MCA Lateral

1. Which of the following circuits can be used to store one bit of data?
   A) Encoder
   B) OR gate
   C) Flip Flop
   D) Decoder

2. What would be the output of the following C program?

```
main ( ){
        int x = 2, y = 5;
        if (x < y) return (x = x+y); else printf ("%d:",x);
        printf("%d:",y);
}
```

   A) 2:
   B) 5:
   C) 7: 5:
   D) No output would be produced

3. What would be the output produced by the following program?

```
main (){
        int d = 1;
        do
                printf("%d\n", d++);
        while (d < = 9);}
```

   A) 45
   B) 2 3 4 5 6 7 8 9 10
   C) 1 2 3 4 5 6 7 8 9 10
   D) 1 2 3 4 5 6 7 8 9

4. Which one of the following C instructions is the odd one out?
   A) j= j + 1;
   B) j =+ 1;
   C) j++;
   D) j+= 1;

5. What would be the value of d at the end of execution of the following C code segment?

```
int a=7,b=12,c=5,d;
d= 2 * b-c/3+ a/b
```

   A) 23
   B) 6
   C) 25
   D) 8

6. Which one of the following is the 2's complement representation of the decimal value 15?
   A) 1111
   B) 10111
   C) 11111
   D) 10001

7. In a C program, suppose the condition part of a for loop is missing. Then which one of the following would be implicitly assumed about this missing for loop conditional?
   A) It is assumed to be present and taken to be false.
   B) It is assumed to be present and taken to be true.

C) It results in a syntax error.
D) Execution will be terminated abruptly.

8. What would be the output of the following C statement?

```
for(i=1; i<4; i++)
        printf("%d",(i%2) ? i : 2*i);
```

A) 1 4 3
B) 1 2 3
C) 2 4 6
D) 2 2 6

9. What would be displayed corresponding to the following C code snippet?

```
char ch[6]={'e', 'n', 'd', '\0', 'p'};
printf("%s", ch);
```

A) endp
B) end0p
C) end
D) error

10. What would be the values of the variables x,y,z, after the following C program statements have been executed?

```
int x = 6, y=8, z, w;
y = x++;
z = ++x;
```

A) y=8, z=8, x=6
B) y=6, x=8, z=8
C) y=9, z=7, x=8
D) y=7, x=8, z=7

11. Which of the following is the correct declaration in C for an array S to hold a character string of length 5?
A) char S[5];
B) string S[5];
C) char S[6];
D) string S[6];

12. How many nodes would a complete binary tree of height d (with root at height 0) have?
A) $2^{d-1}+1$
B) $2^{d+1}-1$
C) $2^{d-1}-1$
D) $2^{d+1}+1$

13. What is the average case time complexity of the quick sort algorithm?
A) $O(n^2)$
B) O(n)
C) O(n log n)
D) O(log n)

14. What would be the number of comparisons required to sort 5 numbers in ascending order using bubble sort?
A) 7
B) 6
C) 10
D) 5

15. What would be the time complexity of adding two matrices of order m×n?
A) O(m + n)
B) O(mn)

C) O(max(m, n))
D) $O((mn)^2)$

16. In a binary tree, the number of leaf nodes is 10. What would be the number of nodes with two children?
    A) 9
    B) 11
    C) 15
    D) 20

17. Out of the following, which one is the slowest sorting procedure?
    A) Quick Sort
    B) Heap Sort
    C) Shell Sort
    D) Bubble Sort

18. A sorting algorithm is said to be stable, if
    A) Its time complexity is constant irrespective of the nature of input.
    B) It preserves the original order of the keys.
    C) Its space complexity is constant irrespective of the nature of input.
    D) It sorts any volume of data in a constant time.

19. Which of the following data structures is appropriate to use for converting a recursion to an iterative procedure?
    A) Queue.
    B) Graph.
    C) Stack.
    D) Tree.

