

Chapters 6 to 8 Homework

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Real Number Representation:

- 1) Represent the number 263.3 in 32-bit floating point representation.
- 2) Represent the number -17.625 in 32-bit floating point representation.
- 3)
 - (a) Using the 2's complement method, express the following negative numbers in binary (use 5-bit binary system) -7, -12.
 - (b) Using the 2's complement method, find the value of the following:
 - (i) $39 + (-25)$
 - (ii) $43 - (+71)$

Boolean Algebra, Logic Gates, Karnaugh Maps:

- 4) Simplify the following Boolean Expression using Boolean laws:

$$F_1 = A.B.C + \bar{A} + A.\bar{B}.C$$

$$F_2 = \bar{A}.\bar{B}.\bar{C} + \bar{A}.\bar{B}.C + \bar{A}.\bar{C}$$

$$F_3 = (A.\bar{B}.(C + B.D) + \bar{A}.\bar{B}).C$$

(mention which laws you are using in which step)

- 5) Given the Boolean function:

$$F = AB'C + A'B'C + D'AB + D\bar{A}'B + DAB$$

find the following:

- (a) Obtain the truth table of the function.
- (b) Simplify the function to a minimum number of laterals using Boolean algebra.
- (c) Obtain the truth table of the function using the simplified expression.

6) For the following function:

$$\left. \begin{array}{l} (a) F = DA + BC \\ (b) F = A + BC \end{array} \right\} \text{prove } F + F' = 1 \text{ \& } F \cdot F' = 0$$

7) Demonstrate by means of truth tables the validity of the following identities:

(a) De-Morgan's theorem for three variables: $(A+B+C)' = A'B'C'$ and $(ABC)' = A' + B' + C'$

(b) The distributive law: $A+BC = (A+B)(A+C)$

8) Reduce the following Boolean expressions to the indicated number of literals (using laws and mention names of laws you are using in which step):

$$(a) R' + T' + RST + RT' \quad \text{to three literals}$$

$$(b) (R'S' + T)' + T + RS + UT \quad \text{to three literals}$$

$$(c) R'S(U' + T'U) + S(R + R'TU) \quad \text{to one literals}$$

$$(d) (R' + T)(R' + T')(R + S + T'U) \quad \text{to four literals}$$

9) Using only minimum gates, draw a logic gate diagram for the following expressions:

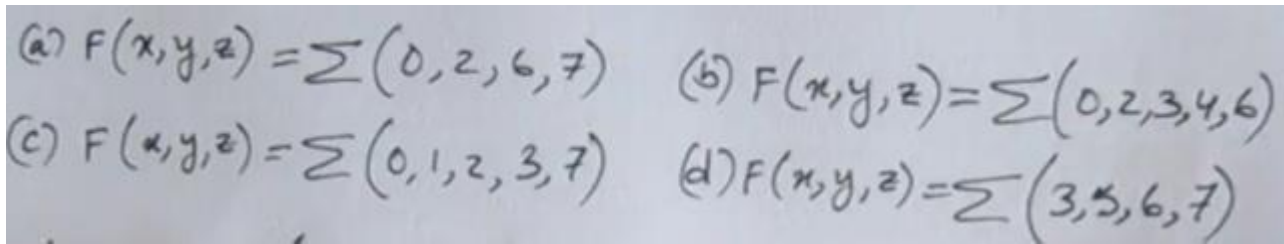
$$F_1 = A.B.C + \bar{A} + A.\bar{B}.C$$

$$F_2 = \bar{A}.\bar{B}.\bar{C} + \bar{A}.\bar{B}.C + \bar{A}.C$$

$$F_3 = (A.\bar{B}.(C + B.D) + \bar{A}.\bar{B}).C$$

Karnaugh Maps:

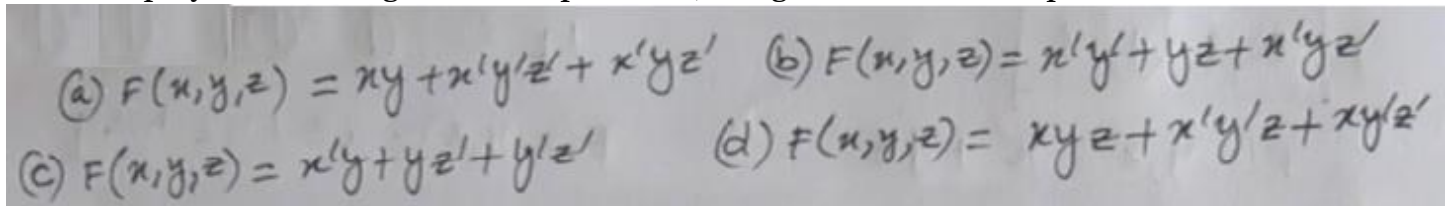
10) Simply the following functions using 3 variable maps:



Handwritten Karnaugh map problems:

(a) $F(x, y, z) = \sum(0, 2, 6, 7)$ (b) $F(x, y, z) = \sum(0, 2, 3, 4, 6)$
(c) $F(x, y, z) = \sum(0, 1, 2, 3, 7)$ (d) $F(x, y, z) = \sum(3, 5, 6, 7)$

11) Simplify the following Boolean expressions, using three-variable maps:



Handwritten Boolean expressions for simplification:

(a) $F(x, y, z) = xy + x'y'z' + x'yz'$ (b) $F(x, y, z) = x'y' + yz + x'yz'$
(c) $F(x, y, z) = x'y + yz' + y'z'$ (d) $F(x, y, z) = xyz + x'y'z + xy'z'$

Induction and Recursion:

12) Prove by induction the recursive formula for the Fibonacci numbers:

$$F_1 = 1$$

$$F_2 = F_1$$

$$F_3 = F_1 + F_2$$

$$F_4 = F_2 + F_3$$

$$F_5 = F_3 + F_4$$

Define the two Recursive Formula Rules, with the basic rule and the recursive rule.

Then, using the below information, validate the formula for F_n .

$n = 1\ 2\ 3\ 4\ 5\ 6\ 7\ 8\ 9\ 10\ 11\ 12\ldots$

$n =$	1	2	3	4	5	6	7	8	9	10
$f_n =$	1	1	2	3	5	8	13	21	34	55
sum $f_n =$	1	2	4	7	12	20	33	54		

Notice from the table it appears that the sum of the first n terms is the $(n+2)$ term minus 1

Let $P(n)$ be the statement $f_1+f_2+f_3+\ldots+f_n=f_{n+2} - 1$

Prove $P(n)$, for all n .