Minor Exam Set-1

(2) (a) $y = \left((a' \cdot b') + (b \cdot c')\right)' \cdot \left((a' \cdot c) + (b \cdot c)\right)$

NAND+NOT NAND+NOT NAND+NOT NAND+NOT

NOR. NOR + NOT

NAND + NOT

There could be some other ways to implement the circuit. We will check for all such answers and correct answers will get full grades.

(b). $y = \left((a' \cdot b') + (b \cdot c')\right)' \cdot \left((a' \cdot c) + (b \cdot c)\right)$

$= (a'b')' \cdot (bc')' \cdot (a'c + bc)$

$= (a + b) \cdot (b' + c) \cdot (a'c + bc)$

$= (ab' + ac + bc)(a' + b) \cdot c$

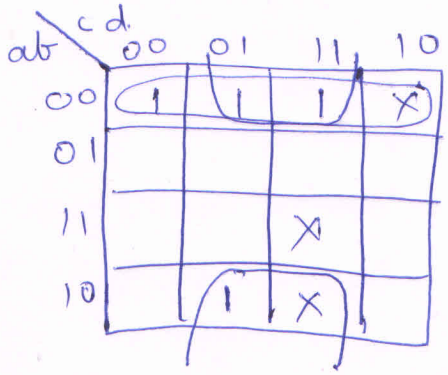
$= (a'bc + abc + bc) \cdot c$

$= bc \cdot c$

$= bc.$

NAND + NOT

(3) $f(a,b,c,d) = \sum m(0,1,3,9) + \sum d(2,11,15)$



$f = a'b' + b'd$

(4) (a) $f = abcde' + ab'd + ab'ce$

$= \{(abcde' + ab'd + ab'ce)'\}'$

$= \{(abcde')' \cdot (ab'd)' \cdot (ab'ce)'\}'$

$= \{(a'+b'+c'+d'+e) \cdot (a'+b+d') \cdot (a'+b+c'+e')$

$= \{(a'+b'+c'+d'+e)(a'+b+c'd'+d'e')\}'$

$= \{a' + b'c'd' + b'd'e' + bc' + c'd' + c'd'e'$
$+ bd' + c'd' + d'e' + be + c'd'e\}'$

$= \{a' + c'd' + bc' + d'e' + bd' + be\}'$

$= a \cdot (c+d) \cdot (b'+c) \cdot (d+e) \cdot (b'+d) \cdot (b'+e$

(4) (b) $f = abcde' + a'b'd + ab'ce$

$= \{(abcde' + ab'd + ab'ce)'\}'$

$= \{(abcde')' \cdot (ab'd)' \cdot (ab'ce)'\}'$

NAND NAND NAND

NAND

(c) $f = abcde' + ab'd + ab'ce$

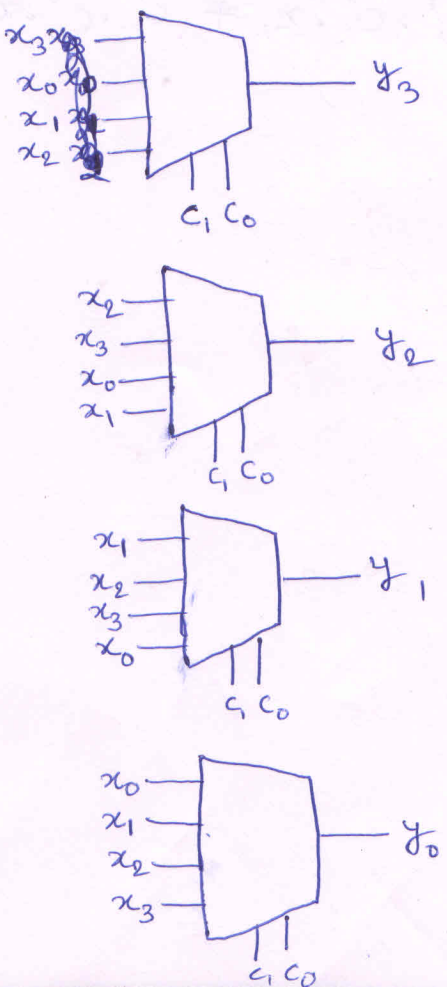
$= \{(abcde')'\}' + \{(ab'd)'\}' + \{(ab'ce)'\}'$

$= (a' + b' + c' + d' + e)' + (a' + b + d')' + (a' + b + c' + e')'$

NOR. NOR NOR

NOR + NOT

(5) (a)

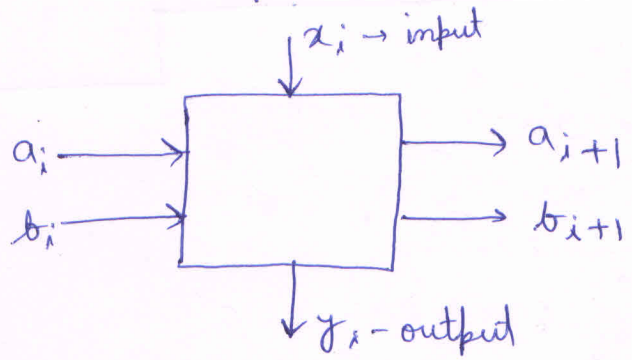


(b) All paths are equivalent in terms of the delay & hence any path could be selected as the critical path.

	y_3	y_2	y_1	y_0
0-shift	x_3	x_2	x_1	x_0
1-shift	x_0	x_3	x_2	x_1
2-shift	x_1	x_0	x_3	x_2
3-shift	x_2	x_1	x_0	x_3

(6) (a) We consider a 2-bit variable "$a_i \cdot b_i$" such that

$a_i\, b_i$ = { 00, # of matched bits = 0
01, " = 1
10, " = 2, and
11, " = 3.