20. Which one of the following data structures is the most suitable for storing and manipulating graphs?
    A) Binary tree
    B) Adjacency linked list
    C) Stack
    D) Ternary tree

21. What is the average case complexity of the Insertion Sort algorithm?
    A) O(nlogn)
    B) $O(n^3)$
    C) $O(n^2)$
    D) $O(2^n)$

22. In order to determine whether a Binary tree is a BST (Binary Search Tree), the tree needs to be traversed in which order?
    A) Preorder
    B) Inorder
    C) Postorder
    D) Any of the three orders

23. A sorted file contains 16 items. What would be the maximum number of comparisons that are needed to search for a specific item in this file by using binary search?
    A) 15
    B) 8
    C) 1
    D) 4

24. What will be displayed when the following C statement executes?

```
printf("%d\n", 'F'-'C');
```

A) 2
B) 3
C) 1
D) 4

25. What is the number of nodes of a complete binary tree with n leaf nodes?
A) n+1 nodes
B) 2n-1 nodes
C) 2n+1 nodes
D) n(n-1)/2 nodes

26. What is the interval between the time of submission of a job to an operating system and the time of completion of the job is called?
A) Waiting time
B) Turnaround time
C) Throughput
D) Response time

27. What is the complexity of searching an element from a set of n elements using the binary search algorithm?
A) O(n)
B) O(log n)
C) $O(n^2)$
D) O(n log n)

28. Which one of the following sorting algorithms shows the best average behavior?
A) Quick Sort
B) Merge Sort
C) Insertion Sort
D) Heap Sort

29. Which one of the following types of memory of a computer is the fastest?
A) Register
B) Cache
C) RAM
D) Hard disk

30. How many flip-flops are required to construct a divide-by-32 circuit?
A) 4
B) 6
C) 5
D) 7

31. Which one of the following devices can be used in a data communication network to perform the conversion between analogue and digital signals?
A) Front end processor.
B) Modem.
C) Decoder.

D) Multiplexer

32. It is necessary to have 8 Mbyte main memory for a computer. What would be the number of 256K x 1bit memory chips required to construct this?
    A) 128
    B) 1024
    C) 256
    D) 32

33. In a computer network, which of the following topologies would require the most extensive cabling?
    A) Bus
    B) Star
    C) Ring
    D) Point to point

34. A multiplexor with a 4-bit data select input is a
    A) 4:1 multiplexor
    B) 2:1 multiplexor
    C) 16:1 multiplexor
    D) 8:1 multiplexor

35. Which one of the following assertions about the difference between constructors and destructors in C++ is correct?
    A) Constructors can take arguments but destructors cannot.
    B) Both constructors and destructors can be overloaded.
    C) Destructors can take arguments but constructors cannot.
    D) Both constructors and destructors can take arguments.

36. A class hierarchy represents which type of relationship among classes?
    A) "is made up of"
    B) "has a"
    C) "is a kind of"
    D) "manages"

37. Which of the following is not an image data file format standard?
    A) MPG
    B) JPG
    C) GIF
    D) BMP

38. Which of the following is an important factor contributing to the high noise immunity of a coaxial cable?
    A) Inner conductor
    B) Diameter of the cable
    C) Outer conductor
    D) Insulating material

39. In an internetwork, at which layer of ISO protocol stack does a router operate?
    A) Physical layer
    B) Datalink layer
    C) Network layer

D) Transport layer

40. What is a constructor in C++?
    A) An operator like new or new[], which creates objects.
    B) A function which is automatically called whenever an object is created .
    C) An object which is automatically created whenever a function is called .
    D) A function that is responsible for controlling the life of an object being created.

41. Which of the following situations most closely describes "multiple inheritance" in object-oriented programming?
    A) Two classes inherit from each other
    B) A base class has two or more derived classes
    C) A child class has two or more parent classes
    D) A child class has both an "is a" and a "has a" relationship with its parent class

42. If an object of a derived class is created and later destroyed, what is the order of the constructor and destructor calls on the object:
    A) Base(), Derived(), ... , ~Base(), ~Derived()
    B) Derived(), Base(), ... , ~Derived(), ~Base()
    C) Base(), Derived(), ... , ~Derived(), ~Base()
    D) Derived(), Base(), ... , ~Base(), ~Derived()

43. What is meant by "function overloading" in object-oriented programming?
    A) A single function does more than one job in a program
    B) Two or more functions have the same name and parameter types
    C) Two or more functions have the same name but different parameter types
    D) Two or more functions have different names but the same parameter types

44. In computers, subtraction is generally carried out by
    A) 9's complement
    B) 10's complement
    C) 1's complement
    D) 2's complement

