



**IBM**

# practice problems

**705 ELECTRONIC  
DATA-PROCESSING MACHINE**

**ACTUAL AND AUTOCODER PROGRAMMING**

Form 22-6731-0

**PROBLEM 1. INPUT-OUTPUT (Tape to Card)**

Input - tape unit  
Output - card punch

- a. Read the record into memory from tape unit.
- b. Write the record on a card punch from memory.

Field	No. of Characters	Example	Memory Address
Employee No.	5	BC232	0800-0804
Social Security No.	9	089280730	0813
Withholding tax class	2	04	0815
Rate	4	0202	0819
Group mark (control panel)			0820

**PROBLEM 2. INPUT-OUTPUT (Card to Tape)**

Input - card reader  
Output - tape unit

- a. Read the record into memory from card reader.
- b. Write the record on a tape unit.

Field	No. of Characters	Example	Memory Address
Part No.	6	JG43-4	6001-6006
Description	14	GASKETbbbbbbbbb	6020
Cost	6	015975	6026
Minimum balance	3	040	6029
Quantity	4	0103	6033

Note: Assume that a group mark has been placed in memory location 6034.

PROBLEM 3. INPUT-OUTPUT

Input - card reader  
Output - tape and printer

- a. Read the record into memory.
- b. Write complete record on tape.
- c. Write partial record on printer starting with customer number.

Field	No. of Characters	Example	Memory Address
Name	16	JohnbAdamsbbbbbb	11001-11016
Customer number	7	1359670	11023
Amount	6	001359	11029
Group mark (control panel)			11030

PROBLEM 4. ADDITION

- a. Factors A and B are on tape record. Read this record into memory and add factors in acc. 00 to produce total.
- b. Place total in memory area as shown below.
- c. Write the completed record on tape.

Field	No. of Characters	Example	Memory Address
		b	9000
A	6	058231 <sup>+</sup>	9006
B	7	0094817 <sup>+</sup>	9013
T	7	bbbbbbb	9020

Note: Assume that a group mark has been placed in memory location 9021.

PROBLEM 5. ADDITION/SUBTRACTION

- a. Read the record from tape.
- b. Using auxiliary storage unit (ASU) 06 compute:  
base pay + overtime pay - deductions = net pay.
- c. Write the completed record on tape.

Field	No. of Characters	Example	Memory Address
Employee No.	6	41782A	9990-9995
Base pay	5	11050 <sup>†</sup>	10000
Overtime pay	4	0925 <sup>†</sup>	10004
Deductions	4	1775 <sup>†</sup>	10008
Net pay	5	bbbbbb	10013

Note: Assume that a group mark has been placed in memory location 10014.

PROBLEM 6. MULTIPLICATION

- a. Read a record containing factors A and B into memory from tape unit 0205.
- b. Using acc. 00, compute product and place in memory area as shown below.
- c. Write the completed record on tape unit 0202.

Field	No. of Characters	Example	Memory Address
		b	30498
A	6	023489 <sup>†</sup>	30504
B	3	990 <sup>†</sup>	30507
P	9	bbbbbbbbb	30516

Note: Assume that a group mark has been placed in memory location 30517.

PROBLEM 7. MULTIPLICATION

Read a record into memory from tape and make the following calculations:

- a. Quantity per assembly x assemblies required = total quantity required.
- b. Total quantity required x unit cost = total cost.
- c. Adjust total cost to the nearest cent.
- d. Adjust total for storage in memory.

Write the completed record from memory on tape.

Field	No. of Characters	Example	Memory Address
Part No.	6	4F971J	0901-0906
Quantity per assembly	4	0139 <sup>†</sup>	0910
Unit cost (3 decimals)	5	02938 <sup>†</sup>	0915
Assemblies required	2	27 <sup>†</sup>	0917
Quantity required	6	bbbbbb	0923
Total cost	7	bbbbbbb	0930

Note: Assume that a group mark has been placed in memory location 0931.

PROBLEM 8. PARTIAL PAYROLL PROBLEM

- a. Read a record into memory from tape unit 0200.
- b. Compute gross pay, current withholding tax, and net pay.
- c. Store results in memory.
- d. Write completed record on tape unit 0201.

$$\begin{aligned}
 \text{Gross pay} &= \text{Hours worked} \times \text{rate.} \\
 \text{Current with.} &= \{ \text{Gross pay} - (\text{Tax CL} \times 13.00) \} \times 18\%. \\
 \text{Net pay} &= \text{Gross pay} - \text{Current with.} - \text{Deductions.}
 \end{aligned}$$

Field	No. of Characters	Example	Memory Address
Name	16	John J. Doe	9030
Department No.	2	01 <sup>+</sup>	9032
Tax CL.	1	3 <sup>+</sup>	9033
Rate per hour (3 decimals)	4	1547 <sup>+</sup>	9037
Hours worked (1 decimal)	3	425 <sup>†</sup>	9040
Deductions (2 decimals)	5	01020̄	9045
Current with.	5	bbbbb	9050
Gross pay	5	bbbbb	9055
Net pay	5	bbbbb	9060

Constant

Exemption amt.	5	b1300̄	9503
Tax percentage	2	18̄	9505

Note: Assume that a group mark has been placed in memory location 9061.

