

# DIGITAL LOGIC AND DESIGN

## MID-SEM EXAM

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5. a) Each of the coin has two sides heads and tails. Represent the heads or tails status of each coin by a logical variable (A for the first coin, B for the second and C for the third coin) where the logical variable is 1 for heads and 0 for tails. Write the logical function  $F(A, B, C)$  which is 1 iff exactly one of the coin is heads after the toss of the coins. Express F in Product of Maxterms and draw the circuit using NAND gates

b) Design a combinational circuit that detects an error in the representation of a decimal digit in BCD. In other words, obtain a logic diagram whose output is logic 1 when the inputs contain a un used combination in the code.

A5)

a) Aim: To find the maxterms of the given function and implement it using NAND gates only.

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a) Truth Table:

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

$\left. \begin{array}{l} 0 = \text{tails} \\ 1 = \text{heads} \end{array} \right\}$

Product of Maxterm:  $\Pi(0, 3, 5, 6, 7) = (A' + B' + C') \cdot (A' + B + C) \cdot (A + B' + C) \cdot (A + B + C') \cdot (A + B + C)$

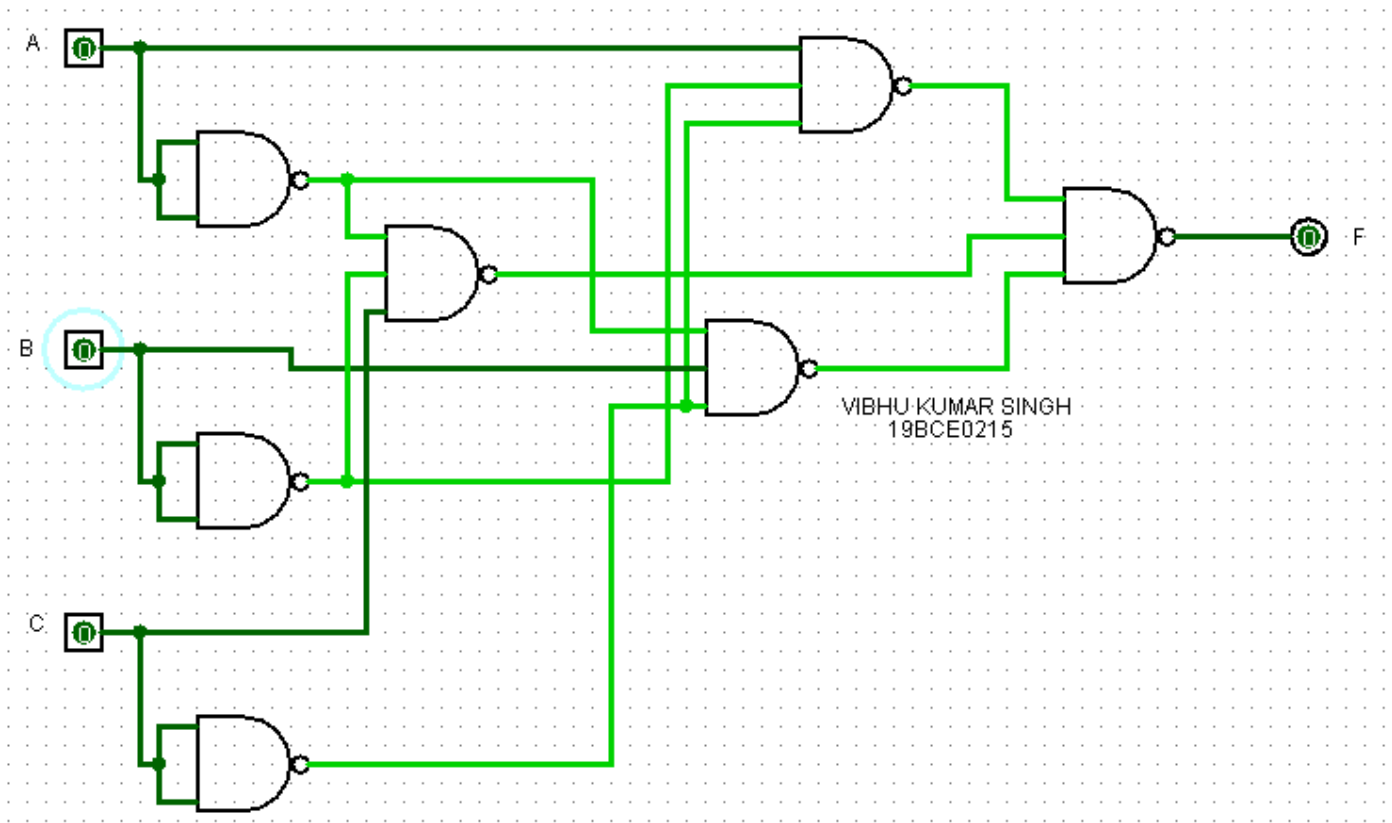
NAND Gates:

$$F(A, B, C) = \sum(1, 2, 4)$$

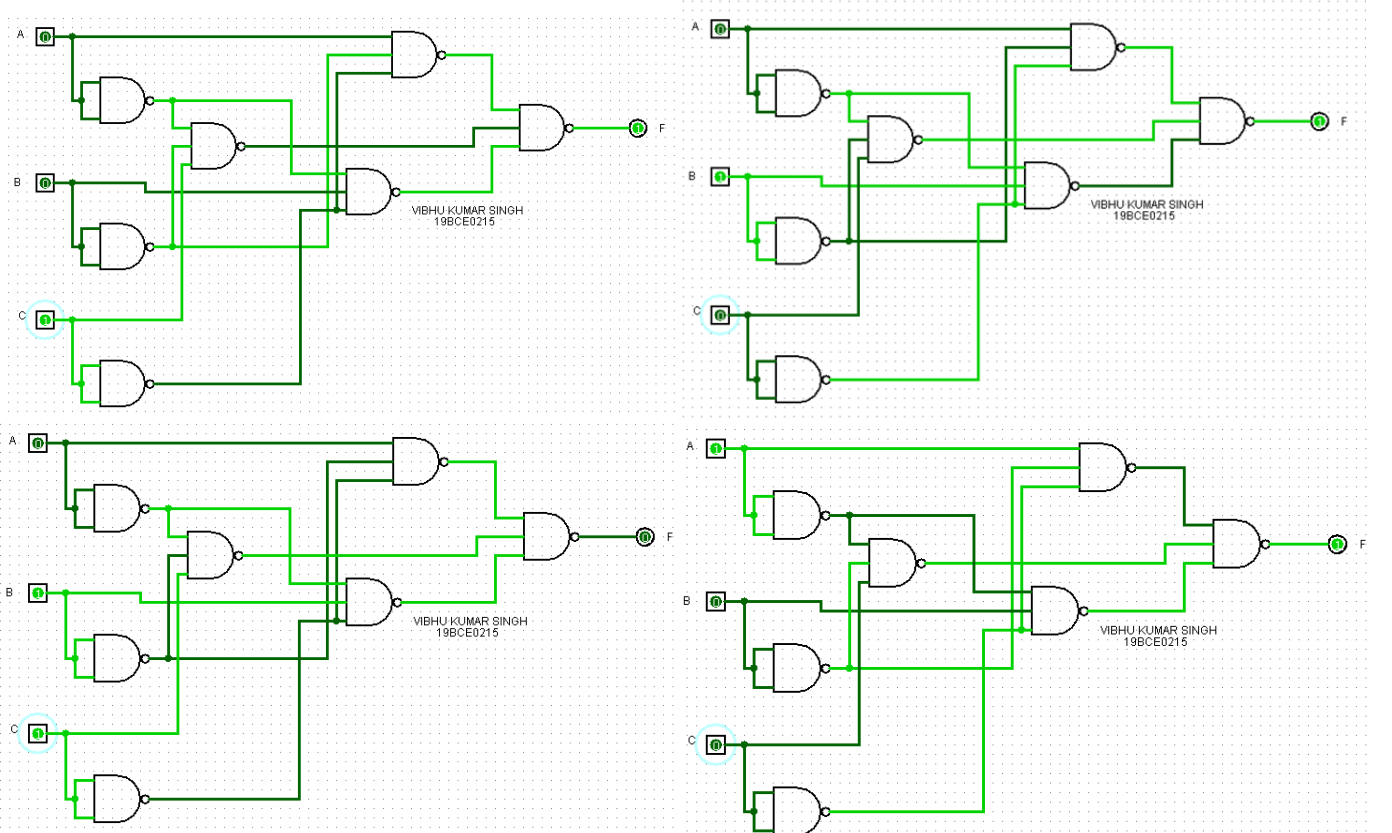
$$= \overline{(A'B'C + A'BC' + AB'C')}$$

$$= \overline{(A+B+C') \cdot (A+B'+C) \cdot (A'+B+C)}$$

### Circuit:



### OUTPUT SCREENSHOTS:



b) Aim: To output 1 if BCD uses more than possible digits (0-9).

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b) Truth table:

	A	B	C	D	E
	0	0	0	0	0
	0	0	0	1	0
	0	0	1	0	0
	0	0	1	1	0
	0	1	0	0	0
	0	1	0	1	0
	0	1	1	0	0
	0	1	1	1	0
	1	0	0	0	0
	1	0	0	1	0
m <sub>10</sub>	1	0	1	0	1
m <sub>11</sub>	1	0	1	1	1
m <sub>12</sub>	1	1	0	0	1
m <sub>13</sub>	1	1	0	1	1
m <sub>14</sub>	1	1	1	0	1
m <sub>15</sub>	1	1	1	1	1

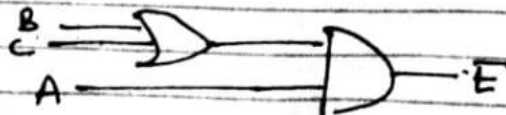
$$E = \sum(10, 11, 12, 13, 14, 15)$$

AB \ CD	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	1	1	1	1

$$E = A.B + A.C$$

$$= A.(B+C)$$

Circuit



# OUTPUT SCREENSHOTS:

