ISC SEMESTER-1 EXAMINATION

COMPUTER SCIENCE

Solved Board Paper - 2021-22

Class–12th

Maximum Marks: 70
Time allowed: One and a half hour
*(Candidates are allowed additional **10 minutes** for only reading the paper.)*
ALL QUESTIONS ARE COMPULSORY
The marks intended for questions are given in brackets [ ]

Select the correct option for each of the following questions.

Choose the correct option to answer the following questions. **[40]**

1. The Boolean equation which holds true for the Involution Law is: **[1]**
(a) A′+1=1 **(b)** ((A+B)′)′=A+B
(c) (A+B)′=A′.B′ **(d)** A.(B+C)=(A+B).C

2. The representation of the Boolean function F(A,B)=p(1,3) in canonical form is:
(a) (A′+B).(A+B) **(b)** S(0,2)
(c) A′B+AB **(d)** (A+B′).(A′+B′)

3. If P=1, Q=1, R=0 and S=1, then the minterm will be:
(a) P+Q+R′+S **(b)** P′Q′RS′
(c) PQR′S **(d)** P′+Q′+R+S′

4. The dual of the Boolean equation (X+Y)′+(X′.Y′)+1 =1 is:
(a) (X.Y)′.(X′+Y′).0=0 **(b)** (X+Y).(X′.Y′)+1=1
(c) (X.Y).(X+Y).0=0 **(d)** (X.Y)′.(X′+Y′).1=1

5. The propositional operator ^ represents:
(a) Negation **(b)** Implication
(c) Conjunction **(d)** Disjunction

6. A decoder is a combinational circuit which:
(a) inputs 2^n lines and output 'n' lines
(b) converts parallel data into serial data
(c) inputs 'n' lines and outputs 2^n lines
(d) adds more than two binary bits

7. The group which eliminates the maximum variables in a Karnaugh's map is:
(a) Quad **(b)** Octet
(c) Pair **(d)** Redundant

8. When three NAND gates are placed in series, it performs:
(a) NAND operation **(b)** AND operation
(c) OR operation **(d)** NOR operation

9. The expression for *Sum of a Full adder* is:
(a) (a+b′).(b+c′).(a+c′) **(b)** a ⊕ b ⊕ c
(c) a′b+ab′+a′c **(d)** a ⊕ b

10. Multiplexers are combinational circuits which are used for:
(a) converting High Level signals into Low Level signals
(b) data transmission
(c) converting binary to decimal
(d) adding binary bits

11. A square matrix A[m][m] is stored in the memory *Row Major wise* with each element requiring 2 bytes of storage. If the base address at A[1][0] is 1020 and the address at A[4][3] is 1056, then the order of the matrix A[m][m] will be:
(a) [6][6] **(b)** [4][4]
(c) [5][5] **(d)** [3][3]

12. The simplified expression for the Boolean expression PQ.(PQ+QR) is:
(a) P **(b)** 1
(c) PQ **(d)** QR

13. Given the proposition A => ~B, find:
(i) The inverse of the proposition:
(a) ~A => B **(b)** B => ~A
(c) ~A => ~B **(d)** ~B => A
(ii) the contra-positive of the proposition:
(a) ~A => B **(b)** B => ~A
(c) ~B => A **(d)** ~A => ~B

14. What is the output of the code given below?

```
void main()
{ int s=1,c;
  for(int i=1;i<=3;i++)
  { c=i;
    while(c!=0)
    s=s*c--;
  }
  System.out.println(s);
}
```

(a) 18 **(b)** 12
(c) 36 **(d)** 4

15. The conditional statement to check for the diagonal elements in a double dimensional array of 'M' number of rows and 'M' number of columns having the row index represented by 'r' and the column index represented by 'c' will be:
(a) `(r==c && r+c == M)`
(b) `(r==c || r+c == M-1)`
(c) `(r==c && r+c == M-1)`
(d) `(r==c || r==M-1 || c==M-1)`

