Subject:	**Computer Science (Theory)**	**Full Marks: 70**
Grade:	**XII**	**Writing Time: 1 Hour 45 Minutes**

Reading Time: 15 Minutes (Excluding Writing Time)
Uploading Time: 15 Minutes (in PDF format only)

General instructions:
1. *ALL QUESTIONS ARE* **COMPULSORY**
2. *The intended marks for questions or parts of questions are given in brackets [].*

(Select the CORRECT option for each of the following questions)

1. The law which represents the Boolean equation A + A'.B = A + B is: [1]

    (a) Commutative Law

    (b) Associative Law

    (c) Distributive Law

    (d) Idemoptence Law

2. The dual of Boolean equation X.Y + X.Y' = X + 0 [1]

    (a) (X' +Y') . (X'+Y) = X'.1

    (b) (X +Y) . (X+Y') = X.1

    (c) (X' +Y) . (X+Y') = X.0

    (d) (X +Y') . (X'+Y) = X.1

3. If W=0,X=1,Y=1,Z=1, then the minterm will be: [1]

    (a) W'+X+Y+Z

    (b) W+X'+Y'+Z'

    (c) W'.X.Y.Z

    (d) W.X'.Y'Z

4. Find the complement of F(A,B,C) = (A'.B.C')   [1]

   (a) A' + B + C'

   (b) A' + B' + C'

   (c) A + B' + C'

   (d) A + B' + C

5. The proposition operator V represents: [1]

   (a) Conjunction

   (b) Disjunction

   (c) Implication

   (d) Biconditional

6. Multiplexer :   [1]

   (a) Converts from number system to any number system.

   (b) Selects decimal information from one or many input lines and directs it to a one output line.

   (c) Selects binary information from one input line and directs it to a one or many output lines.

   (d) Selects binary information from one or many input lines and directs it to a single output line.

7. XNOR gate gives high output: [1]

   (a) when the input combination has odd number of 1's.

   (b) when the input combination has even number of 1's.

   (c) when any input line is high.

   (d) when all the input lines are high.

8. The combinational circuit which converts binary to equivalent decimal form: [1]

   (a) Encoder

   (b) Multiplexer

   (c) Decoder

   (d) Full Adder

9. A paired group in a Karnaugh Map eliminates: [1]

   (a) 4 variables

   (b) 3 variables

   (c) 2 variables

   (d) 1 variable

10. A two input (A,B) XOR gate is represented by: [1]

    (a) $(A' + B).(A + B')$

    (b) $(A' + B'). (A + B)$

    (c) $A.B' + A'.B$

    (d) $A'.B' + A.B$

11. In a decimal to binary encoder, when 7th input switch button is pressed then [2]

    (a) F_0 and F_1 OR gates produce the high output.

    (b) F_0, F_1 and F_3 produce the high output

    (c) F_1, F_2 and F_3 produce the high output

    (d) F_0, F_1 and F_2 produce the high output

12. A matrix A[m][m] is stored in the memory with each element requiring 4 bytes of storage. If the base address at A[1][1] is 1500 and address of A[4][5] is 1608, determine the order of the matrix when it is stored in **Column Major Wise**. [2]

    (a) The order of the matrix A is 4 rows and 4 columns

    (b) The order of the matrix A is 6 rows and 4 columns

    (c) The order of the matrix A is 6 rows and 6 columns

    (d) The order of the matrix A 4 rows and 6 columns

13. If P = "You won't go to bed now" and Q = "You will be tired tomorrow" then,

    (a) write its proposition for inverse: [1]

        (i)   If you won't go to bed now then you will be tired tomorrow.

        (ii) If you go to bed now then you won't be tired tomorrow.

        (iii) You won't go to be now and you will be tired tomorrow.

        (iv) If you go to bed now then you would be tired tomorrow.

(b) write its proposition for converse: [1]

    (i)   If you won't go to bed now then you will be tired tomorrow.

    (ii)   If you go to bed now then you won't be tired tomorrow.

    (iii) If you won't be tired tomorrow then you will go to bed now.