PROBLEM 9. DIVISION

- a. Read a record into memory from tape.
- b. Divide A by B to develop Q (quotient).
- c. Write the completed record on tape.

Field	No. of Characters	Example	Memory Address
		b	27600
A (4 decimals)	7	213084 <sup>†</sup>	27607
B (2 decimals)	2	67 <sup>†</sup>	27609
Q (1 decimal)	6	bbbbbb	27615

Note: Assume that a group mark has been placed in memory location 27616.

PROBLEM 10. DIVISION

- a. Read the record into memory from tape.
- b. Compute % material accepted.  

$$\frac{\text{quantity accepted}}{\text{quantity received}} = \% \text{ accepted}$$
 Adjust % to nearest 1/10 of one percent.
- c. Write the completed record on tape.

Field	No. of Characters	Example	Memory Address
Part No.	6	032615 <sup>†</sup>	1290
Quantity received	4	1100 <sup>†</sup>	1294
Quantity accepted	3	900 <sup>†</sup>	1297
% Accepted	3	bbb	1300

Note: Assume that a group mark has been placed in memory location 1301.

PROBLEM 11.

Memory	Accumulator Before	Acc. Sign	Accumulator After	Acc. Sign
ADD $\overset{+}{3}\overset{+}{265}$ $\overset{+}{b}79$ A650	a55 a33 a320	+ + -		
SUB $\overset{++}{6}\overset{+}{3276}$ b38 $\overset{+}{A}87$	a200 a38 a14	+ + -		
R ADD $\overset{+}{3}\overset{-}{721}$ $\overset{+}{AB}124$ b318	a0 a91 aCA4	+ - -		
R SUB    A127 $\overset{+}{6}\overset{-}{322}$ $\overset{+}{1837653}$	a0 a1279 a6273	+ - +		
MPY $\overset{+}{5}\overset{+}{25}$ b330 $\overset{+-}{55}$	a4 a02 a6	+ - -		
DIV $\overset{+}{2}\overset{+}{22}$ $\overset{+}{b}20$ $\overset{+}{A}5$	a088 a600 a0295	- + +		
STORE $\overset{+}{3}\overset{+}{7298}$ $\overset{-}{6}\overset{++}{5421}$ ABC215	a22 a321 a216	- + +		



PROBLEM 12. LOAD/COMPARE

- a. Store part no. J-123 as a constant in ASU 01.
- b. Read a record into memory from tape.
- c. Compare the constant part number against the part number read from the record.  
 If constant is higher than record read, write the record on tape.  
 If constant is equal to record read, write the record on printer.  
 If constant is lower than record read, stop the machine.

Field	No. of Characters	Example	Memory Address
Part No.	5	B9765	19541-19545
Part location	3	327	19548
Unit cost	5	03750	19553
Constant			
Part No.	5	J-123	13000-13004

Note: Assume that a group mark has been placed in memory location 19554.

PROBLEM 13. SEQUENCE CHECK

- a. Read a record from tape unit 0200.
- b. Check the file for ascending part number sequence.
- c. If out-of-sequence or equals, write record on printer and read in next record.
- d. If in-sequence, develop unit cost, write completed record on tape and read next record.

Field	No. of Characters	Example	Memory Address
Part No.	5	34567 <sup>†</sup>	35504
Total cost (2 decimals)	6	012000 <sup>†</sup>	35510
Total quantity	5	00800 <sup>†</sup>	35515
Unit cost (3 decimals)	5	bbbbbb	35520

Note: Assume that a group mark has been placed in memory location 35521.

PROBLEM 14. END OF FILE

- a. Read the record from tape.
- b. Check for end of file on input tape.
- c. If end of file, develop a sub-routine to do the following:
  1. Rewind input tape.
  2. Put tape mark on output tape.
  3. Rewind output tape.
  4. Type instructions to the operator.
  5. Stop.
- d. If not end of file, compute total cost (quantity x unit cost) and write the completed record on tape.