16. The *carry* expression in cardinal form for a half adder is:
(a) π(0,1,2) **(b)** Σ(0,1,2)
(c) π(3) **(d)** Σ(1,2)

17. What is the output of the code given below?

```
void main()
  { int a,b,c;
```

```
        for(a=150,b=65,c=0;a%b!=0;c=a%b
        ,a=b,b=c);
        System.out.print(b+"");
    }
```

(a) 0 **(b)** 65
(c) 5 **(d)** Error

18. The reduced expression of the Boolean function F=A(B+C(AB+AC)′) is:
(a) 1 **(b)** AB
(c) 0 **(d)** A′C+AB′C

19. The following is an *if-else* code.

```
if(x!=y)
  P=x+y;
else
  P=12;
```

What is the representation of the above code in *ternary form*?
(a) P=(x!=y)? x+y, 12;
(b) P=(x!=y)? P=x+y; P=12;
(c) P=(x!=y)? x+y : 12;
(d) P=(x!=y) x+y, 12;

20. The proposition (P=>~Q)∨(~P=>Q) is a:
(a) Contradiction **(b)** Tautology
(c) Implication **(d)** Contingency

21. Reduce the given Boolean function F(A,B,C,D) =Σ(6,7,10,11,12,14,15) by using 4-variable Karnaugh map and answer the following questions:
(i) What will be the least number of groups and its types formed for reduction
(a) 4 pairs
(b) 2 quads and 1 pair
(c) 1 quad and 2 pairs
(d) 3 quads
(ii) What is the reduced expression of the Boolean function given below?
(a) ABD′+ACD′+BCD′+AC′D′
(b) (B+C).(A+C).(A+B+D′)
(c) AC+ABD′+BCD′
(d) BC+AC+ABD′

22. A Post Graduation College intends to offer courses in three categories of journalism which are, the print, the web and the broadcasting media. A student is eligible to apply if he/she satisfies any one of the criteria given below:

- The student is a graduate in any discipline with an aggregate percentage of 75 or above and with a record of literary skills.

Or

- The student is a graduate in Mass Communication with an aggregate percentage of 75 or above and with a record of literary skills.

Or

- The student is a graduate in Mass Communication and with a record of literary skills but does not have an aggregate percentage of 75 or above.

The inputs are:

Inputs	
G	Graduate in any discipline
M	Graduate in Mass Communication
P	Aggregate percentage of 75 and above
S	Record of Literary Skills

(In all the above cases 1 indicates yes and 0 indicates no).

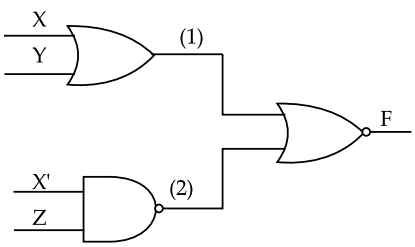
Output: X [1 indicates eligible and 0 indicates not eligible for all cases].

Draw the truth table for the inputs and outputs given above and answer the following questions:

(i) What will be the SOP expression for X(G,M,P,S)?
(a) Σ(5,6,11,13,14,15)
(b) π(5,6,11,13,14,15)
(c) Σ(0,1,2,3,4,7,8,9,10,12)
(d) π(0,1,2,3,4,7,8,9,10,12)
(ii) What will be the complement of the above SOP expression?
(a) S(5,6,11,13,14,15)
(b) P(5,6,11,13,14,15)
(c) S(0,1,2,3,4,7,8,9,10,12)
(d) P(0,1,2,3,4,7,8,9,10,12)

23. Reduce the given Boolean function F(A,B,C,D) = π(3,4,5,6,7,10,12,13,14,15) by using 4-variable Karnaugh map and answer the following questions:
(i) What will be the least number of groups and its types formed for reduction?
(a) 1 octet and 2 pairs
(b) 2 quads and 2 pairs
(c) 1 octet and 3 pairs
(d) 4 pairs
(ii) What is the reduced expression of the Boolean function given above?
(a) (A′+C′).(C′+D).(A′+C′+D).(A+C+D′)
(b) B′.(A′+C′+D).(A+C′+D′)
(c) B′.(A′+C′).(C′+D′)
(d) (A′+C′+D).(A+C+D′).(A+B′+C).(B′+C+D′)

24.