    (iv) If you go to bed now then you would be tired tomorrow.

14. The reduce expression of the Boolean expression F(A,B,C) =π (0,2,4,6)   [2]

    (a) 0

    (b) (A + B).(A' + B)

    (c) (A + C). (A' + C)

    (d) (B + C). (B' + C)

15. What is the output of the code given below: [2]

```
int i,j;
for(i=10;i>=1;i-=3)
{
    for(j=i;j>1;j-=2)
    {
        System.out.print(j + "\t");
    }
    System.out.println(); if(i
    %4==0)
        break;
}
```

    (a) 10 8   6   4   2

         7 5   3

         4 2

    (b) 10   7   4 3   1

         7   4   3   1

         4   3 1

(c) 10   8   6   4

    8   6   4

    6   4

    4

(d) 10 7   4   3

    8   6 4   2

    7 4   3

    5 4

16. What is the output of the code given below: [2]

```
char[ ] alpha={'A', 'B', 'C', 'D'};
int sum=0;
for(int i=0;i<alpha.length;i++)
        sum+=alpha[i] + Integer.parseInt("10");
System.out.print(sum);
```

(a) A10B10C10D10

(b) 300

(c) 306

(d) 310

17. What is the output of the code given below: [2]

```
System.out.print('a' + Integer.parseInt("a") +100 )
```

(a) 230

(b) 294

(c) Runtime Exception: NumberFormatException

(d) 97 a 100

18. The basic logic circuit gate that represents the simplification of the Boolean expression: [2]

A.(A'+B).C.(A+B)

(a) OR Gate

(b) AND Gate

(c) NAND Gate

(d) NOR Gate

19. What is the conditional statement to check the upper triangular elements and lower triangular elements of a two-dimensional square matrix of rows size M and column size M? The row index is represented as **r** and column index is represented as **c**. [2]

 (a) Conditional statement for upper triangular elements (r<c)

   Conditional statement for upper triangular elements (r>c)

 (b) Conditional statement for upper triangular elements (r<=c)

   Conditional statement for upper triangular elements (r>=c)

 (c) Conditional statement for upper triangular elements and lower triangular elements

   (r>0 ||r<M-1 && c>0 && c<M-1)

 (d) Conditional statement for upper triangular elements and lower triangular elements

   (r==0 ||r==M-1 && c==0 && c==M-1)

20. The following proposition **~(P=>Q) <=> (~P v Q)** is a [2]

 (a) Tautology

 (b) Contradiction

 (c) Contingency

 (d) Implication

21. Reduce the Boolean Function F(A,B,C,D)= Σ(0,1,2,3,5,6,7,10,13,14,15) by using the 4-variable Karnaugh map and answer the following questions:

 (a) What will be the least number of groups and their types formed for reduction? [1]

   (i) 2 quads 2 pairs

   (ii) 3 quads 1 pair

   (iii) 3 quads

   (iv) 1 octet 2 quads 1 pair

 (b) The reduced expression for the Boolean function given above is: [2]

   (i) A.B + B.D + C.D'

   (ii) A'.B' + B.D + C'.D

   (iii) A'.B' + B'.D' + C.D'

   (iv) A'.B' + B.D + C.D'

22.
 A school intends to select candidates for the Inter-School Athletic Meet, as per the criteria given below:
  • The candidate is from the Senior School and has participated in an Inter-School Athletic Meet earlier.

OR

The inputs are:

INPUTS	
S	Student is from the Senior School
W	Weight is between 50 kg. and 60 kg.
H	Height is between 5 ft. and 6 ft.
A	Taken part in Inter-School Athletic Meet earlier

(In all of the above cases 1 indicates yes and 0 indicates no)
Output: **X** - Denotes the selection criteria [1 indicates selected and 0 indicates rejected in all cases.]

