FDE

MONARK UNIVERSITY

Assignment - 1

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Date : 29-8-25

Q-1. Convert 11110000.10111 Binary number into decimal number system

→ 1 1 1 1 0 0 0 0 . 1 0 1 1 1

2^6 2^5 2^4 2^3 2^2 2^1 2^0 2^{-1} 2^{-2} 2^{-3} 2^{-4} 2^{-5}

→ $(120.71875)_{10}$

Q-2. Convert AFB2 ~~has~~ number into to ocbal number system

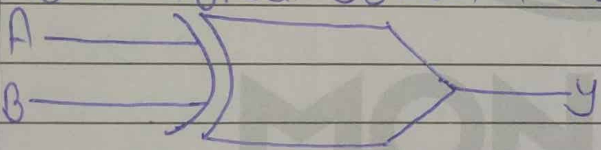
→ $(AFB2)_{16} = (\quad)_8$

A F B 2

$\underbrace{001}_{1}$ $\underbrace{010}_{2}$ $\underbrace{111}_{7}$ $\underbrace{110}_{6}$ $\underbrace{110}_{6}$ $\underbrace{010}_{2}$

$(127662)_8$

Q-3. Draw logical symbol for EX-OR Gate.

→ 

A	B	y
0	0	0
0	1	1
1	0	1
1	1	0

Q-4. Find is complement of 10010 1.

→ 1's complement means invert each Bit.

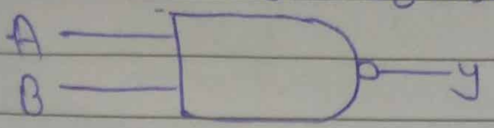
100101 → 011010

Q-5. Define Don't Care.

→ Don't care conditions are input to a logic circuits are inputs to a logic circuit or a function that Do not effect the output.

Q-6. Draw the logic symbol for NAND Gate.

→



A	B	y
0	0	1
0	1	1
1	0	1
1	1	0

Q-7. State De-morgan's Theorems.

→ De Morgan's Theorems are fundamental law in Boolean algebra That explain how to simplyfy logic expression by distributing a negation over an operation.

→ There are 2 Theorems:

(1) theorems 1: The complement of sum of variables is equal To the Product of their individual complement. → $\overline{A + B} = \bar{A} . \bar{B}$

→ That a NOR Gate is equal to and AND gate with inverted inputs.

(2) Theorems 2: The complement of a Product of Variable is equal to the Sum of their individual complements

→ $\overline{A . B} = \bar{A} + \bar{B}$

→ That a NAND gate is equal to OR gate with inverted input.

Q-8. Find 2's complement of 1110000101.

→ 1110000101 ⟶ 0001111010 → 1's complement

$+ \qquad 1$

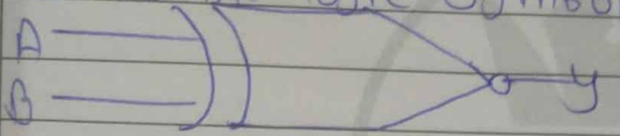
0001111011 → 2's complement

Assignment 2

Q-1. Draw the Truth table of NOR Gate
→

A	B	y
0	0	1
0	1	0
1	0	0
1	1	0

2. Draw the logic Symbol For Ex-NOR Gate
→



A	B	y
0	0	1
0	1	0
1	0	0
1	1	1

-3, give Three exampe of SOP.
→ (1) $y = A + B$ → This is the simplest form
→ It's the same as OR gate
→ It is a Sum of two single variable Product
(2) $Z = AB + C$ → This expression combines two terms a Product (A and B) and a single variable
→ The expression says the output is True if either (A and B) is True, or if C is True.
(3) $f = \bar{A}B + \bar{B}C$ → This expression has 2 Product Terms. The first Term is and The Second.
First term (Not 'A' And 'B')
Second Term (Not 'B' and 'C')

-4. Add :- 11100000 + 11100001

→
```
   0 1 1 1 0 0 0 0 0
 + 1 1 1 0 0 0 0 0 1
 -------------------
 1 0 1 0 1 0 0 0 0 1
```
→ Answer

-5. Substract 10010 - 10011 using 1's complement and 2's complement method

→ 1's complement of 10011 = 01100

→
```
  10010
+ 01100
-------
  11110
```

→ 1's complement of 11110 = 00001.

