 2, 3, 4, 5 of column 19. It is recommended that under no circumstances should one punch more than one full binary card.

Writing the Program

It is assumed that the reader has a working knowledge of STRETCH and Strap-I. However, for those whose knowledge is rusty several references are cited.

1. For STRETCH function, Form No. A22-6530: Reference Manual, 7030 Data Processing System.
2. For complete information about Strap-I and the STRETCH simulator, Form No. C22-6531: Reference Manual, 704-709-7090 Programming Package for the IBM 7030 Data Processing System.
Special attention is called to Appendix C, pages 60-67, which contains a complete list of Strap-I mnemonics and symbolic instruction formats and also a symbolic description of the function of all STRETCH instructions.
3. As a pocket reminder, Form No. X22-6533: IBM 7030 Reference Card. A copy is enclosed.
4. To assist in reading maintenance console, binary decks, etc.: a set of absolute format sheets that also summarize Strap mnemonics and formats. A set of sheets is enclosed.

At the present time not every instruction in STRETCH has been checked out. Appendix A to these notes is a list of those instructions and features that most probably may be expected to function correctly. The information in the list was supplied by Mr. Bill Wolensky, extension 5987-M and will be updated by him weekly. It must be remembered that the operational status of the computer is still subject to rapid perturbations, and the presence of an instruction or feature on the list is not an iron clad guarantee that it will function correctly all the time or under all circumstances. However, a program using only the instructions and features listed will probably work more often than one using others also.

Until such time as the general loading program written by Machine Oriented Programming has become operational, a modified Initial Program Load (IPL) procedure is used to load a program into storage. In order that IPL procedure may be used, the program proper must be preceded by a control word (CW) and (at this time) a branch disabled (BD) instruction, in that order. The data word address field of CW must contain the address at which the BD is to be stored; the count field of CW must contain the number of words that are to be read into storage, including the BD. The operand address field of the BD instruction must contain the address of the first instruction to be executed in the program proper.

When IPL procedure is to be used, it is necessary to have the card deck in so-called PUNFUL form (960 bits of program information). Such a deck may be obtained automatically as output from Strap-I as shown in the example in the next section.

Complete Program Deck for Assembly

The complete program deck to be used as input to Strap-I must contain certain pseudo-operations that give instructions to the assembly program. Following is a Sample Program whose instructions and pseudo-operations are explained below, line by line.

Line	Class	Name	Statement	72	73	80
1			PRNID, SAMPLE PROGRAM BY KILROY			
2			PUNFUL;		PSK 1.01	
3			SLC, 99.;		PSK 1.02	
4			CW(CD), 100., FINAL-FIRST;		PSK 1.03	
5	FINAL		SYN, LAST+1.0;		PSK 1.04	
6	FIRST		BD, START;		PSK 1.05	
7	START		L (BU, 24), NECK-BONE;		PSK 1.06	
8			C1001 (BU, 24), HEAD-BONE;		PSK 1.07	
9	FINISH		B, HERE:		PSK 1.08	
10	BONE		SYN, 1776.;		PSK 1.09	
11	NECK		SYN, START+BONE;		PSK 1.10	
12	HEAD		SYN, NECK+1.0;		PSK 1.11	
13	HERE		SYN, FINISH;		PSK 1.12	
14	LAST		SYN, FINISH DR(N)		PSK 1.13	

Line 1: PRNID means "print identification"; information to right of comma is printed on listing to identify the program.

Line 2: PUNFUL means "punch full cards" as needed for IPL procedure.

Line 3: SLC,99. means "set location counter to storage address 99". This will cause the control word defined in Line 4 to be located at word address 99. The period following the numerals 99 must be present or else the control word will be stored at bit address 99 which is word address 1.35.

Line 4: A control word that will cause instructions to be placed in storage beginning at word address 100. The arithmetic expression "FINAL minus FIRST" that appears in the count field is used to force Strap-I to determine the count (this can save the programmer considerable trouble caused by the mixture of half and full word instructions in STRETCH).

Line 5: Strap-I has had trouble performing address arithmetic on expressions of the form $a+b+c$, but can evaluate $a+b$. This synonym pseudo-op effectively substitutes the value of $LAST + 1.0$ for FINAL so that the control word (Line 4) count field will have the correct value $LAST - FIRST + 1.0$ of the number of words to be read into STRETCH.

Line 6: The branch disabled instruction required by the IPL procedure that causes the program proper to be executed.

Line 7-9: The program proper occupies locations START to FINISH, causes the HEAD-BONE to be connected to the NECK-BONE, and hangs up HERE.

Line 10 - 12: Used to assign numerical values to NECK, BONE, HEAD. Note the patriotic motif!

Line 13: Used to assure that the FINISH of the program proper is HERE.

Line 14: A question of semantics.