Field	No. of Characters	Example	Memory Address
Part No.	6	13700 <sup>†</sup> 1	19000-19005
Quantity	4	0125 <sup>†</sup>	19009
Unit cost	4	0050 <sup>†</sup>	19013
Total cost	8	bbbbbbbb	19021

Constants

Remove No. 1 and 2 tapes	0156-0179
Group mark	0180

PROBLEM 15. END OF FILE

- a. Read a record from tape unit 0200.
- b. Compute:
 
$$\frac{\text{Y-T-D issues}}{\text{months}} = \text{monthly usage}$$
- c. Write the record on tape unit 0201.
- d. Check for end of file on input and output tapes.
  - If end of file on input:
    1. Rewind input tape.
    2. Put TM on output tape.
    3. Rewind output tape.
    4. Stop.
  - If end of file on output tape:
    1. Put TM on output tape.
    2. Rewind output tape.
    3. Stop.

Field	No. of Characters	Example	Memory Address
Part No.	6	D36501 <sup>†</sup>	12073-12078
Y-T-D issues	6	076325 <sup>†</sup>	12084
Months	2	02 <sup>†</sup>	12086
Monthly usage	5	bbbbb	12091
Constant			
Group mark			2000

PROBLEM 16. RECEIVE AND TRANSMIT USING ACC. 00

- a. Read the record into memory locations 6000-6499 from tape unit 0200. There is a RM as the last character of each record.
- b. Transmit each record to the output area starting with memory location 11560.
- c. Write the record on tape unit 0201.

Constant	Memory Address
Group mark	1505

PROBLEM 17. RECEIVE AND TRANSMIT USING ASU 01-15

- a. Read the record from tape unit 0200.
- b. Transmit each field to output area.
- c. Write the record on tape unit 0201.

Field	No. of Characters	Example	Memory Address
<u>Input Area</u>			
A	4	AB36	1017-1020
B	7	0017510	1027
C	4	369J	1031
<u>Output Area</u>			
C	4	369J	6212-6215
A	4	AB36	6219
B	7	0017510	6226
Constant			
Group mark			0905

PROBLEM 18. RECEIVE AND TRANSMIT USING ASU 06

- a. Read master record from tape unit 0200 into memory location 16035.
- b. Read variation record from tape unit 0202 into memory location 19361.
- c. Compare employee number in variation record against employee number in master record. If equal:
  - Replace rate in master record with new rate from variation record.
  - Move corrected master record to output work area 5050-5064.
  - Write the record on tape unit 0201.
 If variation record is low:
  - Write variation record on typewriter.
 If master record is low:
  - Move master record to output work area 5050-5064.
- d. Write the record on tape unit 0201.

Field	No. of Characters	Example	Memory Address
<u>Master Input Area</u>			
Employee No.	5	32561	16035-16039
Rate	4	1650	16043
Tax class	2	03	16045
Std. Hrs.	3	400	16048
RM	1	+ +	16049
<u>Variation Input Area</u>			
Employee No.	5	32561	19361-19365
Rate	4	1735	19369
<u>Constant</u>			
Group mark			10000

**PROBLEM 19. READ WHILE WRITING**

- a. Read a record into memory location 6000-6479 from tape unit 0200.  
There is a record mark as the last character of each record.
- b. Transmit each record to the output work area starting with memory location 11580.
- c. Read while writing.
- d. Write the record on tape unit 0201.

Constant	Memory Address
Group mark	1505

**PROBLEM 20. READ WHILE WRITING**

- a. Read the record from tape unit 0200.
- b. Transmit the fields to output work area leaving two blanks between fields.
- c. Read while writing.
- d. Write the record on tape unit 0201 for later tape-printer conversion.

Field	No. of Characters	Memory Address	
		<u>Input</u>	<u>Output</u>
Payroll No.	3	1000-1002	15063-15065
Employee No.	6	1008	15068-15073
Insurance benefits	5	1013	15076-15080
Advances	5	1018	15083-15087

Constant

Group mark 2005

ASU Set L

12 3 positions

13 5 positions

14 6 positions

PROBLEM 21. Page 1 of 2

Memory	Acc. Storage Before	Acc. Sign	Acc. Storage After	Acc. Sign	Check Indicators
ADD	$\begin{matrix} + & + \\ 6573 \end{matrix}$	a61	-		
	b82V	a134	+		
	$\begin{matrix} + \\ 62243 \end{matrix}$	a3765	+		
SUB	A827	a28	-		
	$\begin{matrix} + & + \\ 7376 \end{matrix}$	a12781	+		
	$\begin{matrix} + \\ 73274 \end{matrix}$	a3274	-		
R ADD	b83S	a7215	-		
	$\begin{matrix} + \\ K375 \end{matrix}$	a16	+		
	$\begin{matrix} + \\ 54381 \end{matrix}$	a9654	+		
R SUB	$\begin{matrix} + \\ 421 \end{matrix}$	a521	+		
	$\begin{matrix} - \\ b538X \end{matrix}$	a151	-		
	$\begin{matrix} + \\ 53743 \end{matrix}$	a9	+		
MPY	$\begin{matrix} - & - \\ 560 \end{matrix}$	a5	-		
	$\begin{matrix} + \\ D120 \end{matrix}$	a003	+		
	b15	a325	-		
DIV	$\begin{matrix} + & + \\ 765 \end{matrix}$	a70	+		
	$\begin{matrix} + \\ b5 \end{matrix}$	a075	+		
	$\begin{matrix} + \\ b5 \end{matrix}$	a75	+		
	A9	a81	+		
LOAD	$\begin{matrix} + \\ A36 \end{matrix}$	a9	-		
	DOEbj	a65431	+		
	$\begin{matrix} + \\ 563AB5 \end{matrix}$	a32761	+		