Draw the truth table for the inputs and outputs and answer the following questions: [2]

(a) The SOP expression of X(A,B,C,D) will be:

   (i)   F(A,B,C,D) = Σ(5,6,7,8,9,10,11,13,14,15)

   (ii)   F(A,B,C,D) = Σ(5,6,8,9,10,11,13,14,15)

   (iii)   F(A,B,C,D) = Σ(6,7,9,10,11,13,14,15)

   (iv)   F(A,B,C,D) = Σ(4,5,6,7,8,9,10,11,13,14,15)

(b) The maximum input combinations for the above truth table will be: [1]

   (i) 2

   (ii) 4

   (iii) 8

   (iv) 16

23. Reduce the Boolean Function F(A,B,C,D)= π(4,6,7,10,11,12,14,15) by using the 4-variable Karnaugh map and answer the following questions:

(a) What will be the least number of groups and their types formed for reduction?   [1]

   (i)   3 quads 1 pair
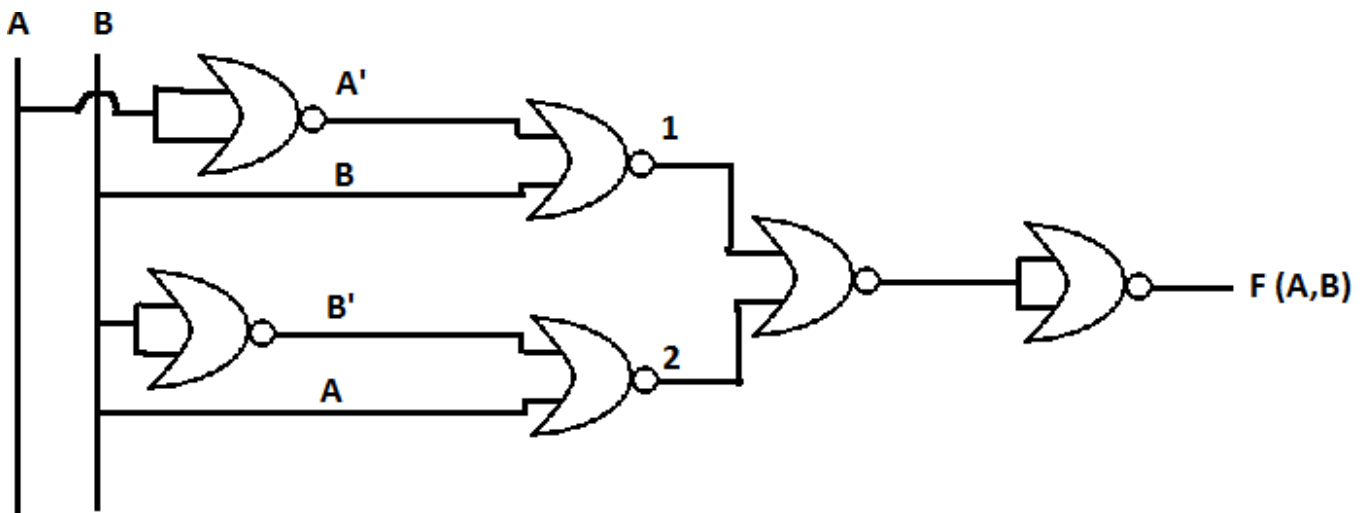
   (ii)   3 quads 2 pair

   (iii)   3 quads

   (iv)   1 octet 2 quads 1 pair

(b) The reduced expression for the Boolean function given above is: [2]

 (i) (B'+D). (A'+C). (B' + C')

 (ii) (B + D') . (A+C') . (B' + C')

 (iii) (B '+ D') . (A+C) . (B' + C')

 (iv) (B'+D) . (A'+C'). (B'+C')

24. From the logic diagram given below where A and B are the inputs and F is the output, answer the

following questions:
(a) The expression 1 is: [1]

 (i) A'.B

 (ii) A.B'

 (iii) A'+B

 (iv) A+B'

(b) The expression 2 is: [1]

(i) A'.B

(ii) A.B'

(iii) A'+B

(iv) A+B'

(c) The final expression F(A,B) is : [1]

(i) (A+B'). (A'+B)

(ii) (A' + B'). (A + B)

(iii) A.B' + A'.B

(iv) A'.B' + A.B

25. Given the Boolean expression F(A,B,C,D)=A + [(B+C).(B' + D')], identify:

   (a) The complement of the expression: [2]