45. What are the typical capacities of main memory and hard disk of a modern desktop PC?
    A) 128KB and 50GB
    B) 256MB and 50GB
    C) 50GB and 256MB
    D) 2GB and 500GB

46. What is the binary representation of 0.125?
    A) 0.11
    B) 0.01
    C) 0.001
    D) 0.011

47. The Internet is an example of which one of the following types of networks?
    A) Circuit-switched network
    B) Packet-switched network
    C) PSTN network
    D) Cell-switched network

48. During which CPU cycle is an instruction moved from primary storage to the processor?
    A) Fetch
    B) Execution
    C) Memory access
    D) Store

49. Which one of the following is the odd word out ?
    A) Petrified
    B) Fearful
    C) Terrified
    D) Daring

50. Suppose x and y are two natural numbers and $6x+11y=112$, then
    A) y is always odd
    B) y is always even
    C) y is even only if x is odd
    D) y is odd only if x is even

51. Which of the following options is closest to the meaning of the word: **Loath**
    A) Tired
    B) Unwilling
    C) Sickly
    D) Spirited

52. Four persons A,B,C,D are standing in a queue. It is known that C and D are not standing adjacent to each other and that C is not in the fourth place. If A is not in the second place and B is in the first place, which place is D occupying?
    A) 1
    B) 2
    C) 3
    D) 4

53. What would be the next term of the series, 1, 4, 9, 16, 25,....
    A) 36
    B) 38
    C) 49
    D) 52

54. What would be the next term of the series 1,6,13,22,33,...
    A) 46
    B) 48
    C) 49
    D) 51

55. The Octal number 127 is equivalent to which of the following hexadecimal numbers?
    A) 057
    B) 05A
    C) 1AE
    D) 0A7

56. How many address and data lines would a memory of 8K×16 would have?
    A) 8 address and 16 data lines
    B) 16 address and 8 data lines
    C) 13 address and 16 data lines
    D) 16 address and 13 data line

57. What would be the decimal equivalent of the binary number 101.101?
    A) 5.6249
    B) 5.625
    C) 5.505
    D) 5.25

58. The method of communication in which transmission takes place in both directions, but only in one direction at a time, is called:
    A) Simplex
    B) Full duplex
    C) Bi-Simplex
    D) Half duplex

59. In which protocol, packets of the same session may be routed through different paths?
    A) TCP only
    B) Both TCP and UDP
    C) UDP only
    D) Neither in TCP nor in UDP

60. The main memory in a Personal Computer (PC) is made of which one of the following types of memories?
    A) Hard disk
    B) Static RAM
    C) Dynamic RAM
    D) CD-ROM.

-----The End----

1. In a survey concerning consumption of cold drink by consumers, it was found that 50% take cold drink A, 45% cold drink B, 40% cold drink C, 25% take cold drink A and B, 10% take cold drink B and C, 16% take cold drink C and A, and 8% take all three brands. The percentage of consumers who take exactly two brands of cold drink is
   (A) 17% (C) 29%
   (B) 27% (D) 37%
2. Let $A=\{1, 2, 3\}$ and $B=\{6, 7\}$ be two sets. If $A\times B$ is the Cartesian product of A and B, then the number of subsets of the set $A\times B$ is
   (A) 256 (C) 64
   (B) 128 (D) 32

3. Let Z be a set of all integers. Let A={0, 1, 2, 3, 4} and $f : A \to Z$ be defined by $f(x) = x^2 - 5x + 2$. The range of f is

(A) {2, -2, -4}
(C) {2, 2, 4}
(B) {2, 2, -4}
(D) {-2, -2, -4}

4. If $\Phi(x) = 2^{mx+1}$, then $\Phi(a).\Phi(b).\Phi(c)$ is equal to

(A) $\Phi(a+b+c)$
(C) $3\Phi(a+b+c)$
(B) $2\Phi(a+b+c)$
(D) $4\Phi(a+b+c)$

5. The amplitude of $\sqrt{12} + 6\left(\frac{1-i}{1+i}\right)$ is

(A) $\frac{\pi}{6}$
(C) $\frac{\pi}{3}$
(B) $-\frac{\pi}{6}$
(D) $-\frac{\pi}{3}$

