

1) $F(A, B, C, D) = \sum (0, 2, 7, 11, 12, 14) + d(3, 4, 5, 6)$

The table will be :-

| | | Step-2 | | | Step-3 | |
|----|--------|--------|------------------|--------------|--------|---------------------|
| | Step-1 | | | | | |
| 0 | 0000 | ✓ | (0, 2) (0, 4) | 00-0 0-00 | ✓ ✓ | (0, 2, 4, 6) 0--0 |
| 2 | 0010 | ✓ | (2, 3) | 001- | ✓ | (2, 3, 6, 7) 0-1- |
| 4 | 0100 | ✓ | (2, 6) | 0-10 | ✓ | (4, 5, 6, 7) 01-- |
| | | | (4, 5) | 010- | ✓ | (4, 6, 12, 14) -1-0 |
| | | | (4, 6) | 01-0 | ✓ | |
| | | | (4, 12) | -100 | ✓ | |
| 3 | 0011 | ✓ | (3, 7) | 0-11 | ✓ | |
| 5 | 0101 | ✓ | (3, 11) | -011 | ✓ | |
| 6 | 0110 | ✓ | (5, 7) | 01-1 | ✓ | |
| 12 | 1100 | ✓ | (6, 7) | 011- | ✓ | |
| | | | (6, 14) | -110 | ✓ | |
| | | | (12, 14) | 11-0 | ✓ | |
| 7 | 0111 | ✓ | | | | |
| 11 | 1011 | ✓ | | | | |
| 14 | 1110 | ✓ | | | | |

| | 0 | 2 | 7 | 11 | 12 | 14 |
|--------|---|---|---|----|----|----|
| $A'D'$ | x | x | | | | |
| $A'C$ | | x | x | | | |
| $A'B$ | | | x | | | |
| BD' | | | | | x | x |
| $B'CD$ | | | | x | | |

$$\therefore Y = A'D' + A'C + BD' + B'CD$$

A

P.T.

2) The truth table for comparator system (C) that takes 3-bit binary numbers [A, B and C] as inputs and outputs:-

| A | B | C | A-3 | 2B | A-3 < 2B |
|---|---|---|-----|----|----------|
| 0 | 0 | 0 | -3 | 0 | 1 |
| 0 | 0 | 1 | -3 | 0 | 1 |
| 0 | 1 | 0 | -3 | 2 | 1 |
| 0 | 1 | 1 | -3 | 2 | 1 |
| 1 | 0 | 0 | -2 | 0 | 1 |
| 1 | 0 | 1 | -2 | 0 | 1 |
| 1 | 1 | 0 | -2 | 2 | 1 |
| 1 | 1 | 1 | -2 | 2 | 1 |

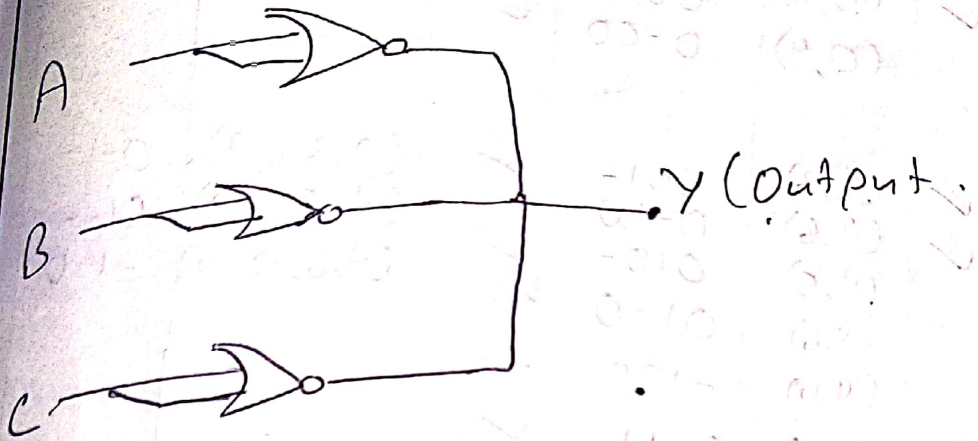
K-map of the table:-

| AB C | AB | A'B' | A'B | AB | AB' |
|-----------------|----|------|-----|----|-----|
| C' | 1 | 1 | 1 | 1 | 1 |
| C | 1 | 1 | 1 | 1 | 1 |