→ 2's complement of 10011 = 01101.

→
```
  10010
+ 01101
-------
  11111
```

→ 2's complement of 11111 = 00001.

→ 1's complement answer = 00001.

→ 2's complement answer = 00001.

-6. y = ΣM(0, 1, 2, 5, 13, 15) Draw the K-MAP and find minimized logical expression

→

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

$y = \bar{A}\bar{B}\bar{D} + \bar{A}\bar{C}D + ABD$

Q-7 State and Prove De-Morgan Theorems with the help of truth table.

→ The complement of sum of variable is equal to the product of their individual complements.

→ Formula : $\overline{A+B} = \bar{A} . \bar{B}$

→ Proof using a Truth table :- I Theorem.

→ the Two sides of the equation $\overline{A+B}$ and $\bar{A}.\bar{B}$ are equivalent if their truth table outputs are identical for all possible input combinations

A	B	A+B	$\overline{A+B}$	$\bar{A}$	$\bar{B}$	$\bar{A}.\bar{B}$
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0

→ The output columns for $\overline{A+B}$ and $\bar{A}.\bar{B}$ are same

→ Second Theorum :-

→ The complement of a product of variables is equal to the sum of their individual complements

A	B	A.B	$\overline{A.B}$	$\bar{A}$	$\bar{B}$	$\bar{A}+\bar{B}$
0	0	0	1	1	1	1
0	1	0	1	1	0	1
1	0	0	1	0	1	1
1	1	1	0	0	0	0

→ $\overline{A.B} = \bar{A} + \bar{B}$

-8 Write a short note on Rom

→ Rom is type of Memory that store data Permanately, its contents are sut during the manufacturing Process and cannot be changed or erased by the user.

→ Non-Volatile: RoM is non-volatile Meaning it retains the Stored information even when the Power is turned off

→ Types of Rom:
(1) PRoM (Programmable RoM)
(2) EPROM (Erasable PROM)
(3) EEPRoM (Electrically ErasablePROM)

→ use to store essential software that controls the hardware.

Assignment-3

Q-1. convert the expression $y = AB + A\bar{C} + BC$ into the Standard Form

→ Missing Term :- $AB(C+\bar{C}) + A\bar{C}(B+\bar{B}) + BC(A+\bar{A})$

$= ABC + AB\bar{C} + A\bar{C}B + A\bar{C}\bar{B} + BCA + BC\bar{A}$

$= ABC + AB\bar{C} + A\bar{C}\bar{B} + BC\bar{A}$

Sop is $ABC + AB\bar{C} + A\bar{C}\bar{B} + BC\bar{A}$

Q-2. Prove That $(A+C)(A+D)(B+C)(B+D) = AB + CD$

→ $(A+C)(A+D)(B+C)(B+D) = AB + CD$

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

$= A + AD + CA + CD$

$= A + CD$

→ First Part = $(A+C)(A+D) = A + CD$

→ Second Part $(B+C)(B+D) = B + CD$

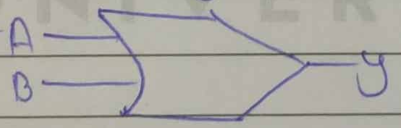
$= A + CD . B + CD$

$= AB + CD$

$=$ LHS = RHS

Q-3. Draw the logic symbol and Truth table for all gates.

→ (1) OR Gate :-

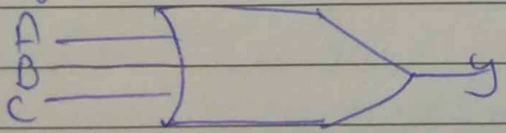


Symbol :- Two variable

A	B	y
0	0	0
0	1	1
1	0	1
1	1	1

← Truth table

Symbol :- 3 variable

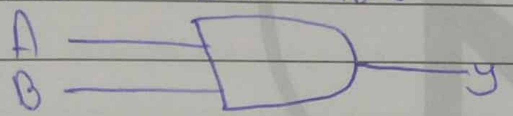


Truth table :

A	B	C	y
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

(2) And Gate :

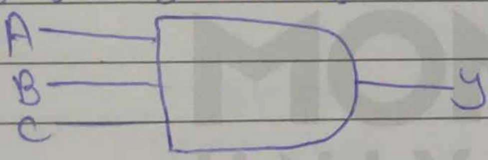
Symbol : 2 Variable



Truth table :