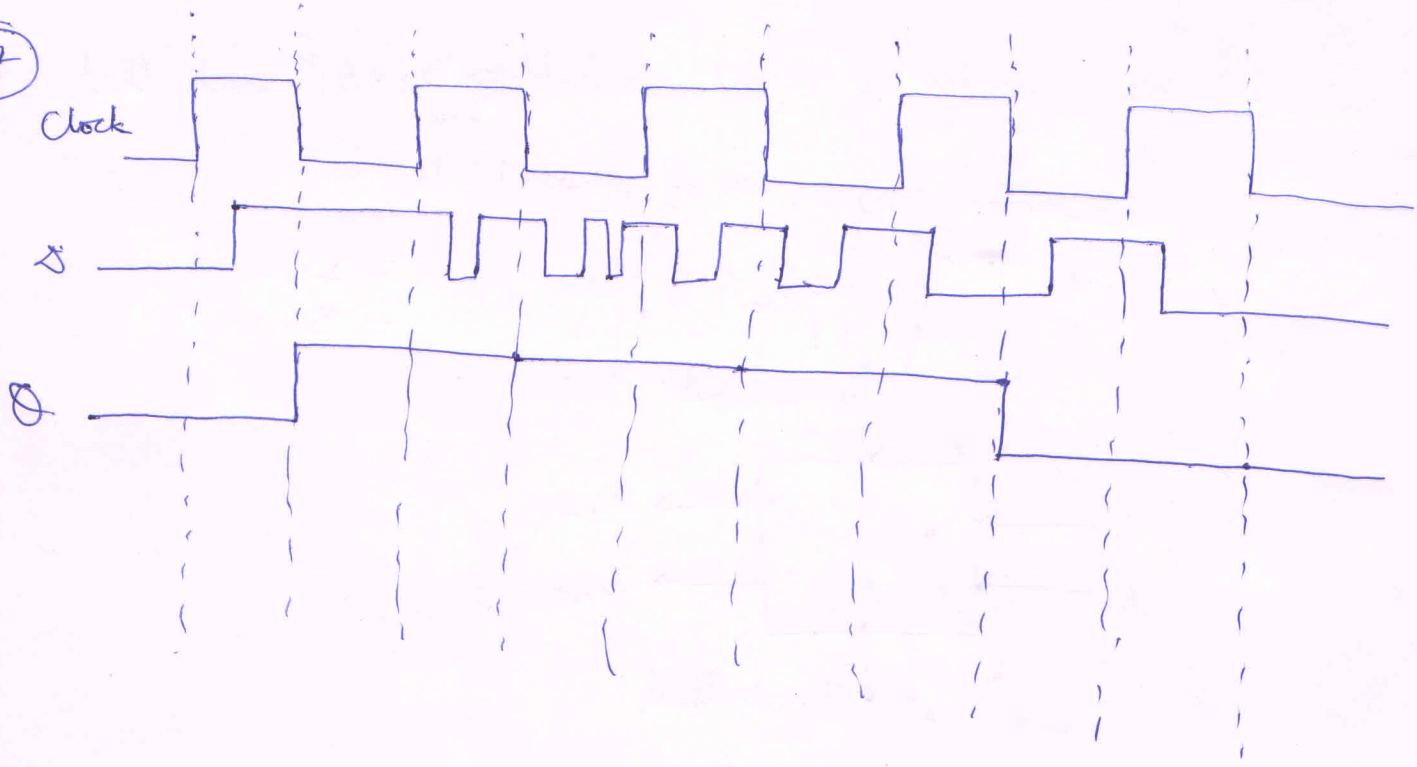
a_i	b_i	x_i	a_{i+1}	b_{i+1}	y_i
0	0	0	0	1	0
0	0	1	0	0	0
0	1	0	1	0	0
0	1	1	0	0	0
1	0	0	1	0	0
1	0	1	1	1	0
1	1	0	0	1	1
1	1	1	0	0	0

(b) (i) $a_{i+1} = a_i' \cdot b_i \cdot x_i' + a_i \cdot b_i'$

$b_{i+1} = a_i' \cdot b_i' \cdot x_i' + a_i \cdot b_i' \cdot x_i + a_i \cdot b_i \cdot x_i'$

$y_i = a_i \cdot b_i \cdot x_i'$

(7)



(8) (a)

M	N	Q_{t+1}
0	0	Q'_t
0	1	1
1	0	0
1	1	Q_t

$$Q_{t+1} = M' \cdot Q'_t + N \cdot Q_t$$

(b) $J = M' Q'_t + N \cdot Q_t$