Groups:- (0, 1, 2, 3, 4, 5, 6, 7)

$$f(A, B, C) = 1$$

Design of circuit will be:-

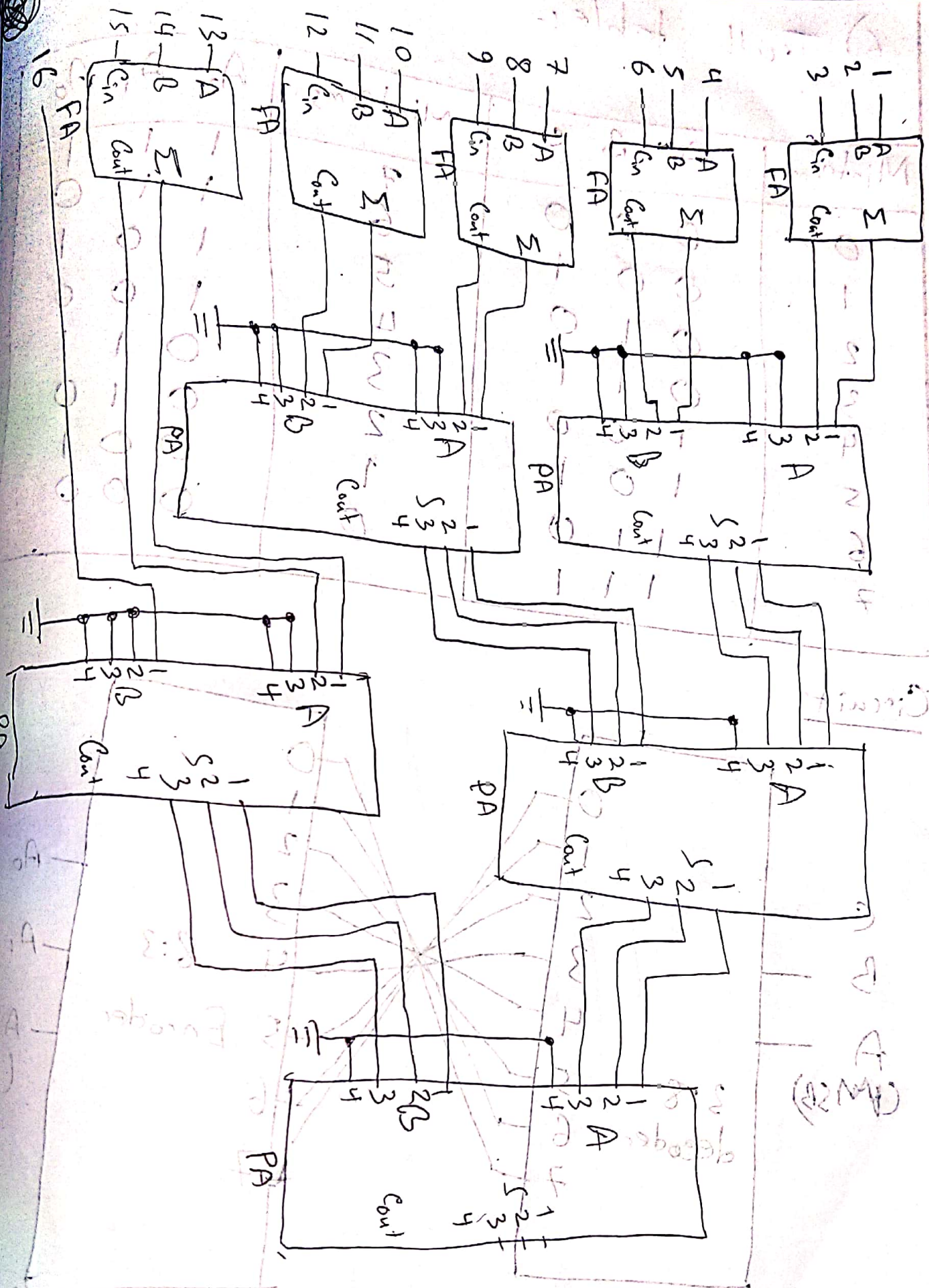