	Accumulator Storage	Acc. Sign	Memory Before	Memory After
STORE	a37	-	<sup>+</sup> 643382	
	a37982	+	<sup>+</sup> <sup>+</sup> <sup>+</sup> A65213A	
	a21	+	DOEb1 <sup>+</sup>	
	a7	-	bA76532	
UNLOAD	a219	+	bAB5600 <sup>+</sup>	
	aDOEbJ	+	DOEbM56 <sup>-</sup>	
	a15	-	<sup>+</sup> 77B4681 <sup>-</sup>	

Instruction	Accumulator Storage Before	Acc. Sign	Accumulator Storage After	Acc. Sign
SHOR 0001	a3976	+		
LENG 0002	a7653	+		
SHOR 0002	a375	-		
LENG 0000	a5762	+		
SET L 0004	a006512	+		
SET L 0005	a372	-		
ROUND 0001	a796	+		
ROUND 0003	a37352	+		
ROUND 0004	a68712	-		



PROBLEM 22. PAYROLL

- a. Read the record from tape and transmit to output area.
- b. Compute:
  1. Withholding tax =  $(\text{gross} - (\text{tax class} \times 1300)) \times 18\%$   
If no tax, store zeros.
  2. F.I.C.A. = 2% of current gross that is taxable. (No earnings over \$4200 are taxable.) If no tax, store zeros.
  3. Net pay = gross - withholding - F.I.C.A.
- c. Adjust Y-T-D withholding and earnings and quarterly F.I.C.A.
- d. Read while writing.
- e. Write the record on tape.
- f. Check for end of file. Assume one reel of input records.

Field	No. of Characters	Example	Memory Address
<u>Input</u>			
Pay period	2	13	1150-1151
Man No.	5	48962	1156
Tax class	1	5	1157
Y-T-D earnings	6	41500	1163
Y-T-D with.	6	05207	1169
Quarterly F.I.C.A.	4	3945	1173
Gross pay	5	18575	1178
Record mark	1	†	1179
<u>Output</u>			
Pay period	2	13	12020-12021
Man No.	5	48962	12026
Tax class	1	5	12027
Y-T-D earnings	6	41500	12033
Y-T-D with.	6	05207	12039
Quarterly F.I.C.A.	4	3945	12043
Gross pay	5	18575	12048
Current with.	4	bbbb	12052
Current F.I.C.A.	3	bbb	12055
Net pay	5	bbbbb	12060
<u>Constants</u>			
		-	
		1300	1000-1003
		18	1005
		2	1006
420000			1012
Group mark			1013

PROBLEM 23. DRUM SEARCH

- a. The cost of each labor ticket is to be applied against its shop order number. Each labor ticket (a punched card) has a seven-digit s.o. number and a four-digit suffix number. The suffix number is the number of the drum section where the s.o. number and the cumulative labor cost are stored.
- b. In each drum section there are 14 s.o. numbers with their associated cumulative costs arranged in ascending sequence. The DM will be in the 190th position of each drum section.
- c. Read the card record and read the proper drum section into memory.
- d. Search memory for the matching s.o. number and adjust the cumulative cost. If the s.o. number is not found by subtracting 1 from constant 13 and transferring on zero, stop the machine.
- e. Write the adjusted information back on the drum.

Field	No. of Characters	Example	Memory Address
<u>Card Record</u>			
Man No.	5	07163	4001-4005
Shop order No.	7	QR7170B	4012
S.O. suffix	4	1206	4016
S.O. cost	5	b0941	4021
<u>Drum Record</u>			
S. O. No.	7	QR5133A	2001-2007
Cost	7	0012395 <sup>†</sup>	2014
S. O. No.	7	QR7170B	2021
Cost	7	0048636 <sup>†</sup>	2028
Other S. O. Nos. & cost			2029-2189
<u>Constants</u>			
Address of 1st S. O.			
No. from drum	5	b2007 <sup>†</sup>	5004
Adjust for next			
S. O. No.	4	0014 <sup>†</sup>	5008
Adjust for cost	4	0007 <sup>†</sup>	5012
For counter	2	13 <sup>†</sup>	5014
For counter	1	1 <sup>†</sup>	5015
Group mark			5016