Columns 73-80 (not 72-80 as shown on the program sheet): Identification to be punched in the symbolic deck - as programmer's initials (Paul S. Kilroy), program number, card number, etc.

Punching the Deck

Program decks may be submitted for punching to Mrs. Gertrude Kelly at Room 337 of the Education Building. Short programs will be ready sooner if the programmer punches them himself. An 026 printing card punch is located in the STRETCH model room and a Strap key punch program card is enclosed.

This program card defines five fields: Class, Name, Operation, Comment, and Identification occupying columns 1, 2 - 9, 10 - 39, 40 - 72, and 73 - 80 respectively.

Fields are defined by 12 punches in all columns except the left hand column of the field.

The 1 punch in columns 1-80 places the punch in alphabetic shift.

A comment begins with an apostrophy ('). On commercial keyboards the @ symbol is used. In either case a 4-8 double punch is used.

At the end of punching in a field, depression of the skip key will skip the card to the beginning of the next field.

The three function control switches, Auto Feed, Auto Skip and Auto Dup, and Print should be on.

Don't forget to set the Program Control Lever.

Assembly

Program decks for assembly (i. e., symbolic decks) should be given to Mr. Brian Gagnon at Room 337 of the Education Building. These decks will be processed along with the regular output of Department 271 unless special arrangements are made with Mr. Tom Apple at Room 337 of the Education Building, Extension 221-M.

Listing

There is attached a sample page of a Strap output listing. You will notice five columns of information. The first column represents the contents of the name field, the second column is the symbolic instruction, the third column is the comments, the fourth column is the octal-hex representation of the instruction and the last column is the octal representation of the contents of the instruction counter. Your print out from Strap will look like this.

Simulation

In general, no program should be run on STRETCH without first being debugged by simulation. Simulation is required for long programs. The reader is referred to the 704-709-7090 Package reference manual, pages 38-46, for a thorough discussion of non-PUNFUL Strap output, card formats, simulator input, deck arrangement, simulated input-output, and tracing and dumping. The discussion is too lengthy to reproduce here.

Running the Program on Stretch

See the operator on duty or engineer in charge, and have him place the computer in IPL state. If you have an IPL tape, he will load it for you. If you have an IPL PUNFUL deck, load the card reader and press the Start Key. After the deck has been read in, press the Unload Key and retrieve your deck (your responsibility).

In either case, cards or tape, if the program gets into storage, STRETCH will be stopped; and the next instruction to be executed will be the initial branch disabled instruction that precedes the program proper. The program may then be executed a step at a time or at normal speed; control is by key at the maintenance console. The operator on duty or engineer in charge will assist you.

Who to Call and See

1. How to program STRETCH: Dr. T. C. Chen
2. How to use Strap-I: Mr. G. A. Grover, 5043-M
Mr. S. L. Prosser, 6049-M
Mr. C. T. Apple, 221-M
Mrs. L. Lowry, 221-M
3. How to use the simulator: Mr. C. T. Apple, 221-M
Mrs. L. Lowry, 221-M
Mr. B. Gagnon, 221-M
4. To have key punching done see Mrs. G. Kelly, Room 337, Education Building
5. To have assembly or simulation runs made see Mr. B. Gagnon, Room 337, Education Building; in special cases call Mr. C. T. Apple, 221-M.
6. Get additional program sheets from Mr. H. G. Methven, 5043-M
7. To determine status of STRETCH instruction set and features, Mr. W. Wolensky
8. Anything else, Dr. Paul S. Herwitz, 5052-M.

GOOD LUCK!!

Paul S. Herwitz

PSH:f
July 5, 1960

Appendix A

<u>Instruction</u>	<u>Reliability</u>
Floating Point +, +A	Unnormalized - OK Normalized - questionable
F+, F+A	65%
E+, E-, E+A, E-A	OK
E+I, E-I, E+AI, E-AI	85%
D+, D-, D+A, D-A	10%
+MG, +MGA	OK
D+MG, D-MG, D+MGA, D-MGA	10%
All loads, except Load Factor	OK
ST, STN, STA, STNA	OK
K, KN, KA, KNA	OK if both factors normalized, or both unnormalized
Variable Field Length	
+, -, M+, M-	OK
L, LN, LWF, LWFN	OK
LTRS, LTRSN	OK
ST, STN	OK
K, KN, KF, KFN	OK
C, CM, CT	OK for "and", "or", "exclusive or", "all ones", "all zeros"
Indexing	
All direct index ops <u>except</u> SVA, LVE, RNX, LVS	OK
SVA	90%
All immediate index ops <u>except</u> LVNI, C+I, C-I	OK
All count and branch ops <u>except</u> CP+, CB-, CBH	OK
All unconditional branch ops <u>except</u> BEW	OK

Appendix A (continued)

