

IBM 7080 Simulator Usage

Richard Cornwell Robert M Supnik

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The IBM 7080 developed out of the IBM 702 which was a unique machine in

that it had character addressed memory, however instructions had to be aligned on 5 character boundaries. Also it had to 256 character long accumulators which could be treated as variable length registers.

IBM replaced this machine with the IBM 705, where the second accumulator was replaced with 15 fixed offset registers, given 14 16 digit registers and 1 32 character register.

The 7080 enhanced this by adding in 3 more register sets that were used to talk to I/O devices.

Instructions addressed the last location of an instruction or field and proceeded to lower memory. All instructions were 5 characters long consisting of a 4 character address and 1 character instruction. Data length was either determined by the length of the referenced accumulator or by a signed character indicating start of next data field.

Simulator Files

<i>Subdirectory</i>	<i>File</i>	<i>Contains</i>
I7000	i7000_defs.h	IBM 7000 simulators general definitions
	\$0.00	\$0.00
	i7000_chan.c	Generic channel interface.
	i7080_cpu.c	7080 CPU, Channel, interface
	i7080_chan.c	7080 Channel.
	i7080_sys.c	7080 System interface
	i7000_cdr.c	711 Card reader
	i7000_cdp.c	721 Card punch
	i7000_com.c	7750 Communications Controller
	i7000_con.c	Inquiry console.
	i7080_drum.c	Drum interface.
	i7000_dsk.c	1301/2302 disk and 7238 drum controller.
	i7000_ht.c	7340 Hypertape controller.
	i7000_lpr.c	716 Line printer
i7000_mt.c	729 Tape controller.	
i7000_chron.c	Chrono Clock.	

IBM 7080 Features

The IBM 7080 simulator is configured as follows:

Device Name(s)	Simulates
CPU	7080 CPU with 160K of memory
CH0	Unit record devices


```

SET CPU 705           Sets CPU to emulate 705-I/II.
SET CPU 7053          Sets CPU to emulate 705-III.
SET CPU 7080          Sets CPU to emulate 7080.
SET CPU 10K           Sets memory to 10K
SET CPU 20K           Sets memory to 20K
SET CPU 40K           Sets memory to 40K
SET CPU 80K           Sets memory to 80K
SET CPU 120K          Sets memory to 120K
SET CPU 160K          Sets memory to 160K
SET CPU NO/EMU40K     Sets emulated memory limit to 40k
SET CPU EMU705        Sets CPU to emulate a 705-I/II.
SET CPU EMU7053       Sets CPU to emulate a 705-III.
SET CPU PROGRAM       Sets CPU to programmable stop mode.
SET CPU NONSTOP       Sets CPU to Non-stop mode

```

The 702 can support only 10k of memory. All 705's modes can support up to 40K of memory.

The 7080 can support up to 160k of memory.

When in 7080 mode the machine starts as either a 705-I/II or a 705-III depending on mode of EMU705/EMU7053 switch. Also the EMU40K fixes the maximum memory for the 7080 to 40K until it enters 80 mode with EEM instruction.

CPU registers include the visible state of the processor as well as the control registers for the interrupt system.

Registers

<i>Name</i>	<i>Size(digits)</i>	<i>Comments</i>
IC	5	Program Counter
A	256	Accumulator 1
ASU1..15	256	Accumulator 2
SW	6	Switches
SW911..916	1	Sense Switches 911 to 916
STOP	6	Stop conditions
STOP0..5	1	Individual Stop conditions

If CPU set to PROGRAM and the stop flag is set to 1, and a 90x trigger is generated, the machine will stop. If flag is set to 0, no stop will occur. If CPU set to NONSTOP all errors must be checked by program.

The CPU can maintain a history of the most recently executed instructions.

This is controlled by the SET CPU HISTORY and SHOW CPU HISTORY commands:

```

SET CPU HISTORY          clear history buffer

```

```

SET CPU HISTORY=0          disable history
SET CPU HISTORY=n         enable history, length = n
SHOW CPU HISTORY          print CPU history
SHOW CPU HISTORY=n       print first n entries of CPU history

```

Instruction history trace shows the Instruction counter, the symbolic operator, and memory address and the contents of the selected register.