PROBLEM 24. READING PROGRAM INSTRUCTIONS FROM DRUM

- a. A program containing 1596 instructions is stored on the drum.
- b. 1596 instructions are equal to 7980 characters. The instructions are arranged in four groups of 399 instructions. A drum mark is at the end of each group.
- c. The first 399 instructions (1995 characters) are on drum sections 1014-1023. The next 399 instructions are on drum sections 1024-1033, and so on.
- d. Read each group of instructions into memory starting with location 7750.
- e. Adjust the SEL instruction address to bring in the next group of 399 instructions. When the fourth group is brought to memory, provision should be made to restore the SEL instruction address to the first group. The first instruction of the last group should accomplish this.

Constants	Memory Address
$\begin{array}{c} + \\ b10 \\ + \\ 1014 \end{array}$	1531-1533
	1537

PROBLEM 25. ERROR CORRECTION ROUTINE

- a. Read the record from tape unit 0200.
- b. Check for read-write error.
- c. If error, backspace tape and read again. Third error, backspace tape and read one more time. If error persists, stop the machine.
- d. If no error, compute salesman's commissions.
- e. Write completed record on tape.

Field	No. of Characters	Example	Memory Address
Salesman No.	3	$\begin{array}{c} + \\ 369 \\ + \end{array}$	6363-6365
Commission %	2	$\begin{array}{c} + \\ 04 \\ + \end{array}$	6367
Sales amount	7	0120990	6374
Commission amount	6	bbbbbb	6380

Constants

$\begin{array}{c} + \\ b2 \\ + \\ 1 \end{array}$	5000-5001
Group mark	5002
	5003

PROBLEM 26. TRANSFER ANY TO DETECT END OF FILE AND READING  
ERRORS USING NORMALIZE AND TRANSFER COUNTER

- a. Read a record from tape into memory location 19000-19105 and check for end of file and reading errors.
- b. If end of file, rewind input tape and stop.
- c. If a read error occurs, reread record two more times. If error persists, stop.
- d. If not end of file or read error, write the record on the printer.
- e. Develop programs only to interrogate for end of page, read-write error and printer-punch error indications.
- f. Use Normalize and Transfer for a counter.

Constants

Memory Address

Group mark

17003

- I. Two signed fields are to be compared in memory. What instructions would be necessary to execute the comparison?
  
- II. It is desired to compare a field which has been placed in memory by a Store instruction against an unsigned field in memory. What instructions would be necessary to place the signed field in accumulator storage and execute the comparison?
  
- III. Show the instructions necessary to divide Inventory Value (xxxxx.xx) located at 4063 by Inventory Quantity (xxxx) located at 4067 to arrive at unit cost (xx.xxx). Round to nearest mil and store cost in memory at 4072. All fields are signed.
  
- IV. Under what conditions will the overflow check indicator be turned ON? How is it turned OFF?
  
- V. Explain the differences between the Unload and Store instructions.
  
- VI. What is the factor that stops the execution of the following instructions?

R ADD	Load
Read (from tape)	Read (from drum)
Unload	Compare
Subtract	Multiply
Write 00	ADD Memory (signed field)
Write 01	ADD Memory (unsigned field)
Read (from card)	Transmit 00
Store	Transmit 01-15

PROBLEM 27. Page 2 of 2

- VII. As the result of multiplication, how many digits result in the product?  
As the result of division, how many digits result in the quotient?
- VIII. Accumulator storage unit 00 contains the factor 0145638. Issue the necessary Shift instructions to arrive at factor 1500.
- IX. What conditions turn on input or output indicators on the following units?  
Tape (Write Status)  
Tape (Read Status)  
Card Reader  
Printer  
Drum
- X. How is it possible to differentiate between the various auxiliary storage units?
- XI. What causes the Tr Any instruction to be effective?
- XII. (a) What causes the RW check indicator to turn on when writing from memory to the printer?

PROBLEM 28. LOW NUMBER SEARCH

Three five-digit numbers are stored in memory as signed numerical fields. By programming, determine which is the lowest number. Store it in memory location 9004 and stop the machine. None of the numbers will be equals.

Field	Example	Memory Address
1st No.	01765 <sup>+</sup>	5774
2nd No.	00321 <sup>+</sup>	5779
3rd No.	76512 <sup>+</sup>	5884

Combination of numbers as they could appear in memory.

