

P. P. Dept Meeting
Multiprogramming - Codd,

April 13, 1959

1. Historical Development

~~all~~ steps toward simultaneous processing - a trend in computer design,

(1) (701, 702, 704) one job at a time
- idle time

Example: punched card installation: at one time

sorter	collator	} all busy
tabulator	Interpreter	
Reproducer		} not busy

701 installation: - only one tape running

(2) 705: limited simultaneous - file maintenance.
one read or write overlapped with calc.
- End of r-w of not easily doable.
- expensive

(3) 705-709 with DSU. - more general & flexible
- up to 6 simult. ops. - read may overlap read, etc.
- still have trouble with end of op being APQ'd.
(usually 705's have 2 TRC)

(4) 7070, 7090, 7050
- interrupt on I/O. same as done otherwise

(5) STRETCH

5 possible signals from I/O.

(6) BULL GAMMA 60.

Scint processing extended to internal units.

- Decimal arithmetic unit
- Logical (binary and)
- Comparator
- input units

has lack of ~~both~~ interrupt & HS memory at present

Multi-facility machine:

uni programming — execution of programs in sequence.

Interleaving: — switching of facility from one prog to another.

Overlapping: — simultaneous execution of progs. on different facilities.

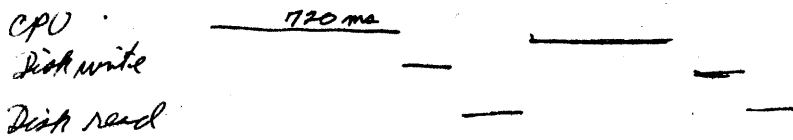
Multiprog: — either or both interleaving or overlapping.

Reasons for Multiprog:

1. Greater efficiency on batch processing.
2. Console debugging
3. Remote inputs from indep. terminals
4. Application of computers — close coop. between man & machine

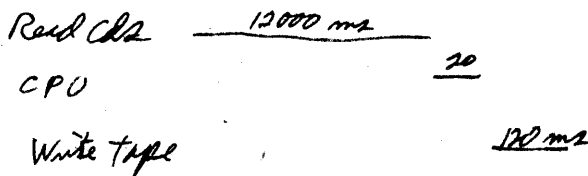
Example of Batch processing:

Prog A: 16 K wds data, 2 K instr, 2 M wds backup

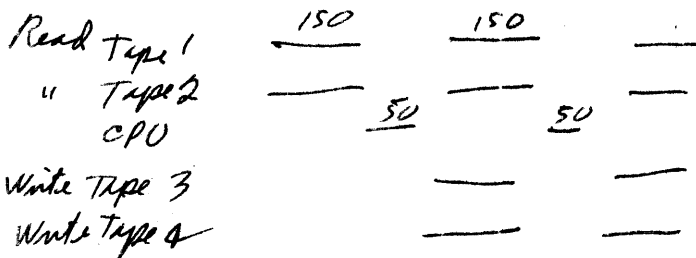


(Nash problem)

Prog B: card-to-tape (editing - conversion - grouping)
1 K wds .5 K instr



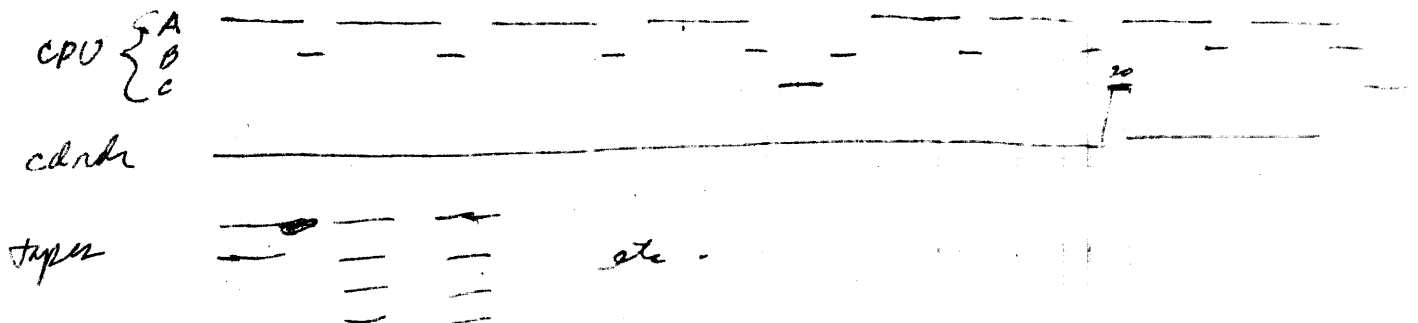
Prog C: file maint 4 K data 3 1/2 K instr 4 tapes



Total: Mem 27 K wds, Disk 2 M wds, cards, 5 tapes

together:

Rule: displace prog if another prog uses CPU less freq or for shorter length of time.



If each by itself runs for 2 hours.
Total separately would be 6 hrs.

Prog A: is delayed 30%

B: is not delayed - except negligible extension.

C: no delay at all.

So total = 2 hr 35 min favorable example.

Example: Two programs of same characteristics, A & A'

CPU	A	A'	A	A'	A	A'
Disk retrace unfile etc	-	-	-	-	-	-

3 hr 26 min instead of 4 hrs

+ Supervisory overhead!

Console debugging:

1. elim. of queuing of program for machine ← main reason
2. Continuity of programmer effort
3. Prompt recog. of useless activity
4. Prompt exploitation of produced results
5. More selective post-mortem info.

debugging paced by user not production load
10 runs per day instead of 5 days etc

On-line demands:

using uniprogramming - every problem would have to be
finished in response time of highest priority.

Man-Machine Cooperation,

human judgment - very hard to program, or requiring a large no. of cases,
eg. analog computers.

Multiprog Standards:

1. each prog. indep. written & compiled
2. minimum of machine's features are placed beyond the programmer's direct influence
3. Amt. of additional info. required from programmer - held to a minimum
4. No program should be allowed to introduce error or undue delay into any other program.
5. Machine malfunctions and programming errors which cause internal alarms should be analysed by supervisor prog. to determine which prog. & communicate to man!
6. Routine scheduling done by supervisor - can be overridden by operating staff.
7. Allocation of storage & I/O by needs of programs being done.
8. accounting for machine time done by supervisor.