With reference to the logic diagram given above, where X, X′, Y and Z are inputs and F is the output, answer the following questions:

(i) What is the expression at (1)?
(a) X.Y **(b)** X′+Y′
(c) X+Y **(d)** X+Y′

(ii) What is the expression at (2)?
(a) (X+Z)′ **(b)** (X+Z′)
(c) X′+Z **(d)** (X′.Z)′

(iii) What is the final expression F(X,Y,Z)?
(a) (XY+X′Z)′ **(b)** ((X+Y)+(X′.Z)′)′
(c) ((X+Y).(X′.Z)′)′ **(d)** (X′+Z)+(XY)′

25. Given the Boolean expression F = P+((Q+R).(Q′+S′)):

(i) Identify the complement of the expression:
(a) P′+(Q′R′+QS) **(b)** P′.(QR+Q′S′)
(c) P′.(Q′R′+QS) **(d)** P′QR+P′QS

(ii) De Morgan's law states that the complement of a sum is equal to:
(a) the complement of their product
(b) the product of their individual complements
(c) the sum of their individual complements
(d) the complement of their sum

26. With reference to the following program code, answer the question that follow:

```
void trick(int a, int b)
{ int p=1;
  for(int j=1; j<=b;j++,p*=a);
  System.out.println(p);
}
```

(i) What will be the output of the method trick() when the values of a=3 and b=4?
(a) 12 **(b)** 127
(c) 81 **(d)** 64

(ii) What is the method trick() computing?
(a) Factorial of a number
(b) Product of the number
(c) Power of a number raised to a number
(d) HCF of the two numbers

27. With reference to the following program code, answer the questions that follow:

```
void funny(int p,int m, int n)
{ for(int i=p;i<=p;i++)
  { switch(i)
    { case 1: m+=10;
      case 2: n-=1; break;
      case 3: m+=n;n+=3;break;
      default: m+=2;
    }
    System.out.println(m+";"+n);
  }
}
```

(i) What will be the output of the method funny() when the values of p=1,m=12 and n=6?
(a) 20:4 **(b)** 22:5
(c) Error **(d)** 24:7

(ii) What is the keyword used in Java to avoid a fall through condition?
(a) case **(b)** continue
(c) switch **(d)** break

28. With reference to the following program code, answer the questions that follow:

```
void play(int n)
{ int s=0;
  while(n!=0)
  { s=s*10+n-(n/10)*10;
    n/=10;
  }
  System.out.println(s);
}
```

(i) What will be the output of the method play() when the value of n=6957?
(a) 27 **(b)** 695
(c) 5679 **(d)** 7596

(ii) What is the method play() performing?
(a) Arranging the digits in ascending order
(b) Reversing the number
(c) Extracting the first 3 digits
(d) Sum of the digits

29. With reference to the following program code, answer the questions that follow:

```
void test(int arr[])
{ int c=0,s=0;
  for(int i=0;i<arr.length;i++)
  { for(int j=1;j<=arr[i];j++)
    { if(arr[i]%j==0) c++;
    }
    if(c==2) s++;c=0;
  }
  System.out.println(s);
}
```

(i) What will be the output of the method test() when the value of arr[]={2,9,13,18,21,29}?
(a) 3 **(b)** 4
(c) 0 **(d)** 1

(ii) What is the method test() performing?
(a) Counting the odd numbers
(b) Checking for the maximum element
(c) Checking the perfect numbers
(d) Counting the prime numbers

30. With reference to the following program code, answer the questions that follow:

```
int solve(int p, int q)
{ for(int r=0;p>0;r=q%p,q=p,p=r);
  return(p==0)?q:-1;
}
```

(i) What will be the output of the method solve() when the values of p=12 and q=8?
(a) 8 **(b)** 16
(c) 96 **(d)** 4

(ii) What is the method solve() performing?
(a) LCM of two numbers
(b) Checking the divisibility of two numbers
(c) HCF of two numbers
(d) Counting the common Prime factors of two numbers