A

P.T.O →

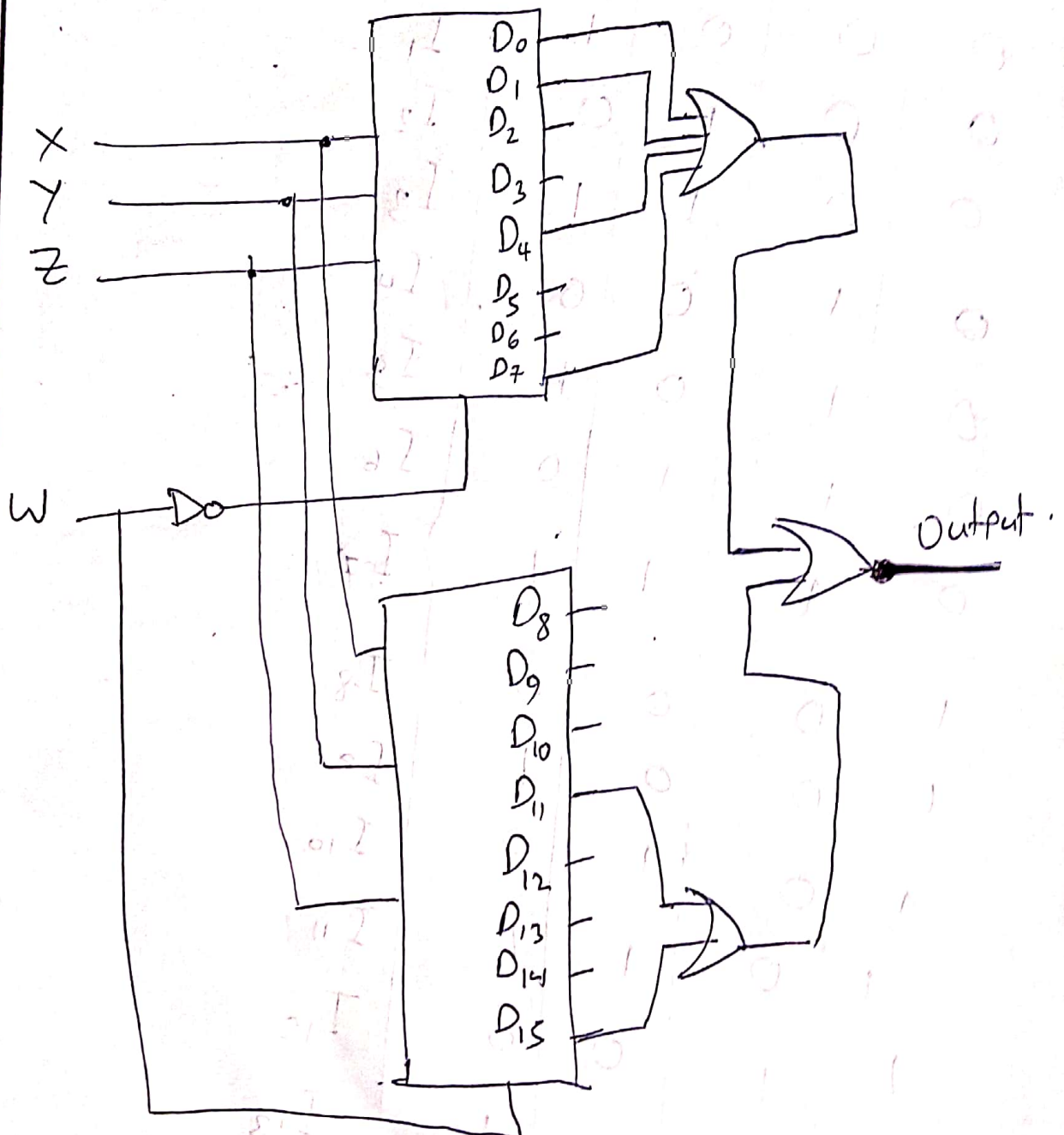
3

16 Person voting system.