01765 <sup>+</sup>	00321 <sup>+</sup>	76512 <sup>+</sup>
5774	5779	5884
76512 <sup>+</sup>	01765 <sup>+</sup>	00321 <sup>+</sup>
5774	5779	5884
00321 <sup>+</sup>	76512 <sup>+</sup>	01765 <sup>+</sup>
5774	5779	5884

PROBLEM 29. INSTRUCTION MODIFICATION PROBLEM;  
 ADDING 100 FACTORS

- Assume that during the processing of a problem 100 three-digit factors have been developed in memory starting with location 1001. 100 six-digit totals have also been developed and are in memory starting with location 1301.
- Add each three-digit factor to a corresponding six-digit total. All of the fields are signed.

Constants	Example	Memory Address
	b0003 <sup>+</sup>	1900-1904
	0006 <sup>+</sup>	1908
Add. of 1st 3-digit total	1003 <sup>+</sup>	1912
Add. of 1st 6-digit total	1306 <sup>+</sup>	1916
Add. of last 3-digit total	1300 <sup>+</sup>	1920

xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>
1	1	1	1	1	1	1
0	0	0	0	2	2	3
0	0	0	1	9	9	0
3	6	9	2	4	7	0

xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>	xxxxx <sup>+</sup>
1	1	1	1	1	1	1
3	3	8	8	8	9	
0	1	8	9	0		
6	2	8	4	0		

PROBLEM 30. CHANGE TAPE ADDRESS ON END OF FILE

- Read a record to be located at memory position 1000 and check for end of file.
- If end of input file, rewind tape and change to alternate tape address (0201 or 0205).
- Write a record and check for end of file.
- If end of output file, record TM, rewind and change to alternate tape address (0202 or 0204).

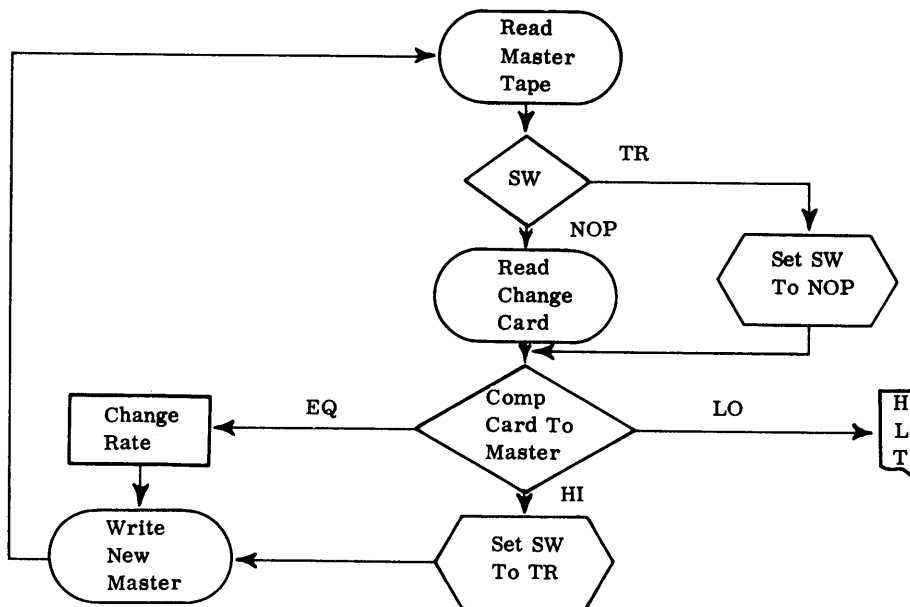
Constants	Memory Address
b06 <sup>+</sup>	13065
0201 <sup>+</sup>	13069
0202 <sup>+</sup>	13073



PROBLEM 31. NOP/TR SWITCH

- a. A master payroll record is on tape unit 0200. Rate change cards affecting this record are on card reader 0100.
- b. Match the change cards against the master record by employee number. There is only one rate change card for any one employee.
- c. If the card is low (unmatched), stop the machine.
- d. If the card record is high (no rate change), write out the master record on tape unit 0201 and read another master record.
- e. If the card and master records are equal, place the new rate in the master record, write on tape unit 0201, and read another master record and change card.