31. The following program code converts a decimal integer number 'num' to its equivalent value in any given base 'b'. 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.

```
void convertnum(int num, int b)
{ int A[]=new int[20];
  int x=?1?;
  while(num !=0)
  { A[x++]=?2?;
    num /=b;
  }
  for(int i=?3?;i>=0;i--)
  { if(?4?)
      System.out.print(A[i]);
    else
      System.out.print((char)
(?5?));
  }
}
```

Answer the following questions:

(i) The statement or expression at ?1? is:
(a) 1 **(b)** 0
(c) –1 **(d)** 10

(ii) The statement or expression at ?2? is:
(a) num*num **(b)** num/b
(c) num%b **(d)** num

(iii) The statement of expression at ?3? is:
(a) x–1 **(b)** x
(c) x–2 **(d)** 0

(iv) The statement or expression at ?4? is:
(a) i<num **(b)** A[i]>num
(c) A[i]>10 **(d)** A[i]<10

(v) The statement or expression at ?5? is:
(a) A[i] **(b)** A[i]+55
(c) A[i]+65 **(d)** A[i]*10

32. The following program code sorts the columns of a double dimensional array in descending order using **Bubble 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.

```
void sortcol(int M[][])
{ int r=M.length;
  int c=?1?;
  int t;
  for(int k=0; ?2?; k++)
    for(int i=0;i<r-1;i++)
      for(int j=0;j<r-1-i;j++)
      { if(?3?)
        { ?4?=M[j][k];
          M[j][k]=?5?;
          M[j+1][k]=t;
        }
      }
}
```

Answer the following questions:

(i) The statement or expression at **?1?** is:
(a) M.length **(b)** M[0].length
(c) M.length() **(d)** M[1].length()

(ii) The statement or expression at **?2?** is:
(a) k<=r **(b)** k<=c
(c) k<r **(d)** k<c

(iii) The statement or expression at **?3?** is:
(a) M[j]<M[j+1]
(b) M[k][j]<M[k][j+1]
(c) M[j][k]<M[j+1][k]
(d) M[i][k]<M[i+1][k]

(iv) The statement or expression at **?4?** is:
(a) t **(b)** M[j+1][k]
(c) r **(d)** c

(v) The statement or expression at **?5?** is:
(a) M[i+1][k]
(b) M[k][j+1]
(c) M[j][k]
(d) M[j+1][k]

ANSWERS

1. Option (b) is correct.
Explanation: In Involution law (a′)′ =a. Here in option B ((A+B)′)′ = A+B

2. Option (d) is correct.
Explanation: In product of sum, 1 will be represented by (A+B′) and 3 will be represented by (A′+B′). So canonical form will be (A+B′).(A′+B′)

3. Option (c) is correct.
Explanation: Minterm is product of boolean variables either in normal form or complemented form.

4. Option (a) is correct.
Explanation: In duality, change AND into OR and vice versa. Similarly 0 into 1 and 1 into 0. For this given equation dual of the expression will be (XY)′. (X′ + Y′).0 = 0 i.e., option **(a)**.

5. Option (c) is correct.
Explanation: This symbol (^) will represent AND in boolean algebra which is known as Conjunction.

6. Option (c) is correct.
Explanation: Decoder circuit used for convert binary number to other number system like Decimal, Octal etc. It accepts n bit binary value and produces 2^n value as output.

7. Option (b) is correct.
Explanation: In Karnaugh's map maximum variable can be used in an octet. Because in octet 8 blocks will group together.

8. Option (a) is correct.
Explanation: From first get it product NAND, then second gate convert the NAND into AND and third gate once again convert it into NAND.

9. Option (b) is correct.
Explanation: In Full adder expression for Sum is A′B′C + A′BC′+AB′C′+ABC. After simplification it produces two XOR gate, i.e. a ⊕ b ⊕ c.

10. Option (b) is correct.
Explanation: Multiplexer allowing the transmission of data from different channels and produced one output. It is used in data transmission.

11. Option (c) is correct.
Explanation: In Row Major for calculate the address of a cell of a matrix is

Address of A[I][J] = B + W(N(I-R_0)+(J-C_0))

B = Base address
W = Width of the cell of matrix
N = Number of column
I = Row subscript of the element.
J = Column subscript of the element.
R_0 = Lower range of the row.
C_0 = Lower range of the column.
Using the above formula output will be 5.