A	B	y
0	0	0
0	1	0
1	0	0
1	1	1

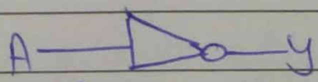
Symbol : 3 Variable



Truth table :

A	B	C	y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

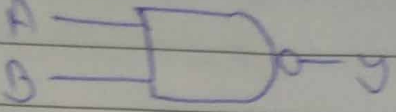
(3) NOT gate : symbol :



Truth table :

A	y
0	1
1	0

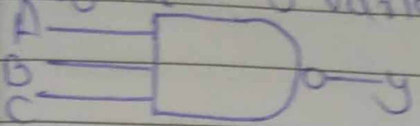
(4) NAND Gate: Symbol: 2 Variable



Truth table:

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

Symbol: 3 Variable



Truth table:

A	B	C	y
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

-4 Explain minterm and maxterm

→ minterm: Minterm are also known as Canonical Product term
- → A minterm is Product (AND) Term that contains all the Variable of a function
- → A value of the Minterm is '1' for exactly one unique combination of the input Variable

→ Maxterm: Maxterm are also known as canonical sum term.
- → A Maxterm is Sum (OR) Term That also contains all the variable of a function
- → A Maxterm evaluates to '0' for exactly One unique combination of the input variable

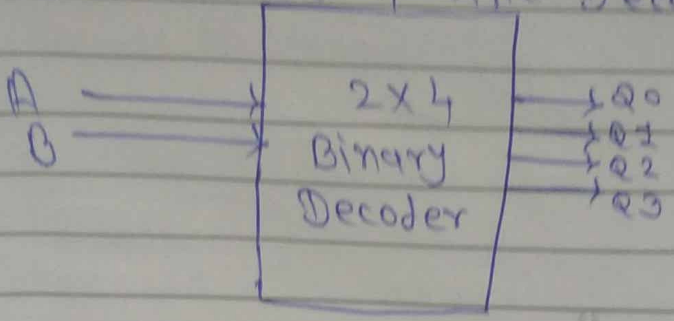
Q-5. Substract 10010 - 10011 using 2's complement method.
→ 10011 → 01100 → 1's complement
+ 1
01101 → 2's complement

→ 10010 → invert each Bit
+ 01101
11111 → 00000
11111 → 00000 means -1.

Q-6. Explain R-S and D-flip flop.
→ R-S flip-flop: The R-S (Reset-set) flip-flop, also known as an R-S latch, is the simplest types of flip-flop.
→ It has two inputs R and S, and Two outputs, Q and $\bar{Q}$, which are always complements of each other.
→ It can be built using either NAND gates or NOR Gates.
→ D flip-flop: The D (Date OR Delay) flip-flop is an improved version of R-S flip flop that eliminated the invalid state.
→ It has a single data input, D, and a clock input, cLk.
→ The D flip flop transfers the value of the D input to the output at a specific movement in time, determined by the clock signal.

Q-7. Explain 2 to 4 line Decoder.

→



→ Truth table :-

A	B	Q0	Q1	Q2	Q3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

→ A 2 to 4 line Decoder is combination of logic circuit that convert a 2-Bit Binary input into one of 4 unique output lines.

→ It has 2 input and 4 outputs.

Q-8. Reduce The expression: $y = A + B(AC + (B + \bar{C})D)$

→ $y = A + B(AC + (B + \bar{C})D)$

$y = A + B(AC + BD + \bar{C}D)$

$y = A + BAC + BBD + B\bar{C}D$

$y = A + BAC + BD + B\bar{C}D$

$y = A + A(BC) + BD + B\bar{C}D$

$y = A + BD + B\bar{C}D$

$y = A + BD(1 + \bar{C})$

→ $1 + \bar{C} = 1$

$y = A + BD(1)$

$\boxed{y = A + BD}$

Assignment - 4

Q-1. Conversion:

(1) Binary to Hexadecimal - $(1011011011)_2$

→ Use '8421' rule:

8421 8421 8421

0010 1101 1011

$= \boxed{2DB}$

(2) Hex to Decimal - $(2DB)_{16}$

→ $(2DB)_{16}$

$= (2 \times 16^2) + (B \times 16^1) + (11 \times 16^0)$

$= 512 + 208 + 11$

$= \boxed{(731)_{10}}$

(3) Octal to Hex - $(756.603)_8$

→ $(756.603)_8$

$=$ 111 101 110 . 110 000 011

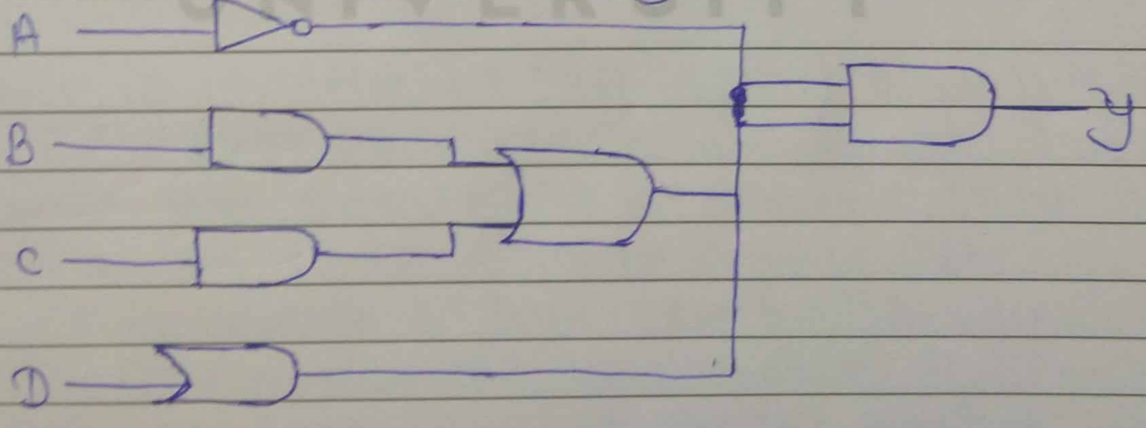
$=$ 1 1110 1110 . 1100 0001 1

$=$ 1 E E . C 1 8

$= \boxed{(1EE.C18)_{16}}$

Q-2. Draw the logic circuit of $y = A + B(AC + (B + \bar{C})D)$.

→ $y = A + B(AC + B + \bar{C})D)$



Q-3. Compare SOP and POS.

→

SOP	POS
(1) Sum of Product	(1) Product of sum
(2) Each Product term represent a min term.	(2) Each Sum term represent a Max term.
(3) Design using AND-OR Gate	(3) Design using OR-AND gate
(4) $F = AB + \bar{A}C$	(4) $F = (A+B)(\overline{A}+D)$

Q-4. using K-MAP Realize The following expression using minimum number of gates. $y = \Sigma m$ $(1, 3, 4, 5, 7, 9, 11, 13, 15)$

→

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

→ $y = D + \vec{A} B \vec{C}$

Q-5. What is Multiplexer? Explain Types of multiplexer.

→ A multiplexer (mux) is combinational logic circuit that selects one of several input lines and routes it to a single output line.

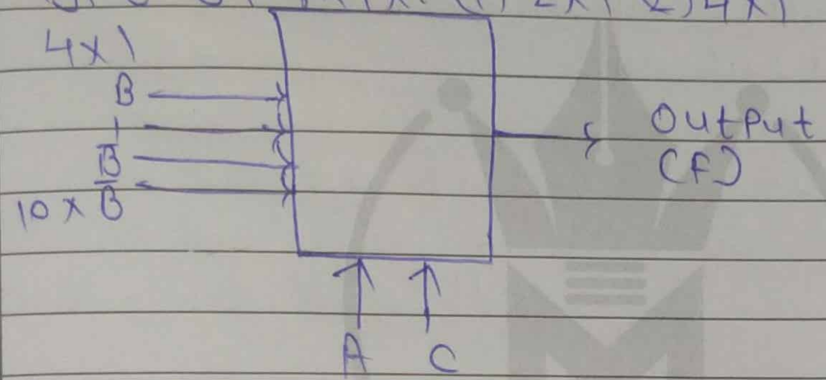
→ It often called a "Data Selector" Because it acts like a switch that chooses a specific input to pass through to the output.