I/O Channels (CH0..CH6)

The 7080 supports up to 11 channels.

```

SET CHn UREC              Tapes are on unit record device.
SET CHn 7261              Tapes are on Data Synchronizer.
SET CHn 754               Tapes are standard 705 drives.
SET Chn HS                Set channel to High Speed.

```

Channel 0 is for unit record devices.

Channels 1 through 4 are for tape drives. These support the option of

Channels 5-10 are for 7908 devices. For CPU channels are defined as:

Channel	CPU address
0	0-1999
20	2000 or 0200
21	2100 or 0210
22	2200 or 0220
23	2300 or 0230
40	4000 7908 high speed channel.
41	4100 7908 high speed channel.
44	4400 7908 channel.
45	4500 7908 channel.
46	4600 7908 channel.
47	4700 7908 channel.

Registers

Channels have the following registers:

<i>Name</i>	<i>Size(digits)</i>	<i>Comments</i>
ADDR	5	Channel Data Address
CMD	1	Channel Command.
FLAGS	32 (binary)	Channel Flags

For meaning of bits in FLAGS see i7000_defs.h.

The command:

```
SHOW CH                Print summary of devices on channel
```

Unit record devices.

Inquiry Station (INQ)

The inquiry station allows for communications with the operating system.

The station is half duplex and will either print or accept input.

Whenever the computer sends a message it is prefixed with a 'R' character.

When the station is ready to receive input it prompts with a 'I'. Input is buffered until the return character is entered.

Backspace will remove the last character typed.

An <esc> will send an interrupt to the processor to request it read a record from the console.

An <esc> while in input mode will cancel input mode and clear any typed message.

Card Reader (CDR)

The card reader (CDR) reads data from a disk file.

Cards are simulated as ASCII lines with terminating newlines.

Card reader files can either be text (one character per column) or column binary (two characters per column). The file type can be specified with a set command:

```
SET CDR FORMAT=TEXT    Sets ASCII text mode
SET CDR FORMAT=BINARY  Sets for binary card images.
SET CDR FORMAT=BCD     Sets for BCD records
SET CDR FORMAT=CBN     Sets for column binary BCD records.
SET CDR FORMAT=AUTO    Automatically determines format.
```

or in the ATTACH command:

```
ATTACH CDR <file>      Attaches a file
ATTACH CDR -f <format> <file> Attaches a file with the given format.
ATTACH CDR -s <file>   Added file onto current cards to read.
ATTACH CDR -e <file>   After file is read in, the reader will
                        receive an end of file flag.
```

The card reader can be booted with the:

```
BOOT CDR
```

The CDR loads the first card into memory location 0 and transfers to location 4.

Error handling is as follows:

error	processed as
not attached	report error and stop
end of file	out of cards
OS I/O error	report error and stop

721 Card Punch (CDP)

The card reader (CDP) writes data to a disk file. Cards are simulated as ASCII lines with terminating newlines. Card punch files can either be text (one character per column) or column binary (two characters per column). The file type can be specified with a set command:

```
SET CDPn FORMAT=TEXT      Sets ASCII text mode
SET CDPn FORMAT=BINARY    Sets for binary card images.
SET CDPn FORMAT=BCD       Sets for BCD records.
SET CDPn FORMAT=CBN       Sets for column binary BCD records.
SET CDPn FORMAT=AUTO      Automatically determines format.
```

or in the ATTACH command:

```
ATTACH CDPn <file>          Attaches a file
ATTACH CDPn -f <format> <file> Attaches a file with the given format.
```

Error handling is as follows:

error	processed as
not attached	report error and stop
OS I/O error	report error and stop

716 Line Printer (LP)

The line printer (LP) writes data to a disk file as ASCII text with terminating newlines. Currently set to handle standard signals to control paper advance.

```
SET LPn NO/ECHO           Sets echoing to console of line-printer output.
SET LPn LINESPERPAGE=lpp Sets number of lines per page on printer.
SET LPn SINGLE            Set printer to single spacing.
SET LPn DOUBLE            Set printer to double spacing.
SET LPn PROGRAM           Set printer to single spacing.
```

If the printer is set to PROGRAM spacing the first character of the print record controls spacing.