      (i)   (A' + B' + C') . (A' + B + D)

      (ii) (A + B + C) . (A' + B + D)

      (iii) A'.B'.C' + A'.B.D

      (iv) A.B.C + A'.B.D

   (b) The law used: [1]

      (i)   Distributive Law

      (ii)   De Morgan's Law

      (iii)   Associative Law

      (iv)   Idempotent Law

26. With reference to the program code given below, answer the questions that follow: public static

   int fun(int t)

```
{

        int i,j,ctr,sum;
        sum=0;
        for(i=2;i<=t;i++)
        {
                ctr=0;
                for(j=1;j<=i;j++)
                {
                        if(i%j==0)
                                ctr++;
                }
                if(ctr==2)
                        sum+=i;
        }
        return sum;
}
```

(a) What is the output of the method **fun( )** when the value of **t** is **10**?   [2]

    (i)   15

    (ii)   19

    (iii) 17

    (iv) 12

(b) What is the method fun performing?   [1]

    (i)   Returning the sum of Fibonacci Series till **t.**

    (ii)   Returning the sum of the Prime Numbers till **t.**

    (iii)   Returning the sum of the Even Numbers till **t.**

    (iv) Returning the sum of the Odd Numbers till **t.**

27. With reference to the program code given below, answer the questions that follow: public static

void **Test()**

```
{
        int[] arr={7,14,21,28,35,42};
        int[] temp=new int[arr.length]; int
        i,j,k,n,pos;
        n=arr.length;

        for(i=0;i<n;i++)
        {
          for(j=0;j<(n-i);j++)
                temp[j]=arr[j];

          for(k=n-j,pos=0;k>0;k--,pos++,j++)
                temp[j]=arr[pos];

          for(int x=0;x<temp.length;x++)
                System.out.print(temp[x] + " ");
          System.out.println();
        }
}
```

(a)   What will be the output of the following method: [2]

(i)   7   14   21   28   35   42

       42 35   28   21   14   7

       6   14   21   28   35   42

       7   42   35   28   21   14

       (ii)   7   14   21   28   35   42

               7   14   21   28   35   7

               7   14   21   28   7   14

               7   14   21   7   14   28

               7   7   14   21   28   35

       (iii)   7   14   21   28   35   42

               7   41   12   82   53   24

       (iv)   7   7   7   7   7   7

               14   14   14   14   14   14

               21   21   21   21   21   21

               28   28   28   28   28   28

               35   35   35   35   35   35

(b)   What is the method **Test()** performing?   [1]

    (i)   Reversing each number in the given array

    (ii) Repeating each number in a row

    (iii) Cyclic Shift

    (iv) Alternative Arangement

28. With reference to the program code given below, answer the questions that follow: public static
    void GuessWhat()

    {

            Scanner scn=new Scanner(System.in);

```
System.out.println("Enter three integers : "); int

x=scn.nextInt();

int    y=scn.nextInt();

int z=scn.nextInt(); int

res=0;

for(int i=1;i<=x && i<=y && i<=z;i++)

{

        if(x%i==0 && y%i==0 && z%i==0)

                res=i;

}

System.out.println("Result : " + res);

}
```

(a) What will be the output of GuessWhat() if x=14, y=28 and z=42 ?   [2]

(i) 84

(ii) 14

(iii) 0

(iv) 28

(b) What is the method performing?   [1]

(i) LCM of the three numbers

(ii) GCD of the three numbers

(iii) Checking for prime numbers

(iv) Checking for composite numbers

29. With reference to the program code given below, answer the questions that follow: public static

void Fun()

{

```
int[ ] arr={34,56,67,78,89};

int i,t,y,x;

for(i=0;i<arr.length;i++)

{

  t=arr[i];

  y=0;
```

```
            while(t>0)
            {

                x=t%10;

                y=y*10+x;

                t=t/10;

            }

            arr[i]=y;

        }

        for(i=0;i<arr.length;i++)

            System.out.print(arr[i] + " ");

    }
```

    a.   What will be the output of the method Fun( )?   [2]