12. Option (c) is correct.

Explanation: Using Distributive law it will produce PQ as output.

13. (i) Option (a) is correct.

Explanation: The inverse of a given conditional statement is a new condition whose antecedent and consequent are the negation of the original conditional statement.

(ii) Option (b) is correct.

Explanation: A new conditional statement obtained whose antecedent is the negation of the consequent of the original conditional statement and consequent as negative antecedent of the original conditional statement.

14. Option (b) is correct.

Explanation: Value of S will be 1 x 2 x 1 x 3 x 2 x 1 which is equal to 12

15. Option (b) is correct.

Explanation: If the size of a square matrix = 5, then the indexes of the diagonal will be (0,0), (1,1),(2,2),(3,3,) and (4,4). Other one is (0,4), (1,3), (2,2), (3,1) and (4,0). That means when row = column or row + column = size -1.

16. Option (c) is correct.

Explanation: Carry of half adder is AND which in cardinal form is ∩(3).

17. Option (c) is correct.

Explanation: Loop will continue till a%b not equals to 0. In first iteration c = 20, a=65, b=20. In second iteration c=5 a=20 and b=5. Here a is divisible by b, so loop will stop and it will produce the output 5, as the value of b.

18. Option (b) is correct.

Explanation:

A(B+C(AB + AC)')
= AB + AC(A(B+C))'
= AB + AC(A' + (B+C)')
= AB + ACA' + ACB'C'
(Using De'Morgans law)
= AB + 0 + 0
= AB

19. Option (c) is correct.

Explanation: In ternary operator ? (question mark) and : (colon) will be used not the ,(comma).

20. Option (b) is correct.

Explanation: In truth table value of P -> Q' is 1, 1, 1, 0 and the value of P' -> Q is 0, 1, 1, 1. P->Q' V 'P' -> Q will be 1, 1, 1, 1 which is tautology.

21. (i) Option (b) is correct.

Explanation: After plotting Karnaugh's map it will produce 2 quads (cell number (6,7,14,15) and (10,11,14,15)) and one pair (cell number (12,14)).

(ii) Option (d) is correct.

Explanation: Reduced expression will be BC + AC + ABD' (Which is nearer to Option **(d)** is correct.)

22. (i) Option (a) is correct.

Explanation: After draw the truth table at the position of 5,6,11,13,14,15 produced 1 as output and other position produced 0. So SOP expression will be the Option **(a)** is correct.

(ii) Option (d) is correct.

Explanation: After complementing the SOP expression it will produce POS expression for this reason Option **(d)** will be the correct option.

23. (i) Option (a) is correct.

Explanation: After plotting Karnaugh's map it will produce 1 octet (cell number (4,5,6,7,12,13,14,15) and two pairs cell number (3,7) and (10,14).

(ii) Option (b) is correct.

Explanation: From Octet output will be B' and from 1st pair output will be (A+C'+D') and from 2nd pair output will be (A' + C'+ D)

24. (i) Option (c) is correct.

Explanation: OR gate produce X + Y

(ii) Option (d) is correct.

Explanation: NAND gate produced (X'.Z)'

(iii) Option (b) is correct.

Explanation: NOR gate of expression 1 and 2 will produce the output as ((X+Y)+(X'.Z)')'.

25. (i) Option (c) is correct.

Explanation: After compliment using De'Morgans law which is change AND into OR and vice versa it produce option C.

(P+((Q+R).(Q'+S')))'
=P'.(Q+R)'+(Q'+S')'
[De'Morgans law]
=P'.(Q'R' + QS)

(ii) Option (b) is correct.

Explanation: De Morgan's law states that the complement of a sum is equal to the product of their individual complements, e.g. (A+B)'=A'.B'.

26. (i) Option (c) is correct.

Explanation: Here loop will execute 4 times and 3 will be multiply with p which is initially 1, 4 times. Output will be 3 x 3 x 3 x 3 = 81

(ii) Option (c) is correct.

Explanation: It will produce 3 ^ 4, i.e. 81.

27. (i) Option (b) is correct.