6. If $z = x + iy$ and $|z+6| = |2z+3|$, the value of $x^2 + y^2$ is equal to

(A) 9
(C) 15
(B) 12
(D) 18

7. If 1, ω, and ω^2 are roots of cube root of unity, then the roots of $(x-1)^3 + 8 = 0$ are

(A) -1, $1+2\omega$, $1+2\omega^2$
(C) -1, -1, -1
(B) -1, $1-2\omega$, $1-2\omega^2$
(D) -1, $1-\omega$, $1-\omega^2$

8. If ${}^nC_{r-1}=36$, ${}^nC_r=84$ and ${}^nC_{r+1}=126$, then the value of r is

(A) 4
(C) 2
(B) 3
(D) 1

9. The number of diagonals in a polygon of **11** sides is

(A) 55
(C) 22
(B) 33
(D) 44

10. The number of terms in the expansion of $(1+2x+x^2)^n$ when expanded in decreasing power of x, is

(A) $2n+1$
(C) $n+1$
(B) $2n$
(D) n

11. The value of λ for which the system of equations

$x - 2y + z = 0$, $\lambda x - y + 2z = 0$ and $2x - y + z = 0$

has a nontrivial solution, is

(A) 5
(C) 9
(B) 3
(D) 7

12. If $a+b+c = 9$, then the value of

$$\begin{vmatrix} 1+a & b & c \\ a & 1+b & c \\ a & b & 1+c \end{vmatrix}$$

is

(A) 7
(B) 8
(C) 9
(D) 10

13. Assuming that the sum and products of two matrices given below are defined, which of the following is not true for matrices?

(A) $XY=XZ$ does not imply $Y=Z$
(B) $X+Y=Y+X$
(C) $(XY)^T=Y^TX^T$
(D) $XY=0$ implies $X=0$ or $Y=0$

14. If $A = \begin{bmatrix} 1 & 0 & 2 \\ -1 & 1 & -2 \\ 0 & 2 & 1 \end{bmatrix}$ and $\text{Adj.}A = \begin{bmatrix} 5 & a & -2 \\ 1 & 1 & 0 \\ -2 & -2 & b \end{bmatrix}$,

then

(A) $a = -4, b = 1$
(B) $a = 4, b = 1$
(C) $a = 4, b = -1$
(D) $a = -4, b = -1$

15. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ and its inverse $B = \left[b_{ij}\right]$, then the element of b_{23} of matrix B is

(A) -1
(B) 1
(C) -2
(D) 2

16. The value of

$$\cos\frac{\pi}{15}.\cos\frac{2\pi}{15}.\cos\frac{4\pi}{15}.\cos\frac{7\pi}{15}$$

is equal to

(A) $\frac{1}{4}$ (C) $\frac{1}{16}$

(B) $\frac{1}{8}$ (D) $\frac{1}{32}$

17. If $\sin(\pi\cos\theta) = \cos(\pi\sin\theta)$, then $\sin 2\theta$ is equal to

(A) $-\frac{3}{4}$ (C) $-\frac{1}{4}$

(B) $\frac{3}{4}$ (D) $\frac{1}{4}$

18. $3\tan^{-1} x = \pi + \tan^{-1}\left(\frac{3x - x^3}{1-3x^2}\right)$ is true if

(A) $x < \frac{1}{\sqrt{3}}$ (C) $x > \frac{1}{\sqrt{3}}$

(B) $x > \sqrt{3}$ (D) $\frac{1}{\sqrt{3}} < x < \sqrt{3}$

19. Let ABC is an acute-angled triangle. The least value of $\tan^2 A + \tan^2 B + \tan^2 C$ is

(A) 3 (C) 9

(B) 6 (D) 12

20. The coefficient of $\cos^3\theta$ in the expansion of $\cos 7\theta$ in power of $\cos\theta$ is

(A) 56 (C) 112

(B) -56 (D) -112

21. The image of the point (4, -3) with respect to the line $x - y = 0$ is

(A) (-4, -3) (C) (-4, 3)

(B) (3, 4) (D) (-3, 4)

22. The equations to the sides of a triangle are $x - 3y = 0$, $4x + 3y = 5$ and $3x + y = 0$. Then the line $3x - 4y = 0$ passes through the

