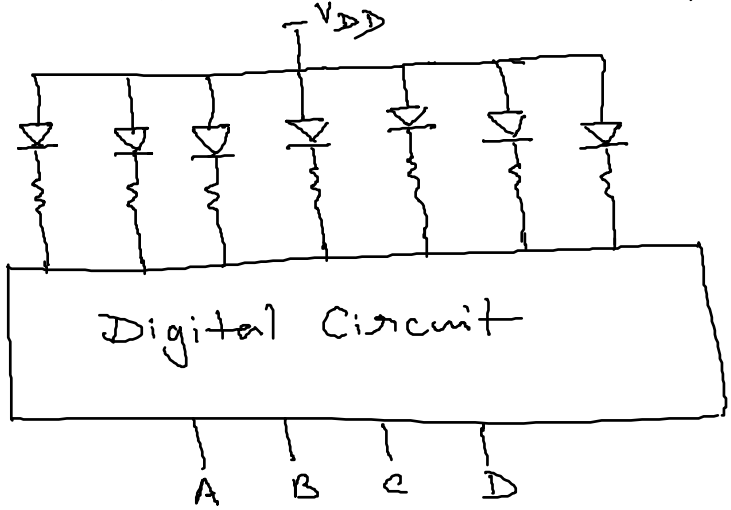
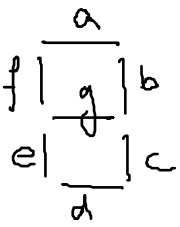
1. Minimize the expressions

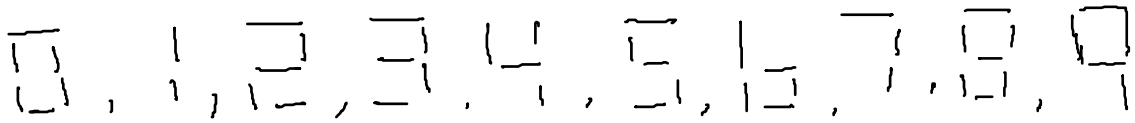
$F = \bar{A}\bar{B}\bar{C}D + \bar{A}B\bar{C}D + \bar{A}\bar{B}CD + ABC\bar{D} + AB\bar{C}D$

$F = (A + \bar{B}C)(A + B + CD + \bar{A}C)$

2. A seven-segment LED display is shown in below. Design the circuity necessary to produce the display shown.

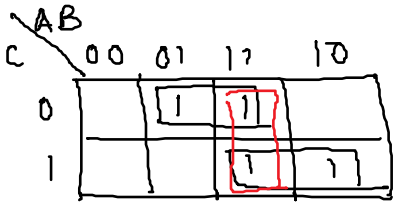




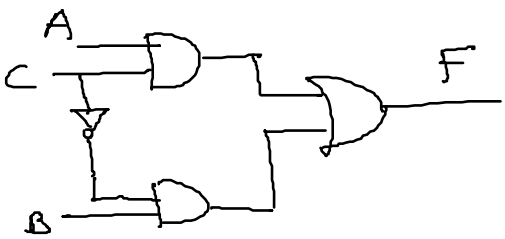


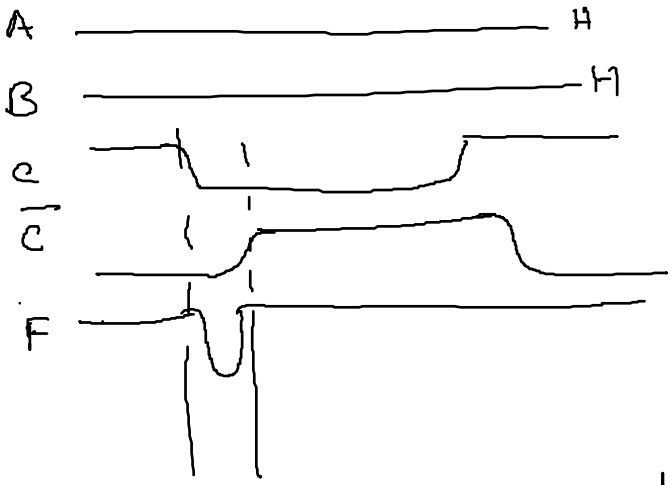
3. Realize the expression $X = \bar{A}B + A\bar{C} + ABC$ using only two-input NAND gates and inverters.