<u>Instruction</u>	<u>Reliability</u>
All branch on bit ops <u>except BPN, PZBN</u>	OK
All branch on indicator ops <u>But the only indicators checked</u> out are XCZ, XVLZ, XVZ, XVGZ, XL, XE, XH, MOP, AN, AL, AE, AH RZ RLZ, RGZ	OK OK for VFL 50% for VFL
Miscellaneous ops SIC, R	90%

<u>Features</u>	<u>Reliability</u>
Interrupt system	Not checked out but supposedly operative
Indexing	Very Good
Memory	Good - Very Good but new boxes on as of 7/6/60.
Exchange	Good - Very Good but has not been operated under program control

<u>Input-Output</u>	<u>Reliability</u>
Card Reader	Very Good
Tapes	Good
Console	Good
Printer	Fair-Good
Punch	Poor

CORRECTION SHEET

July 11, 1960

On Page #2, line 14 should read as follows:

14 LAST DR (N) PSK 1.13

On Page #3, the explanation for line 14 should read as follows:

This is a data reservation pseudo operation that bounds off the instruction counter to full word address if necessary. The name LAST is therefore assigned a full word address and the arithmetic in lines 4 and 5 will produce an integer count in CW.

PSH:f

Appendix A

July 11, 1960

No Change

/f

Appendix A

July 15, 1960

No Change

/g

Appendix A

<u>Instruction</u>	<u>Reliability</u>
Floating Point +, +A	Unnormalized - OK Normalized - questionable
F+, F+A	65%
E+, E-, E+A, E-A	OK
E+I, E-I, E+AI, E-AI	85%
D+, D-, D+A, D-A	10%
+MG, +MGA	OK
D+MG, D-MG, D+MGA, D-MGA	10%
All loads, except Load Factor	OK
ST, STN, STA, STNA	OK
K, KN, KA, KNA	OK if both factors normalized, or both unnormalized
*	Fair
/	20% operative
Variable Field Length	Including word boundary crossover
+, -, M+, M-	OK
L, LN, LWF, LWFN	OK
LTRS, LTRS N	OK
ST, STN	OK
K, KN, KF, KFN	OK
C, CM, CT	OK for "and", "or", "exclusive or", "all ones", "all zeros"
Indexing	
All direct index ops <u>except</u> SVA, LVE, RNX, LVS	OK
SVA	90%
All immediate index ops <u>except</u> LVNI, C+I, C-I	OK
All count and branch ops <u>except</u> CB+, CB-, CBH	OK - intermittent 7/22/60
All unconditional branch ops <u>except</u> BEW	OK

Appendix A (continued)

Instruction

All branch on bit ops

Reliability

OK

All branch on indicator ops -
except non I-Box indic.

Intermittent

But the only indicators checked
out are

XCZ, XVLZ, XVZ, XVGZ,
XL, XE, XH, MOP, AN, AL,

AE, AH

RZ

RLZ, RGZ

OK

OK for VFL

50% for VFL

Miscellaneous ops

SIC, R

90%

Features

Reliability

Interrupt system

Not checked out but supposedly operative

Indexing

Good

Index Storage

Fair

Memory

Good - Very Good

Exchange

Good - Very Good but has not been operated
under program control

Input-Output

Reliability

Card Reader

Very Good

Tapes

Good

Console

Good

Printer

Fair-Good

Punch

Fair

g/7-22-60

APPENDIX A

Since more instructions will work properly than are not working, this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except: LVS	
RNX	
Interrupt	30%
EX	
Time Clock	
LVE	
T's and SWAP's	50%
Progressive Indexing	
Serial Arithmetic Unit	Very Good
Except: CV	
*, /	75%
LFT	85%
LTRS	85%
Parallel Arithmetic Unit	
Except: *, /	75%
SRT	
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	5%
Card Reader	Very Good
Card Punch	Poor-Unknown
Printer	Good
Tapes	Poor-Unknown
Console	Very Good

Occasional Intermittents
Occasional Failures at High Speed

WW/f
August 10, 1960

APPENDIX A

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except: LVS	
RNX	
Interrupt	30%
EX	
Time Clock	30%
LVE	
T's and SWAP's	50%
Progressive Indexing	15%
Serial Arithmetic Unit	Very Good
Except: CV	
*, /	75%
LFT	85%
LTRS	85%
Parallel Arithmetic Unit	
Except: *, /	75%
SRT	
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	5%
Card Reader	Very Good
Card Punch	Poor-Unknown
Printer	Good
Tapes	Poor-Unknown
Console	Very Good