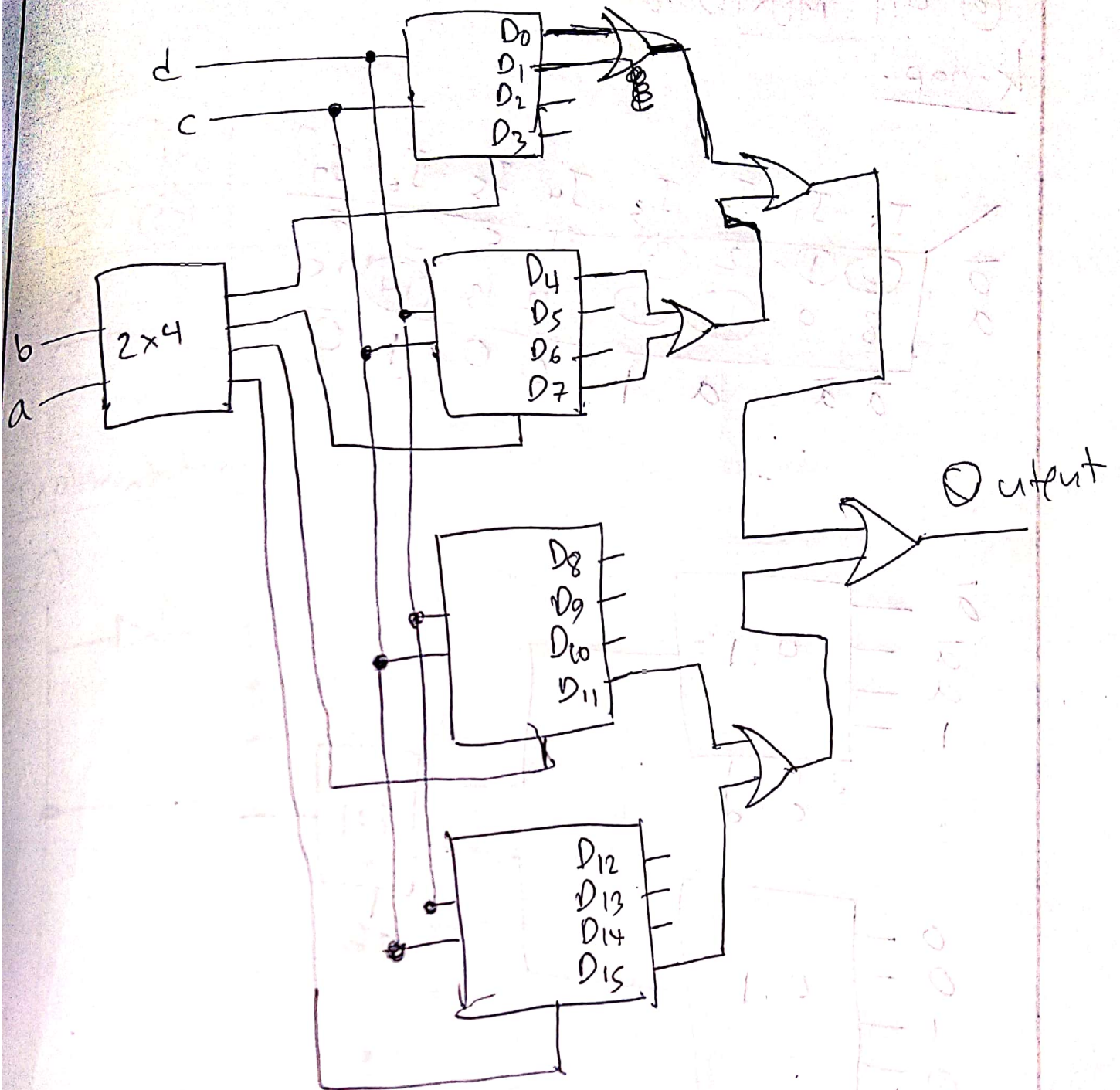


4) $F(a, b, c, d) = \Sigma(0, 1, 4, 7, 11, 15),$

a) 3:8 Decoder:



b) 2:4 Decoder



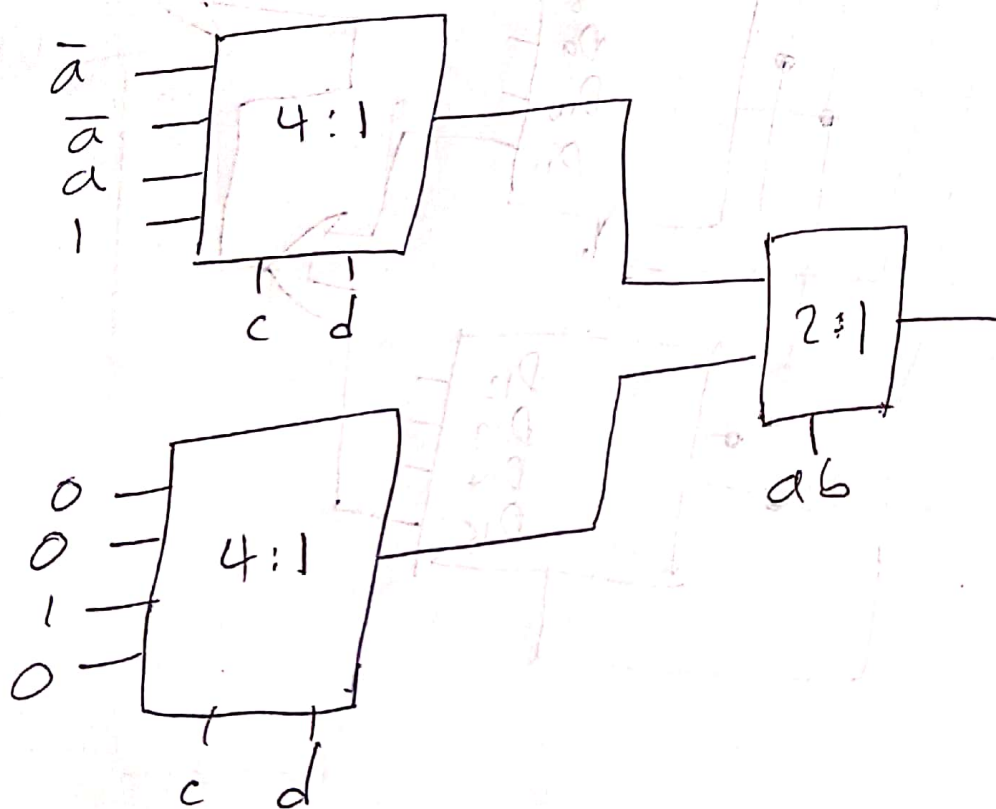
P.T.O

5) $F(a, b, c, d) = \Sigma(0, 1, 3, 6, 10, 11, 14)$

① 4:1 MUX(s) and 2:1 MUX

k-map:

| | I_0 | I_1 | I_2 | I_3 | I_4 | I_5 | I_6 | I_7 |
|-----------|------------------|------------|------------|-------|-------|-------|-------|-------|
| \bar{a} | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| a | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | $\bar{a}\bar{a}$ | $\bar{a}a$ | $a\bar{a}$ | aa | 0 | 0 | 1 | 0 |



P.T.O.