→ A mux has 2^n input lines, n select lines, and one output line

→ The value of the select lines determines which of the 2^n input lines is connected to the single output.

→ Types of Mux: (1) 2x1 (2) 4x1 (3) 8x1 (4) 16x1

→ 4x1

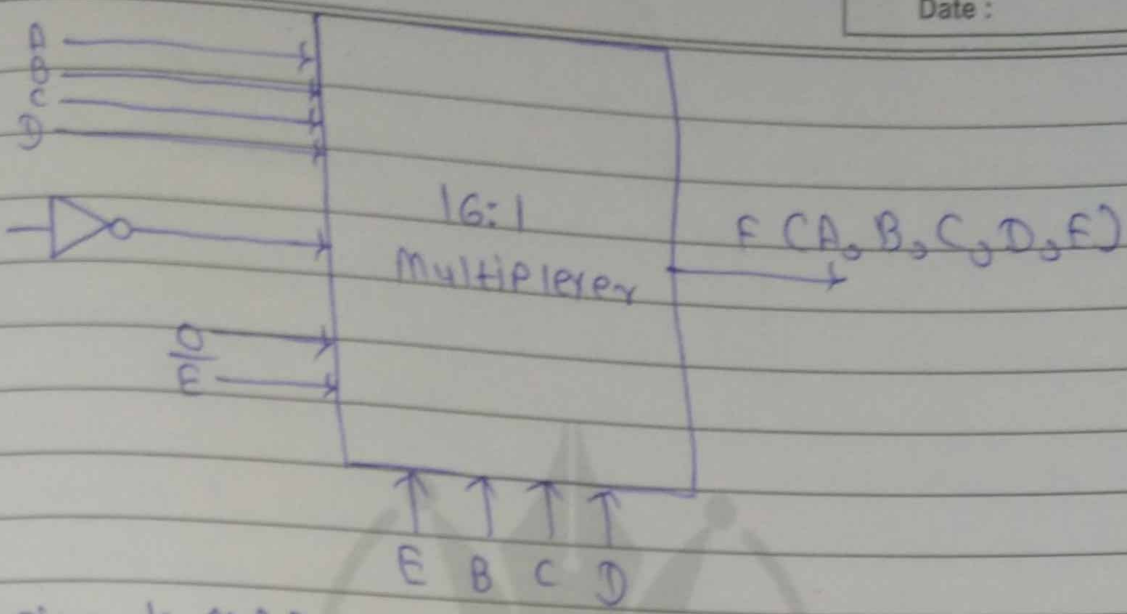


→ truth table

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

Q-6. Implement the following function using 16:1 multiplexer. $F(A, B, C, D, E) = \Sigma m(2, 4, 5, 7, 10, 14, 15, 16, 17, 25, 30, 31)$.

→



Q-7. Define K-MAP and Explain structure for Three and four-variable K-MAP.

→ 3 Variable K-MAP:-

→ A 3-variable K-MAP is a grid with $2^3 = 8$ cells.

→ The variables are Typically arranged with two variables Defining the rows and the third variable defining the column.

→ the variables are ordered according to gray code (00, 01, 10, 11) where only one Bit changes Between Adjacent cells.

→ The MAP is = 2x4 grid or a 4x2 grid.

→ 4 Variable K-MAP:-

→ A 4 variables K-MAP is a grid with $2^4 = 16$ cells, Typically arranged in 4x4 grid.

→ The rows and columns are Defined by Pairs of Variables, with each Pair following The gray code sequence.

→ this structure allows for grouping of cells in groups of 2, 4, 8 or 16.

Q-8. classify Memory.

→ There are Two main Types (1) Primary Memory
(2) secondary Memory

(1) Primary Memory :-

→ Primary Memory is also known as main memory is the computer's working memory.

→ It's Directly accessible by the central Processing unit (CPU) and is used to hold data and Programs that are currently being Processed.

→ It is generally much faster but more expensive Then Secondary Memory.

→ 2 Types of Primary Memory :- (1) RAM
(2) ROM

(2) Secondary Memory :

→ Secondary Memory, also called auxilary memory, is non-volatile storage used for long-term data program storage.

→ It is not directly Accessible by the CPU.

→ Data must first be loaded into Primary memory

→ It is much slower and cheaper than Primary memory

→ Types :- (1) HDD
(2) SSD
(3) optic storage