Occasional Intermittents
Occasional Failures at High Speed

WW/f
August 16, 1960

APPENDIX A

AUG 26 1960

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except: LVS	
RNX	
Interrupt	30%
EX	
Time Clock	
LVE	
T's and SWAP's	50%
Progressive Indexing	
Serial Arithmetic Unit	Very Good
Except: CV	
*, /	75%
LFT	85%
LTRS	85%
Parallel Arithmetic Unit	
Except: *, /	75%
SRT	
*+	40%
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	5%
Card Reader	Good
Card Punch	Poor-Unknown
Printer	Good
Tapes	Poor-Unknown
Console	Very Good

Occasional Intermittents
Occasional Failures at High Speed

WW/f
August 23, 1960

APPENDIX A

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except: LVS	
RNX	
Interrupt	30%
EX	
Time Clock	
LVE	
T's and SWAP's	50%
Progressive Indexing	
Serial Arithmetic Unit	Very Good
Except: CV	30%
*, /	75%
LFT	85%
LTRS	85%
Parallel Arithmetic Unit	
Except: *, /	85%
SRT	
**	40%
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	5%
Card Reader	Good
Card Punch	Poor-Unknown
Printer	Good
Tapes	Poor-Unknown
Console	Very Good

Occasional Intermittents
Occasional Failures at High Speed

WW/f
August 30, 1960

APPENDIX A

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except: LVS	
RNX	
Interrupt	30%
EX	
Time Clock	
LVE	
T's and SWAP's	50%
Progressive Indexing	30%
 Serial Arithmetic Unit	 Very Good
Except: CV	30%
/	75%
LFT	85%
LTRS	85%
 Parallel Arithmetic Unit	 Good
Except: /	85%
SRT	
*+	40%
 Memory	 Good
 Exchange	 Usually Good
 Index Memory	 Very Good
 I & E Checkers	 Good
 Indicators	 Good
 I/O Instructions	 5%
Card Reader	Good
Card Punch	Poor-Unknown
Printer	Good
Tapes	Poor-Unknown
Console	Very Good

Occasional Intermittents

WW/f

September 6, 1960

J. Kalisky

APPENDIX A

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except: LVS	
RNX	
Interrupt	30%
EX	
Time Clock	
LVE	
T's and SWAP's	75%
Progressive Indexing	30%
Serial Arithmetic Unit	Very Good
Except: CV	60%
/	75%
LFT	85%
LTRS	85%
Parallel Arithmetic Unit	Good
Except: /	85%
SRT	
*+	40%
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	5%
Card Reader	Good
Card Punch	Poor - Unknown
Printer	Good
Tapes	Poor - Unknown
Console	Very Good

Occasional Intermittents

WW/f
September 12, 1960

APPENDIX A

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except: LVS	
RNX	
Interrupt	40%
EX	
Time Clock	
LVE	
T's and SWAP's	75%
Progressive Indexing	45%
Serial Arithmetic Unit	Very Good
Except: CV	60%
/	75%
LFT	85%
LTRS	85%
Parallel Arithmetic Unit	Good
Except: /	85%
SRT	
*+	50%
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	20%
Card Reader	Good
Card Punch	Poor-Unknown
Printer	Good
Tapes	Poor-Unknown
Console	Very Good

Occasional Intermittents

WW/f

September 19, 1960

APPENDIX A

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except:	
RNX	
Interrupt	40%
EX	
Time Clock	
Progressive Indexing	45%
Serial Arithmetic Unit	Very Good
Except: CV	60%
/	75%
LFT	85%
LTRS	85%
Parallel Arithmetic Unit	Good
Except: /	85%
SRT	
*+	50%
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	20%
Card Reader	Good
Card Punch	Poor-Unknown
Printer	Good
Tapes	Poor-Unknown
Console	Very Good

Occasional Intermittents

WW/f

September 26, 1960

A. J. Kirby
5/10/60

APPENDIX A

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Except:	
RNX	95%
Interrupt	95%
EX	80%
Serial Arithmetic Unit	Very Good
Parallel Arithmetic Unit	Good
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	50%
Card Reader	Very Good
Card Punch	Fair-Good
Printer	Fair-Good
Tapes	Fair-Good
Console	Fair

Infrequent Intermittents, particularly parity and residue checks

WW/f

November 22, 1960

APPENDIX "A"

No Change

WW/f
December 7, 1960

APPENDIX A

Since more instructions will work properly than are not working this appendix will indicate the overall status of various parts of the machine with individual exceptions listed.

<u>Section</u>	<u>Reliability</u>
I Box	Very Good
Serial Arithmetic Unit	Very Good
Parallel Arithmetic Unit	Very Good
Memory	Very Good
Exchange	Usually Good
Index Memory	Very Good
I & E Checkers	Good
Indicators	Good
I/O Instructions	75%
Card Reader	Very Good
Card Punch	Fair-Good
Printer	Fair-Good
Tapes	Fair-Good
Console	Fair-Good

Infrequent Intermittents, particularly parity and residue checks

WW/f

December 19, 1960