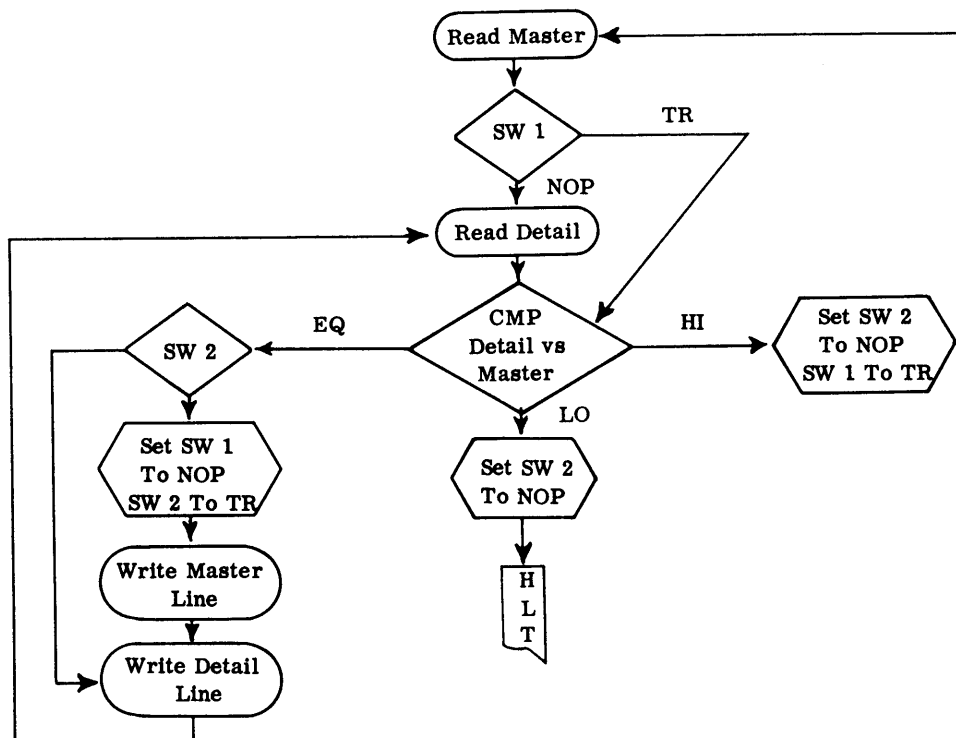
Field	No. of Characters	Example	Memory Address
<u>Master Record</u>			
Employee No.	5	64027	3001-3005
Name	16	HbJbJONESbbbbbbb	3021
S. S. No.	9	094612397	3030
Rate	3	150	3033
<u>Change Card</u>			
Employee No.	5	64027	2021-2025
Rate	3	158	2028
<u>Constant</u>			
Group mark			1560



PROBLEM 32. NOP/TR SWITCH

- a. A master inventory record is on tape unit 0200. Detail transactions affecting this file are on tape unit 0202.
- b. Match the master and detail records.  
 If detail is low, stop the machine.  
 If detail is high, read another master record and compare. (Only write records on which there is activity.)  
 If detail and master are equal, write the master record and the following detail transactions on tape unit 0201.

Field	No. of Characters	Example	Memory Address
<u>Master Record</u>			
Product No.	4	B439	4001-4004
Product description	20	Carburetor	4024
Quantity	4	0024	4028
Unit cost	6	019050	4034
Value	7	0024950	4041
<u>Detail Record</u>			
Product No.	4	B439	5020-5023
Unit cost	6	019050	5029
Quantity	4	0008	5033
<u>Constant</u>			
Group mark			1563



PROBLEM 33. DIGIT SELECTION; VARIABLE INTERVAL CODE

- a. A transaction record can contain one of five 2-digit codes.
- b. Develop a program to transfer to a different sub-routine for each of the five codes.

Field	No. of Characters	Example	Memory Address
State code	2	b09 <sup>+</sup>	0908-0910
Constants		01	0611-0612
		04	0614
		09	0616
		26	0618
		34	0620

PROBLEM 34. DIGIT SELECTION; UNIFORM INTERVAL CODE

- a. A transaction record can contain codes 0-7.
- b. Transfer to a sub-routine for the eight codes and stop if codes 8 or 9 are present.
- c. Use the method of modifying a Transfer instruction to direct the program to the proper sub-routine.

Constants	Example	Memory Address
Code	b6 <sup>+</sup>	0909-0910
Instruction interval	005 <sup>+</sup>	0913
Address of 1st code	9979 <sup>+</sup>	0917

PROBLEM 35. TABLE LOOK-UP Page 1 of 2

a. Search the table of items given below for the number 54, using the formula:

$$1. \frac{N_0 + 1}{2} = N_1 \text{ (rounded)}$$

$$2. \frac{N_1}{2} = N_2 \text{ (rounded)}$$

$$3. \frac{N_2}{2} = N_3 \text{ (rounded)}$$

The formula is repeated until the number is located.  $N_0$  is equal to the number of items in the table.

b. Certain facts about the table look-up procedure must be established:

1. The reference portion of the items in the table must be in ascending sequence.
2. The length of all the items in the table, including the reference facts within each item, must be equal.
3. The number of factors in the table must be known.
4. The address in memory of both the first and last items in the table must be known.

c. Items: 44, 48, 50, 54, 59, 66, 69, 71, 77, 82

Item	Example	Memory Address
1	<del>44</del>	0901
2	<del>48</del>	0903
3	<del>50</del>	0905
4	<del>54</del>	0907
5	<del>59</del>	0909
6	<del>66</del>	0911
7	<del>69</del>	0913
8	<del>71</del>	0915
9	<del>77</del>	0917
10	<del>82</del>	0919