(A) incentre of the triangle (C) orthocentre of the triangle

(B) centroid of the triangle (D) circumcentre of the triangle

23. The normal at the point (3, 4) on a circle cuts the circle at the point (-1, -2). Then The equation of circle is

(A) $x^2 + y^2 + 2x - 2y - 11 = 0$ (C) $x^2 + y^2 - 2x - 2y - 13 = 0$

(B) $x^2 + y^2 - 2x - 2y - 11 = 0$ (D) $x^2 + y^2 + 2x - 2y - 13 = 0$

24. The circle $x^2 + y^2 + 6x - 2y + k = 0$ bisects the circumference of the circle $x^2 + y^2 + 2x - 6y - 15 = 0$. The value of k is

(A) -23 (C) -21

(B) 23 (D) 21

25. If the distance of a point on the ellipse $4x^2 + 9y^2 = 36$ from its centre is 2, then the eccentric angle of the point is

(A) $\frac{\pi}{2}$ (C) $\frac{\pi}{4}$

(B) $\frac{\pi}{3}$ (D) $\frac{3\pi}{4}$

26. The locus of the mid-point of the line segment joining the focus to a moving point on the parabola $y^2 = 4ax$ is another parabola with directrix

(A) $x + a = 0$ (C) $2x - a = 0$

(B) $2x + a = 0$ (D) $x = 0$

27. The eccentricity of a hyperbola is 2 and the distance between its foci is 8. The equation of the hyperbola is

(A) $\frac{x^2}{12} - \frac{y^2}{4} = 1$ (C) $\frac{x^2}{4} - \frac{y^2}{12} = 1$

(B) $\frac{x^2}{8} - \frac{y^2}{2} = 1$ (D) $\frac{x^2}{16} - \frac{y^2}{9} = 1$

28. The line-segment joining the points A(1, 2, 3) and B(-3, 4, -5) intersects the xy plane at the point P. The value of the ratio AP : PB is

(A) $3:5$ (C) $5:7$

(B) $3:7$ (D) $5:9$

29. The distance of the point (1, -2, 3) from the plane $x - y + z = 5$ measured parallel to the line

$$\frac{x}{2} = \frac{y}{3} = \frac{z-3}{-4}$$

is

(A) $\frac{\sqrt{13}}{5}$ (C) $\frac{\sqrt{21}}{5}$

(B) $\frac{\sqrt{29}}{5}$ (D) $\frac{2}{\sqrt{5}}$

30. The projection of the line

$$\frac{x-1}{3}=\frac{y-2}{4}=\frac{z-3}{5}$$

on the plane $x-y+z+2=0$ is

(A) $\frac{x-2}{5}=\frac{y-2}{16}=\frac{z-2}{11}$

(B) $\frac{x+2}{5}=\frac{y+2}{16}=\frac{z+2}{11}$

(C) $\frac{x-2}{1}=\frac{y-2}{10}=\frac{z-2}{5}$

(D) $\frac{x+2}{1}=\frac{y+2}{10}=\frac{z+2}{5}$

31. The angle between the lines whose direction cosines are given by the equations

$$3l+m+5n=0,\ 6mn-2nl+5lm=0,$$

is

(A) $\cos^{-1}\left(\frac{1}{2}\right)$

(B) $\cos^{-1}\left(\frac{1}{3}\right)$

(C) $\cos^{-1}\left(\frac{1}{6}\right)$

(D) $\cos^{-1}\left(\frac{1}{9}\right)$

32. If $\vec{a}+\vec{b}+\vec{c}=0$, then $\vec{a}\times\vec{b}$ is equal to

(A) $\vec{c}\times\vec{a}$

(B) $\vec{b}\times\vec{c}$

(C) $\vec{a}\times\vec{c}$

(D) $\vec{c}$

33. Let $\vec{a}=\hat{i}+\hat{j}+\hat{k},\ \vec{b}=\hat{i}-\hat{j}+\hat{k},$ and $\vec{c}=-\hat{i}+\hat{j}+\hat{k}.$ Then $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ is equal to