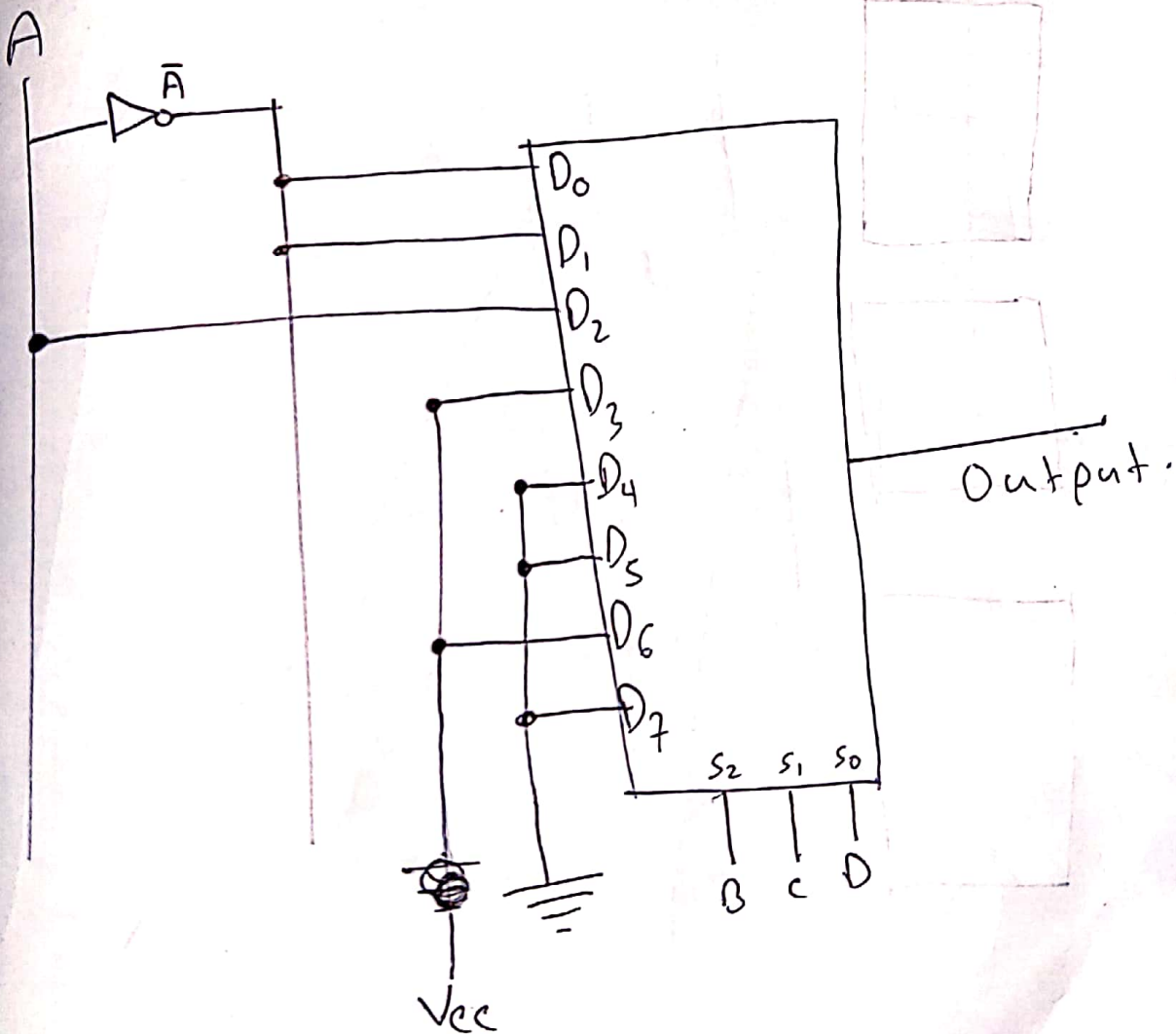
⑥ 8:1 MUX.

$$F(a, b, c, d) = \Sigma(0, 1, 3, 6, 10, 11, 14).$$

Kmap:

| | D_0 | D_1 | D_2 | D_3 | D_4 | D_5 | D_6 | D_7 |
|-----------|-----------|-----------|-------|-------|-------|-------|-------|-------|
| \bar{a} | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| a | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | \bar{a} | \bar{a} | a | 1 | 0 | 0 | 1 | 0 |

Implementation:



6) Truth table:-

| Minterms | A | B | C | Minterms | A ₂ | A ₁ | A ₀ |
|----------|---|---|---|----------|----------------|----------------|----------------|
| 0 | 0 | 0 | 0 | 7 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 6 | 1 | 1 | 0 |
| 2 | 0 | 1 | 0 | 5 | 1 | 0 | 1 |
| 3 | 0 | 1 | 1 | 4 | 1 | 0 | 0 |
| 4 | 1 | 0 | 0 | 3 | 0 | 1 | 1 |
| 5 | 1 | 0 | 1 | 2 | 0 | 1 | 0 |
| 6 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 7 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

Circuit:-