Constant Data

Number items in table plus one	b11	1001
Constant .5	5	1002
Length of items	02	1004
Calculating address for searching table	0899	1008

Constant Data	Example	Memory Address
Number to be located in table	5 <sup>+</sup>	1010
Minus one	0 <sup>-</sup>	1012
Constant one	01	1014
Address of first item	0901	1018
Address of last item	0919	1022

PROBLEM 36. SALES DISCOUNT PROBLEM (AUTOCODER SOLUTION)

- The following sales record is on tape unit 0200.
- Calculate discount percent, amount and net sales.
- When gross sales exceed \$100.00, allow 3% discount.
- When gross sales are \$100.00 or less, allow 2% discount.
- Write record onto tape 0201.

Sales Record	No. of Characters	Example
Invoice No.	6	12849B
Date	5	06105
Cust. name and address	33	A. B. Jones
Gross sales (2 decimals)	6	004995 <sup>+</sup>
Discount % (2 decimals)	2	bb
Discount amt.	5	bbbbb
Net sales	6	bbbbb <sup>+</sup>
Group mark	1	<sup>+</sup>
Constant Data (DCON optional)		
2 percent	2	0 <sup>+</sup> <sub>2</sub>
3 percent	2	0 <sup>+</sup> <sub>3</sub>
One hundred	6	01000 <sup>0</sup>

PROBLEM 37. STORE FOR PRINT (AUTOCODER SOLUTION)

- Read record from tape unit 0200.
- Calculate quantity x unit cost = value.
- Store all fields for printing with one space between each field, decimal points in unit cost and value fields, and comma in value fields as follows:

	Item	Item	Qty.	Unit Cost	Value
Output Record	Code b	Descript b	xxxxx b	xx.xxx b	x,xxx,xxx.xx b ‡

- Write out record on tape unit 0201, restore commas, and read in new records.

Fields	No. of Characters	Example
<u>Input Record</u>		
Item Code	6	493DUX
Description	30	POWER UNIT CHASSIS
Quantity	5	01640 <sup>+</sup>
Unit Cost (3 decimals)	5	10461 <sup>+</sup>

Quantity, unit cost and value will always be plus.

PROBLEM 38. ALTERNATOR (AUTOCODER SOLUTION)

- A record is read from tape unit 0200 into PAY RCD.
- In case of reading error, re-read record. If error occurs on second read, stop the machine.

Field	No. of Characters	Example
Constant Data		
	1	-
	1	5

PAY RCD 

xx
--

PROBLEM 39. WRITE AND ERASE (AUTOCODER SOLUTION)

- a. A sales record is on tape unit 0200. The record includes sales value by salesman, state and district.
- b. Arrange the record for printing on printer 0400 as shown below.
- c. Write the program to recognize a change in district and state number. Print each different district and state number only once as follows:

District	State	Salesman	Sales
01	04	Jones	6784.63
		Larvson	15562.18
		Monet	965.42
	09	Askins	8641.89
		Thomas	3562.17
02	03	Bell	9852.65

Field	No. of Characters	Example
<u>Input Record</u>		
District	2	01
State	2	04
Salesman	20	Jones
Sales	7	0678463
<u>Print Record</u>		
Carriage Control Char	1	0 or 1
District	2	01
Blanks	3	bbb
State	2	04
Blanks	3	bbb
Salesman	20	Jones
Blanks	3	bbb
Sales	8	b6784.63
Blank	1	b
Group Mark	1	‡
(Blanks are for spacing between fields.)		
<u>Constants (DCON Optional)</u>		
Decimal point	1	.
District (prev.)	2	00
State (prev.)	2	00
Group mark	1	‡

PROBLEM 40. CARRIAGE CONTROL (AUTOCODER SOLUTION)

- a. Write additional instructions to Problem 39 to double space between districts and skip to channel 1 on overflow. Additional constant data is available as follows:

Field	No. of Characters	Example
Zero	1	† 0
One	1	† 1

PROBLEM 41. NORMALIZE AND TRANSFER (AUTOCODER SOLUTION)

- a. A six position amount field in ASU 01 is to be stored for printing in memory, for example, at address 7090.  
 b. Place dollar sign (\$) and decimal point (.) in proper positions in memory for printing amount.  
 c. Replace insignificant zeros to the left of the decimal point with asterisks (\*).

Field	No. of Characters	Constant Data
	1	\$
	1	.
	1	*
	4	000†
Address of \$	4	
Control Address of *	4	
Calc. Address	4	
Control counter		

Input | 0 0 0 0 7 9 |

Output | \$ \* \* \* \* . 7 9 b |

ASU  
 6 | a 0 0 0 0 7 9 + |