M.P. BIRLA FOUNDATION HIGHER SECONDARY SCHOOL

SELECTION EXAMINATION 2020-21

CLASS XII

Subject: Computer Science

Max Marks : 70

Writing time : 3hr.

Section A

Question 1:

Question 1

(a) Verify using the truth table, if (X=>Y).(Y=>X) is a *tautology*, *contradiction* or *contingency*. **[2]**

(b) State the two Idempotence laws of Boolean Algebra. Verify any one of them using Truth Table. **[2]**

(c) Show how a NAND gate can be used to construct an OR gate. **[2]**

(d) Given, F (X, Y, Z) = (X+Y).(Y+Z) write the function in canonical product-of-sum form. **[2]**

(e) Given, the Boolean Function, F (X, Y, Z) = Σ (2, 3, 4, 6, 7). Reduce it using Karnaugh's Map. And also find the complement of its result. **[2]**

Question 2

b) What is a half adder? Draw the truth table, derive its Boolean expression and draw a logic diagram for Half adder. [6]

b) Convert the following infix expression to its postfix form:
A + ((B+C*K)/ (D+E*F))-H/G [2]

c) In an array of real numbers ARR[25][25], ARR[1][1] is stored in location 1000. Find the address of ARR[12][12] when the array is stored row major wise. Assume each real number requires 4 bytes. [2]

Question 3:

(a) Give output of the following function where x and y are arguments greater than 0. Show the dry run/working.

```
void confusing ( int x, int y )
{
  if ( x > 1 ) // base case
   {
    if ( x % y = = 0 )
      {
        System.out.print( y + " " );
        confusing ( x / y, y);
      } // end of inner if
    else
        confusing ( x , y+1);
   } //end of outer if
}
```

(i) What will the function confusing (24 , 2) return ? **[2]**

(ii) What will the function confusing (84 , 2) return ? **[2]**

(iii) In one line, state what the function is doing, apart from recursion. **[1]**

(b) The following function is a part of some class which prints whether a number is a **Magic Number** or not. It returns the value 1 when the number is a Magic Number, otherwise it returns 0.
There are some places in the code marked by ?1?, ?2?, ?3?, ?4?, ?5? which must be replaced by a statement / expression so that the function works properly:

/* A Magic Number is a number whose sum of the digits equals to 1, when this addition of digits is performed till the number itself becomes a single digit number. **Example:** 289, adding 2+8+9 it gives 19, then add, 1+9 it gives 10, then add 1+0, it gives 1, which is a single digit number, and since its sum is equal to 1, so, 289 is a magic number */

```
int isMagic (int n)
{
   int dig = 0, s = n;
   while ( ? 1 ? )
    {
      n = s, s = 0;
      while (n > 0)     {
         dig = ? 2 ?;
         s = s + ? 3 ?;
         ? 4 ?;          } //end of inner while
    } //end of outer while
if ( ? 5 ? )
    return 1;
else
    return 0;
}
```

(i) What is the expression/value at **? 1 ?** **[1]**
(ii) What is the expression/value at **? 2 ?** **[1]**
(iii) What is the expression/value at **? 3 ?** **[1]**
(iv) What is the expression/value at **? 4 ?** **[1]**
(v) What is the expression/value at **? 5 ?** **[1]**

Section B

Question 4:

a) Given the Boolean function
F(A,B,C,D)= Σ(0,1,2,4,5,7,11,13,15)
Use Karnaugh's map to reduce this function F, using the given SOP form. Draw ligic gate diagram for the reduced SOP form. You may use gates with more than two inputs. Assume that variables and their complements are available as inputs.

b) Now given X(A,B,C,D)= Π(2,3,4,7,9,10,11,12)
Use Karnaugh's map to reduce this function F, using the given POS form. Draw logic gate diagram for the reduced POS form. You may use gates with more than two inputs. Assume that variables and their complements are available as inputs. **[5x 2 =10]**

Question 5

(a) Draw the logic diagram and Truth Table to Encode the Hexadecimal lines (A – F). Briefly explain the working of the logic diagram. **[5]**

(b) Prove that the complement of A.(A + B).B.(B + C̄) is a Universal Gate. **[3]**

(c) Given : F (x, y, z) = n (2,3,6,7) **[2]**
Verify : F (x, y, z) = Σ (0,1,4,5)

Question 6:

A class PrimeFac contains an array of 50 integers. Some of the members of the class are given below:

Class name	:	PrimeFac
Data members		
num[]	:	array to store integers.
freq[]	:	array to store the frequency of prime factors of numbers.
Member functions		
PrimeFac()	:	constructor to inititalize array elements to 0.
void enter()	:	to enter values into array num[]
voidfrefac()	:	to determine the frequency of prime factors of the numbers stored in num[] and assign it to freq[].
voiddisp()	:	to display both the arrays.

Specify the classPrimeFac giving details of the constructor, void enter(), void frefac() and void disp().You need not write the main function.

[10]

Question 7.

A super class Worker has been defined to store the details of a worker. Define a sub class Wages to compute the monthly wages for the worker. The details of both the classes are given below:

Class name	:	Worker
Data members	:	
Name	:	to store the name of the worker
Basic	:	to store the basic pay in decimal
Member functions		
Worker(....)	:	parameterized constructor to assign values to the instance variables
void display()	:	display worker details
class name	:	Wages
Data members		
hrs	:	stores the hours worked
rate	:	stores rate per hour
wage	:	stores the overall wage of the worker
Member functions		
Wages(....)	:	parameterized constructor to assign values to the instance variables of both classes
double overtime( )	:	calculates and returns the overtime amount as (hours * rate)
void display()	:	calculates the wage using the formula wage=overtime amount +basic pay and displays it along with other details

Specify the class Worker giving details of the constructor() and void display(). Using the concept of inheritance, specify the class Wages giving details of the constructor(), double overtime() and void display(). The main function need not be written.

[10]