(i)   89   78   67   56   34

(ii)   340 560   670   780   890

(iii)   43   65   76   87   98

(iv)   44   66   77   88   99

    b.   What is the method performing?   [1]

        (i)   Reverse of the array

        (ii)   Multiplying each array element by 10

        (iii)   Reversing each array element

        (iv)   Adding each array element by 10

30. The following program checks whether the positive integer number 'n is **Automorphic**
number by returning true or false. There are some places in the code marked as **?1?,**
?2?, ?3?, ?4? and ?5? which are to be replaced by the statement/expression so that the code
works properly.

```
import java.util.Scanner;
public class Test
{
    public static boolean checkAutomorphic()
    {
```

```
        int n,temp,count,sq,rem;
        Scanner scn=new Scanner(System.in);
        count=sq=rem=0;

        System.out.print("Enter a number : ");
        n=scn.nextInt();

        temp=n;
        while(temp>(a)_____)
        {
           count++;
           temp=(b)_____;
        }


        sq=n*(c)_____;
        rem=sq%(d)_____;
        if(n==(e)_____)
           return true;
        else
           return false;
     }
   }
```

(a) (i) 1

   (ii) 10

   (iii) 0   [1]

(b) (i) temp+1

   (ii) temp/10

   (iii) temp-1   [1]

(c) (i) 10   [1]

   (ii) n

   (iii) temp

(d) (i) (int)Math.pow(10,count)

   (ii) (int)Math.pow(count,10)

   (iii) (int)Math.pow(10,temp)   [1]

(e) (i) sq   [1]

   (ii) rem

   (iii) temp

31. With reference to the program code given below, answer the questions that follow: public static

```
void Test()
{
    int i,k=1,flag=0; int[]
    arr={2,5,7,9};

    for(i=0;i<arr.length-1;i++)
    {
        if(arr[i]==arr[i+1])
        {
            k++;
            flag=1;
        }
        else
        {
            System.out.print("\n" + arr[i] + "\t" + "\t" + k); flag=0;
        }
        if(flag==0)
            k=1;
    }
    System.out.print("\n" + arr[i] + "\t" + "\t" + k);
}
```

(a)   What will be the output of the following code?   [2]

(i)   3

(ii)   2   1

        5   1

        7   1

        9   1
                                            (iii) 14

        (iv)   2222, 5555,7777,9999

(b)   What is the method performing?   [1]
    (i)   Counts the number of prime numbers in the array

    (ii)   Counts the occurrences of each array element

    (iii) Find the sum of prime numbers

    (iv)   Repeating digits to each array element

32. The following program code sorts a single dimension array in ascending order using

Selection Sort Technique. There are some places in the code marked as **?1?, ?2?, ?3?, ?4?** and **?5?** which are to be replaced by a statement /expression so that the code works properly.

```
public ?1? selectionSort()
{
    for (int i = 0; i < arr.length-1; i++)
    {
        int min_index = ?2?;
        for (int j = i + 1; j < ?3?; j++)
        {
            if (?4? > arr[j])
                min_index = ?5?;//searching for lowest index
        }
        int smallerNumber = arr[min_index];
        arr[min_index] = arr[i];
        arr[i] = smallerNumber;
    }
    return arr;
}
```

Answer the following questions.

(a) What is the statement or expression at **?1?**   [1]

   (i)   int

   (ii) void

   (iii) int[ ]

   (iv) double

(b) What is the statement or expression at **?2?**   [1]

   (i)   arr

   (ii) i

(iii) j

(iv) arr[min_index]

(c) What is the statement or expression at **?3?**   [1]

    (i)   arr[i]

    (ii) arr.length

    (iii) arr[min_index]

    (iv) arr[j]

(d) What is the statement or expression at **?4?**   [1]

    (i)   arr[[i]

    (ii) arr.length

    (iii) i

    (iv) arr[min_index]

(e) What is the statement or expression at **?5?**   [1]

    (i)   i

    (ii)   j

    (iii)   arr[min_index]

    (iv)   arr[j]

———————————