Explanation: Case 1 will execute which increase the value of m by 10 after that control moves to case 2 and reduce the value of n by 1. So output will be 22:5

(ii) Option (d) is correct.

Explanation: In this code after case 1 there is break statement, which occurs fall through in switch case. To avoid fall through we must add break statement at the end of every case statement.

28. (i) Option (d) is correct.

Explanation: Here while will execute and print the passed digit in reverse order.

(ii) Option (b) is correct.

Explanation: It will produce the reversing the number.

29. (i) Option (a) is correct.

Explanation: Loop i will repeat 6 times which is the length of the array arr[]. And the loop j will be for count the number of factors of each number. If it is equal to 2 that means the number is prime. Because only prime number has two factors. In this array only 3 prime numbers are there (2, 13, 29).

(ii) Option (d) is correct.

Explanation: This program will count number of prime number present in the array.

30. (i) Option (d) is correct.

Explanation: It will find the HCF using division method.

(ii) Option (c) is correct.

Explanation: Find HCF of two numbers.

31. (i) Option (b) is correct.

Explanation: Initialize the value of x with 0.

(ii) Option (c) is correct.

Explanation: Store the remainder into the array

(iii) Option (a) is correct.

Explanation: Start the loop from x-1, because after complete the previous loop x will increase by 1.

(iv) Option (d) is correct.

Explanation: All digit (i.e. from 0 to 9) will print.

(v) Option (b) is correct.

Explanation: From 10 it will represented by letter. 10 = A, 11 = B, 12 = C etc. To achieve this we use ASCII value of capital letters which is from 65 to 90.

32. (i) Option (a) is correct.

Explanation: Find number of column of the array.

(ii) Option (d) is correct.

Explanation: Loop will continue c times.

(iii) Option (c) is correct.

Explanation: Checking for descending order.

(iv) Option (a) is correct.

Explanation: It is a temporary variable for swapping values.

(v) Option (d) is correct.

Explanation: Interchange the value of M[j][k] with M[j+1][k]

❑❑

Semester – 1

OMR SHEET

Booklet Series: **A**

Use English Numbers / Letters only. Use Blue / Black Ball Point Pen to write in box.

Booklet Series: Ⓐ Ⓑ Ⓒ Ⓓ

Subject

Roll Number

Name

Test Date

Invigilator's Signature

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Proper Marking

The OMR Sheet will be computer checked Fill the circles completely and dark enough for proper detection, Use ballpen (black or blue) for marking.

Ⓐ Ⓑ ● Ⓓ

Avoid Improper Marking

◒ ◉ ▨ Partially Filled

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IMPORTANT

The candidate should check that the Test Book Series printed on the OMR Sheet is the same as printed on the Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the invigilator for replacement of both the Test Booklet and the Answer Sheet.

Darken the circle for each question.

Q.No.	Response
	Section-I
1.	
a.	① ② ③ ④
b.	① ② ③ ④
c.	① ② ③ ④
d.	① ② ③ ④
e.	① ② ③ ④
2.	
a.	① ② ③ ④
b.	① ② ③ ④
c.	① ② ③ ④

Q.No.	Response
d.	① ② ③ ④
e.	① ② ③ ④
3.	
a.	① ② ③ ④
b.	① ② ③ ④
c.	① ② ③ ④
d.	① ② ③ ④
e.	① ② ③ ④
	Section-II
4.	
a.	① ② ③ ④
b.	① ② ③ ④

Q.No.	Response
c.	① ② ③ ④
d.	① ② ③ ④
e.	① ② ③ ④
5.	
a.	① ② ③ ④
b.	① ② ③ ④
c.	① ② ③ ④
d.	① ② ③ ④
e.	① ② ③ ④
6.	
a.	① ② ③ ④
b.	① ② ③ ④
c.	① ② ③ ④

Q.No.	Response
d.	① ② ③ ④
e.	① ② ③ ④
	Section-III
7.	
a.	① ② ③ ④
b.	① ② ③ ④
c.	① ② ③ ④
d.	① ② ③ ④
e.	① ② ③ ④
8.	
a.	① ② ③ ④
b.	① ② ③ ④
c.	① ② ③ ④
d.	① ② ③ ④
e.	① ② ③ ④