Character (Octal)	Action
060	Suppress spacing.
020	Single space after.

Character (Octal)	Action
012	Single space before.
003	Skip to channel 3 (every 5th line)
002	Skip to channel 2 (every 8th line)
001 & 009	Skip to channel 1 (or 9), (top of form).

Error handling is as follows:

error	processed as
not attached	report error and stop
OS I/O error	report error and stop

Magnetic Tape devices

729 Magnetic Tape (MTA-D)

These come in groups of 10 units each.

Each individual tape drive support several options: MTA used as an example.

SET MTAn REWIND	Sets the mag tape to the load point
SET MTAn LOCKED	Sets the mag tape to be read only.
SET MTAn WRITEENABLE	Sets the mag tape to be writable.
SET MTAn LOW	Sets mag tape to low density.
SET MTAn HIGH	Sets mag tape to high density.

Options: Density LOW/HIGH does not change format of how tapes are written. And is only for informational purposes only.

Tape drives can be booted with:

BOOT MTxn Read in record into location 0.

ChronoClock

Disabled by default. This is a special 729 tape drive which returns the current time. It supports the option of setting the channel and drive that it will occupy.

Note: You must disable the real 729 drive that is replacing.

The clock responds to Read and Backspace commands. A read results in a 10 character buffer being generated that has the Month, Day, Hour, Minutes, Seconds and Milliseconds.

This time is taken from the local computer time.

SET CHRON CHAN=n	Set channel for chrono clock.
SET CHRON UNIT=n	Sets the unit for the chrono clock.

Example: To set Chronoclock to unit A9 do the following:

```
SET MTA9 DISABLE
SET CHRON UNIT=9 CHAN=20
```

7908 Devices

These devices must be attached to a 7908 channel to work.

1301/1302/2302/7320 Disk devices

The 7631 file control supports up to ten devices, which can be 7320 drums, 1301 disks, 1302 disks, or 2302 disks. Unit types are specified with the SET command.

```
SET DKn TYPE=7320           Unit n is a drum
SET DKn TYPE=7320-2        Unit n is a drum (two modules)
SET DKn TYPE=1301          Unit n is a 1301 disk
SET DKn TYPE=1301-2        Unit n is a 1301-2 disk (two modules).
SET DKn TYPE=1302          Unit n is a 1302 disk
SET DKn TYPE=1302-2        Unit n is a 1302-2 disk (two modules).
SET DKn TYPE=2302          Unit n is a 2302 disk
```

Units can be SET ENABLED or DISABLED. In addition, units can be set to enable or disable formatting:

```
SET DKn FORMAT             Enable formatting
SET DKn NOFORMAT           Disable formatting
SET DKn HA2                Enable writing of home address 2
SET DKn NOHA2              Disable writing of home address 2
SET DKn MODULE=n           Sets modules for unit, modules can only be even. 0 to 8.
SET DKn CHAN=n             Sets channel for unit (A-H)
SET DKn SELECT=n           Sets select on channel (0 or 1).
```

Formatting is disabled by default.

Error handling is as follows:

error	processed as
not attached	report error and stop
OS I/O error	report error and stop

Hypertape 7340 Tape drive (HTA)

These come in groups of 10 units each. The controller defines which channel the devices will be on. By default these devices are not installed.

```
SET HTA CHAN=n             Sets channel for unit (A-H).
SET HTA SELECT=n           Sets select on channel (0 or 1).
```

Each individual tape drive support several options: HTA used as an example.

SET HTAn LOCKED Sets the mag tape to be read only.
SET HTAn WRITEENABLE Sets the mag tape to be writable.

NOTE: Hypertape drives may not be working correctly since there is very little documentation available on them.

7750 Communications Controller (COM and COML)

The 7750 is modeled as a terminal multiplexer with 33 lines. It consists of two device: COM is the multiplexer controller, and COML is the individual lines.

For the first 32 lines, the 7750 performs input and output through Telnet sessions connected via a user-specified listening port.

The 33rd line is permanently attached to the simulator console window.