(A) -1

(B) -2

(C) -3

(D) -4

34. The position vectors of the points A, B, C and D are $3\hat{i}-2\hat{j}-\hat{k},\ 2\hat{i}+3\hat{j}-4\hat{k},$ $-\hat{i}+\hat{j}+2\hat{k}$ and $4\hat{i}+5\hat{j}+\lambda\hat{k}$ respectively. If the points A, B, C and D lie on a plane, the value of λ is

(A) $-\frac{136}{17}$

(B) $-\frac{146}{17}$

(C) $-\frac{156}{17}$

(D) $\frac{146}{17}$

35. Sum of the infinite series $\frac{3}{2!}+\frac{5}{4!}+\frac{7}{6!}+...\infty$ is

(A) e

(B) $e-1$

(C) $e-2$

(D) $e+1$

36. If $\log_e\left(\frac{1}{1+x+x^2+x^3}\right)$ is expanded in ascending powers of x, the coefficient of x^{24} is

(A) $\frac{1}{8}$ (C) $\frac{1}{2}$

(B) $\frac{1}{4}$ (D) 0

37. The value of the infinite series $x^{\frac{1}{2}}.\ x^{\frac{1}{4}}.\ x^{\frac{1}{8}}.\ x^{\frac{1}{16}}... \infty$ is

(A) 0 (C) x

(B) 1 (D) ∞

38. The root of the quadratic equation

$$x^2+2\sqrt{2}.\,x\ .\ i+6=0$$

are

(A) $-2\sqrt{2}\ i$ and $\sqrt{2}\ i$ (C) $3\sqrt{2}\ i$ and $-\sqrt{2}\ i$

(B) $2\sqrt{2}\ i$ and $-\sqrt{2}\ i$ (D) $-3\sqrt{2}\ i$ and $\sqrt{2}\ i$

39. If the inequality

$$\frac{|x|-5}{|x|-3}>0, x\neq\pm3$$

holds, then the solution set lies in the interval

(A) $(-\infty,-5)\cup(-3,3)$ (C) $(-\infty,-5)\cup(-3,3)\cup(5,\infty)$

(B) $(-\infty,-5)\cup(5,\infty)$ (D) $(-3,3)\cup(5,\infty)$

40. The value of

$$\lim_{h\to0}\left\{\frac{1}{h\ \sqrt[3]{8+h}}-\frac{1}{2h}\right\}$$

is equal to

(A) $-\frac{1}{48}$ (C) $-\frac{4}{3}$

(B) $-\frac{16}{3}$ (D) $\frac{1}{12}$

41. Consider the function

$$f(x) = \frac{\tan(\pi[x-\pi])}{1+[x]^2},$$

where $[x]$ is the greatest integer function. Which of the following is true?

(A) $f(x)$ is discontinuous at some x.

(B) $f'(x)$ exists for all x but $f''(x)$ does not exist.

(C) $f'(x)$ exists for all x.

(D) $f(x)$ continuous for all x but $f'(x)$ does not exist for some x.

42. The angle between the tangents to the curves $y = \sin x$ and $y = \cos x$ at a point of intersection is

(A) $\frac{\pi}{4}$

(B) $\tan^{-1}\left(2\sqrt{2}\right)$

(C) $\tan^{-1}\left(\frac{1}{2\sqrt{2}}\right)$

(D) $\tan^{-1}\left(\sqrt{2}\right)$

43. For the function $f(x) = xe^x$, the point

(A) x = -1is a minimum

(B) x = 0 is a minimum

(C) x = -1is a maximum

(D) x = 1 is a maximum

44. Let $f\left(\frac{x+y}{2}\right) = \frac{1}{2}[f(x)+f(y)]$ for all real x and y. If $f'(0)$ exists and equal to (-1), then $f'(2)$ is equal to

(A) 1

(B) 2

(C) -1

(D) -2

45. Let $x = a\sec^2\theta$ and $y = a\tan^3\theta$. Then the value of $\frac{dy}{dx}$ at $\theta = \frac{\pi}{4}$ is

(A) $\frac{4}{3}$

(B) $\frac{3}{4}$

(C) $\frac{2}{3}$

(D) $\frac{3}{2}$

46. Let $z = \log\left(\frac{x^2-y^2}{x^2+y^2}\right)$. Then the value of

$$x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}$$

is

(A) z

(B) 2

(C) 1

(D) 0

47. A function $f(x, y)$ is defined as

$$f(x,y)=\begin{cases}\dfrac{x^3+2y^3}{x^2+y^2}, & (x,y)\neq(0,0)\\ 0, & (x,y)=(0,0)\end{cases}.$$