4. Static Hazards—



$F = B\bar{C} + AC$

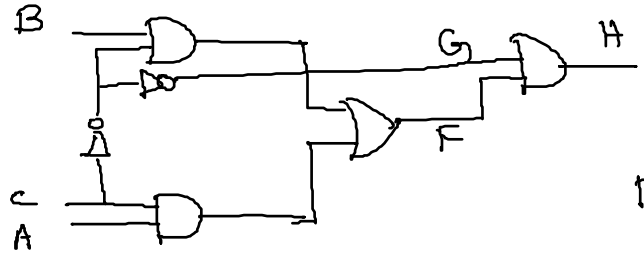


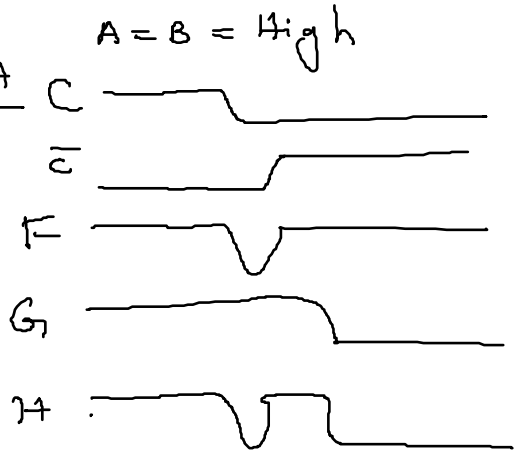


Timing chart of the circuit.
(Static Hazard)

Boolean function using Hazard cover, $F = B\bar{C} + Ac + AB$

5. Dynamic Hazard —





* Two or more unwanted transitions.
* Dynamic hazard can only exist as a result of static Hazard.
* Hazard covers can eliminate static hazard it can eliminate dynamic hazards too.

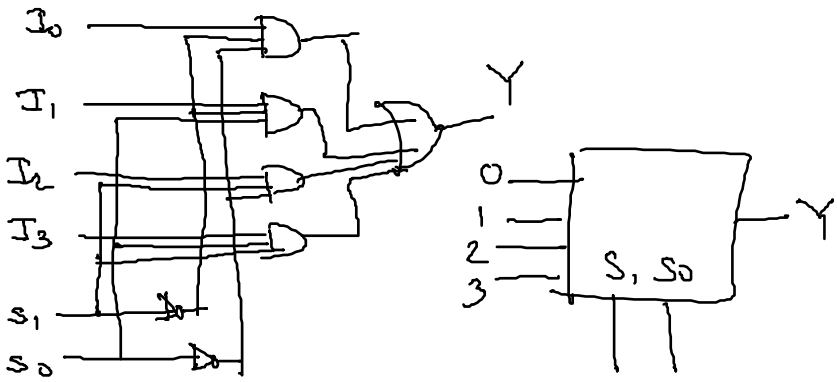
6. Design a 2 to 4 line decoder with enable input —

E	A	B	D_0	D_1	D_2	D_3
1	x	x	0	0	0	0
0	0	0	0	1	1	1
0	0	1	1	0	1	1
0	1	0	1	1	0	1
0	1	1	1	1	1	0

7. Design a 4x16 decoder using two 3x8 line decoder.

8. Multiplexer —

S_1	S_0	Y
0	0	I_0
0	1	I_1
1	0	I_2
1	1	I_3



9. Use a 4x1 MUX to implement

$$F(A,B,C) = \sum(1, 3, 5, 6)$$

10. How to build a larger MUX with smaller MUX sizes and additional logic gates.