The ATTACH command specifies the port to be used for Telnet sessions:

ATTACH COM <port> set up listening port

where port is a decimal number between 1 and 65535 that is not being used other TCP/IP activities.

Each line (each unit of COML) can be set to one of twp modes: KSR-35 and KSR-37. In KSR-35 mode, lower case input and output characters are converted automatically to upper case, and parity is ignored. In KSR-37 mode, lower case characters are left alone, and even parity is generated on input. KSR-37 is the default.

Once COM is attached and the simulator is running, the 7750 listens for connections on the specified port. It assumes that any incoming connection is a Telnet connections. The connections remain open until disconnected either by the Telnet client, a SET COM DISCONNECT command, or a DETACH COM command.

SET COM DISCONNECT=n Disconnect line n
SET COM CHAN=n Set channel for com controller.

The 7750 implements the following special SHOW commands

SHOW COM CONNECTIONS Displays current connections to the 7750
SHOW COM STATISTICS Displays statistics for active connections

The 7750 implements the following special SET commands:

SET COMLn LOG=filename Log output of line n to filename
SET COMLn NOLOG Disable logging and close log file
SET COMLn KSR35 Set line n to ksr-35
SET COMLn KSR37 Set line n to ksr-37
SET COMLn 2741 Set line n to 2741

Registers The controller (COM) implements these registers:

<i>Name</i>	<i>Size</i>	<i>Comments</i>
ENABLE	1	Enable flag
STATE	6	Controller state
MSGNUM	12	Input message sequence number

4 Symbolic Display and Input

The IBM 7080 simulator implements symbolic display and input. Display is controlled by command line switches:

-c	Display/Enter as BCD character
-d/-s	Display as character dump.
-m	Display/Enter instruction mnemonics.
(none)	Display/Enter as number.

Instruction input uses standard 7080 assembler syntax.

- <opcode> <address>,<ASU>
- <opcode> <address>

5 Sim Load

The load command looks at the extension of the file to determine how to load the file. Based on extension the file is converted to characters and loaded based on the 7080 load format.

Character Codes

This is the mapping between character codes used by the simulator:

Commercial	Scientific	ASCII	BCD	Card	Remark
			00		Blank
1		0	01	1	
2		0	02	2	
3		0	03	3	
4		0	04	4	
5		0	05	5	
6		0	06	6	
7		0	07	7	
8		0	10	8	
9		0	11	9	
0		0	12	10	
#	=	=	13	3-8	
@	'	'/@	14	4-8	
:		:	15	5-8	
>		>	16	6-8	
√		"	17	7-8	Tape Mark
b		_	20	2-8	
/		/	21	10-1	
S		S	22	10-1	
T		T	23	10-2	
U		U	24	10-3	
V		V	25	10-4	
W		W	26	10-5	
X		X	27	10-6	
Y		Y	30	10-7	
Z		Z	31	10-8	
#		#	32	10-2-8	Word Mark
,		,	33	10-3-8	
%	(%/(34	10-4-8	
`		`	35	10-5-8	
\		\	36	10-6-8	
#		{	37	10-7-8	Segment Mark

Commercial	Scientific	ASCII	BCD	Card	Remark
-		-	40	11	also -0
J		J	41	11-1	
K		K	42	11-2	
L		L	43	11-3	
M		M	44	11-4	
N		N	45	11-5	
O		O	46	11-6	
P		P	47	11-7	
Q		Q	50	11-8	
R		R	51	11-9	
!		!	52	11-2-8	
\$		\$	53	11-3-8	
*		*	54	11-4-8	
]]	55	11-5-8	
;		;	56	11-6-8	
△		△	57	11-7-8	
&	+	&/+	60	12	also +0
A		A	61	12-1	
B		B	62	12-2	
C		C	63	12-3	
D		D	64	12-4	
E		E	65	12-5	
F		F	66	12-6	
G		G	67	12-7	
H		H	70	12-8	
I		I	71	12-9	
?		?	72	12-2-8	
.		.	73	12-3-8	
□))	74	12-4-8	Lozenge
[[75	12-5-8	
<		<	76	12-3-8	
## *			77	12-7-8	Group Mark

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