Then

(A) $f_x(0,0)=1, f_y(0,0)=2$

(B) $f_x(0,0)=2, f_y(0,0)=1$

(C) $f_x(0,0)=0, f_y(0,0)=2$

(D) $f_x(0,0)=1, f_y(0,0)=0$

48. The solution of the differential equation

$$\frac{dy}{dx}=\frac{x}{y}-\frac{x}{1+y}$$

with initial condition $y(0)=2$ is

(A) $3y^2+2y^3=3x^2+14$

(B) $3y^2+2y^3=3x^2+28$

(C) $3y^2+2y^3=x^2+14$

(D) $3y^2+2y^3=x^2+28$

49. The solution of the differential equation

$$3x^2y^4\,dx+4x^3y^3\,dy=0$$

with initial condition $y(1)=2$ is

(A) $x^3y^4=8$

(B) $x^3y^4=16$

(C) $x^4y^3=8$

(D) $x^4y^3=16$

50. The solution of the differential equation

$$\frac{dy}{dx}+y=(x+1)^2$$

with the initial condition $y(0)=0$ is

(A) $y=1+x^2-e^x$

(B) $y=x^2+e^{-x}-1$

(C) $y=1-e^x$

(D) $y=1+x^2$

51. Consider the equation

$$\frac{d^2x}{dt^2}=0.$$

Given that $x = 0$ and $\frac{dx}{dt} = 5$ when $t = 0$. If $t = 5$, the value of x is

(A) 50
(B) 25
(C) 5
(D) 1

52. If $\int x^{-3} 5^{\sqrt{x}}\, dx = k 5^{\sqrt{x}}$, then the value of k is

(A) $-2 \log 5$
(B) $\frac{-1}{2 \log 5}$
(C) $\frac{-2}{\log 5}$
(D) $\frac{2}{\log 5}$

53. If k is the constant of integration, the value of the integral $\int \frac{x^2\ dx}{\left(x \cos x - \sin x\right)^2}$ is

(A) $\frac{x \sin x + \cos x}{x \cos x - \sin x} + k$
(B) $\frac{x \sin x - \cos x}{x \cos x - \sin x} + k$
(C) $\frac{x \sin x}{x \cos x - \sin x} + k$
(D) $\frac{\cos x}{x \cos x - \sin x} + k$

54. The value of the definite integral $\int_0^{\pi/2} \frac{\cos^2 \theta}{\cos^2 \theta + 4 \sin^2 \theta}\ d\theta$ is equal to

(A) $\frac{\pi}{3}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{2}$

55. The value of

$$\int_{-\pi/4}^{\pi/4} \frac{x + \frac{\pi}{4}}{2 - \cos 2x}\, dx$$

is

(A) $\frac{\pi^2}{\sqrt{3}}$
(B) $\frac{\pi}{\sqrt{3}}$
(C) $\frac{\pi}{6\sqrt{3}}$
(D) $\frac{\pi^2}{6\sqrt{3}}$

56. The area bounded by the curve $y = \sqrt{4 - x^2}$, $y \geq 0$ and the x-axis is

(A) 6π
(B) 4π

(C) 2π (D) π

57. If in a distribution, $n = 10$, $\sum x = 20$ and $\sum x^2 = 200$, then the value of standard deviation of the distribution is

(A) 4 (C) 16

(B) 2 (D) 6

58. Three numbers are chosen at random from the first 20 natural numbers. The probability that their product is even, is

(A) $\frac{17}{19}$ (C) $\frac{12}{19}$

(B) $\frac{15}{19}$ (D) $\frac{2}{19}$

59. The number of ways in which an examiner can assign 10 marks to 4 questions, giving not less than 2 marks to any question is (all questions carry marks equal to integral values)

(A) 16 (C) 8

(B) 4 (D) 10

60. If the equation $a^2 - 2a\sin x + 1 = 0$ always bears real roots, the value(s) of a is(are)

(A) 0 (C) ± 2

(B) ± 1 (D) ± 3