Mahindra University Hyderabad

École Centrale School of Engineering
End-semester Regular Examination

Program: B.Tech. Branch: Computation & Mathematics Year: Second Semester: Second
Subject: Computer Organization (MA 2211)

Date: 30/05/2024 **Start Time: 10:00 PM**
Time Duration: 03:00 Hours **Max. Marks: 100**

Instructions:

1) **All questions are compulsory.**
2) **Start each answer on a new page and number your answers clearly. Answer all parts of the same question together and in sequence.**
3) **An explanation of every step is essential. Correct outcomes without description will not be evaluated.**

Q 01: Select the correct choice for the following questions with a proper explanation. Correct choices without valid justification will not be considered. [02 × 15]

A) Complement of the expression $A'B + CD'$ is _____.

i) $(A' + B)(C' + D)$ ii) $(A + B')(C' + D)$ iii) $(A' + B)(C + D')$

iv) $(A + B')(C + D')$ v) None of these

B) One of De Morgan's theorems states that $(A + B)' = A' \cdot B'$. Simply stated, this means that logically, there is no difference between:

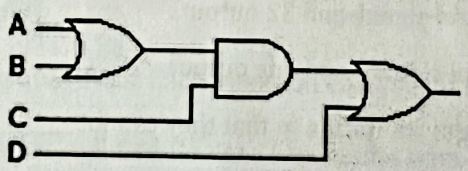
i) A NOR and an AND gate with inverted inputs

ii) A NAND and an OR gate with inverted inputs

iii) An AND and a NOR gate with inverted inputs

iv) A NOR and a NAND gate with inverted inputs

C) The Boolean expression for the following logic circuit can be given as:



i) $CA + CB + CD$ ii) $CA + BD'$ iii) $C(A + B) + D$

iv) $CA + CB + D$ v) None of these

D) The Boolean function $AB + AC$ is equivalent to _____.

i) $AB + AC + BC$ ii) $A'B'C' + ABC' + A'BC$ iii) $ABC + A'BC + B'C'$

iv) $ABC + ABC' + AB'C$ v) None of these

E) The expression for Absorption law is given by _____.

i) $A + AB = A$ ii) $A + AB = B$ iii) $AB + AA' = A$

iv) $A + B = B + A$ v) None of these

F) Consider the Boolean function $Y = (a + bc) \cdot (pq + r)$. The complement of Y, i.e., Y' is:

i) $(a' + b'c') \cdot (p'q' + r')$ ii) $a'(b' + c') + (p' + q')r'$

iii) $(a' + b'c') + (p'q' + r')$ iv) $(a'b'c') + (p'q'r')$

G) There are _____ minterms for four variables (a, b, c, d).

i) 0 ii) 2 iii) 4

iv) 8 v) None of these

H) The expression $Y = AB + BC + AC$ shows the _____ operation.

i) EX-OR ii) SOP iii) POS

iv) NOR v) None of these

I) Determine the values of A, B, C, and D that make the sum term $A' + B + C' + D$ equal to zero.

i) $A = 1, B = 0, C = 0, D = 0$ ii) $A = 1, B = 0, C = 1, D = 0$

iii) $A = 0, B = 1, C = 0, D = 0$ iv) $A = 1, B = 0, C = 1, D = 1$

J) Total number of inputs in a half adder is _____

i) 2 ii) 3 iii) 4

iv) 1 v) None of these

K) A 32 to 1 multiplexer has the following terminals:

i) 32 outputs, one input, and 5 control signals

ii) 32 inputs, one output, and 5 control signals

iii) 5 inputs, one control signal, and 32 outputs

iv) 5 inputs, 32 control signals, and one output

L) Half-adders have a major limitation in that they cannot _____

i) Accept a carry bit from a present stage

ii) Accept a carry bit from the next stage

iii) Accept a carry bit from a previous stage

iv) Accept a carry bit from the following stages

M) Both OR and AND gates can have only two inputs.

i) True ii) False

N) How many input lines are in a 'Full Adder'?

i) 2 ii) 4 iii) 1

iv) 3 v) None of these

O) What is a multiplexer?

i) It is a type of decoder which decodes several inputs and gives one output

ii) A multiplexer is a device which converts many signals into one

iii) It takes one input and results into many output

iv) It is a type of encoder which decodes several inputs and gives one output

Q 02: Answer the following questions. Each question consists of six marks. [06 × 05]

A) Design a combinatorial circuit with two inputs, which produce output as logic 0 when any one input is 1.

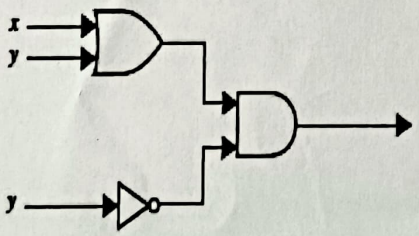
B) Create a circuit that needs to be built that produces an output of 1 if the decimal digit is 5 or greater, i.e., ≥ 5, and an output of 0 if the decimal digit is less than 5. How can this circuit be built using OR, AND, and inverters?

C) Multiply $(11010.1110)_2$ by $(1011.1101)_2$. Also, divide the octal number $(2276)_8$ by $(102)_8$. Show the calculation part.

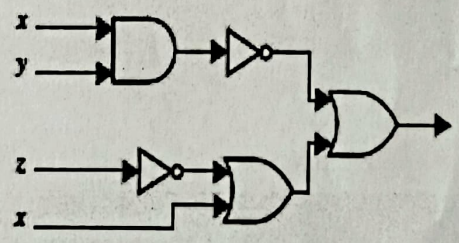
D) Explain Binary Coded Decimal (BCD). Convert $(237574)_8$ into BCD code. What are six illegal combinations in the BCD code? Explain why they are illegal.

E) Find the output of the given circuits.

i)



ii)



Q 03: Answer the following questions. Each question consists of ten marks. [10 × 04]

A) Write the truth table and simplified Boolean expression with four inputs and one output for the following instances. Finally, design the combinational circuit for them.

i) The output is 1 when the binary value of the inputs is less than or equal to five.

ii) The output is 1 when the binary value of the inputs is greater than or equal to ten.

B) What is K-map? Demonstrate the K-map used for three variables, x, y, z, and for four variables, w, x, y, z. Finally, use K-maps to minimize the following Sum of Product expansions.

i) $F_1 = xy\bar{z} + x\bar{y}\,\bar{z} + \bar{x}yz + \bar{x}\,\bar{y}\,\bar{z}$

ii) $F_2 = xy\bar{z} + x\bar{y}\,\bar{z} + \bar{x}\,\bar{y}z + \bar{x}\,\bar{y}\,\bar{z}$

C) Explain the following by taking a suitable example. Also, give figures where it seems necessary.

i) Half Adder with designing and logic diagram.

ii) 3 to 8 Decoder with truth table and logic diagram.

D) Implement a converter, which converts a 4 – bit binary code WXYZ into its equivalent Gray code ABCD.