Previous Paper (Solved)

JNU–MCA ENTRANCE EXAM., 2012

Master of Computer Applications

1. Among the following statements, identify the number of correct statements:

(i) The function defined by

$$f(x) = \frac{ax+b}{cx+d}$$

always has maxima and minima for whatever values of the real numbers a, b, c and d.

(ii) $\log(x)$ is a convex function in the real line.

(iii) The function defined by $f(x) = x - \sin x$ is a decreasing function throughout in any interval of values of the variable x.

A. 0 B. 1
C. 2 D. 3

2. For arbitrary constants c_1 and c_2, the solution space of the differential equation $y'' - 8y' + 16y = 0$ will be

A. $y(x) = c_1 e^{-4x} + c_2 x e^{-4x}$
B. $y(x) = c_1 e^{4x} + c_2 e^{-4x}$
C. $y(x) = c_1 e^{4x} + c_2 x e^{4x}$
D. None of the above

3. Evaluate the integral

$$\int_{-1}^{1} |2x - 1|\, dx$$

where $|\cdot|$ denotes the absolute value

A. $\frac{5}{2}$ B. $\frac{3}{2}$
C. 0 D. None of these

4. How many committees of five people can be chosen from 20 men and 12 women if at least 4 women must be chosen on each committee?

A. 9872 B. 10012
C. 10692 D. None of these

5. There are five different houses, A to E, in a row. A is to the right of B and E is to the left of C and right of A. Further, B is to the right of D. Which house will be in the middle?

A. A B. B
C. D D. None of these

6. If a matrix A is invertible, then which property/properties of A remains/remain true?

(i) A is symmetric
(ii) A is triangular
(iii) All entries are integers

A. Only (i)
B. Only (i) and (ii)
C. All the properties (i), (ii) and (iii)
D. None of the above

7. The number of diagonals that can be drawn by joining the vertices of an octagon is

A. 28 B. 20
C. 24 D. 48

8. The limit of $A^x \sin\left(\frac{B}{A^x}\right)$ when $x \to \infty$ and $0 < A < 1$ is:

A. B B. 1
C. A D. 0

9. A particle acted by constant forces $4i + j - 3k$ and $3i + j - k$ is displaced from the point (1, 2, 3) to the point (5, 4, 1), where i, j and k are unit vectors along the X-, Y- and Z-axis respectively. Then the total work done by the forces is

A. 20 units
B. 30 units
C. 40 units
D. None of the above

10. The maximum value of the function defined by

$$f(x) = 2\sin x + \sin 2x$$

in the interval $\left[0, \frac{3\pi}{2}\right]$ is

A. $\frac{5}{2}$ B. $\frac{3\sqrt{5}}{2}$

C. $\frac{3\sqrt{3}}{2}$ D. None of these

11. In how many ways can the letters of the word 'attention' be rearranged?

A. 28220 B. 30240

C. 32120 D. None of these

12. In a certain code language

(i) 'mxy das zci' means 'good little frock'

(ii) 'jmx cos zci' means 'girl behaves good'

(iii) 'nug drs cos' means 'girl makes mischief'

(iv) 'das ajp cos' means 'little girl fell'

Which word in that language stands for 'frock'?

A. zci

B. das

C. mxy

D. Insufficient information

13. The number of solutions of the equation $\sqrt{3x^2 + x + 5} = x - 3$ is

A. ∞ B. 1

C. 0 D. None of these

14. The radius of the circle in which the sphere $x^2 + y^2 + z^2 = 5$ is cut by the plane $x + y + z = 3\sqrt{3}$ is

A. $\sqrt{3}$ B. $3\sqrt{3}$

C. $\frac{1}{\sqrt{3}}$ D. None of these

15. Suppose A, B and C are sets. Consider the following statements:

(i) $A \in B$, $B \subseteq C$. Then $A \subseteq C$ is true.

(ii) $A \not\subset B$. Then $B \subset C$ is true.

(iii) $C \in \wp(A)$ if and only if $C \subseteq A$, where $\wp(A)$ denotes the power set of A.

The number of correct statements among (i)-(iii) is

A. 1 B. 2

C. 3 D. None of these

16. Of 30 personal computers (PCs) owned by faculty members in a university department, 20 run Windows, 8 have 21 inch monitors, 2[illegible] have CD-ROM drives, 20 have at least two of these features and 6 have all the three features. How many PCs have at least one of these features?

A. 22 B. 24

C. 27 D. None of these

17. In the complex plane, consider the following statements:

(i) If $|e^z| = 1$, then z is a pure imaginary number.

(ii) There are complex numbers z such that $|\sin z| > 1$.

(iii) The function $\sin \bar{z}$ is nowhere analytic where $\bar{z}$ is the complex conjugate of the number z.

Identify the number of correct statements.

A. 0 B. 1

C. 2 D. 3

18. Among the six students A, B, C, D, E and F, it is given that

(i) D and F are tall, while the others are short

(ii) A, C and D are wearing glasses, while the others are not

Identify the short students who are not wearing glass.

A. B, E, F

B. B, E

C. B, C

D. None of these

19. For the matrix $A = \begin{pmatrix} 2 & c & c \\ c & c & c \\ 8 & 7 & c \end{pmatrix}$, find the number of c values in which the matrix A is not invertible.

A. 0 B. 1

C. 2 D. 3

20. Transform the well-formed formula $P \rightarrow Q \wedge R$ into a disjunction normal form (DNF) and conjunction normal form (CNF) respectively.
A. $\neg P \vee (Q \wedge R)$ and $(\neg P \vee Q) \wedge (\neg P \vee R)$
B. $P \vee \neg(Q \wedge R)$ and $(P \wedge \neg Q) \wedge (\neg P \vee R)$
C. $\neg P \wedge (Q \vee R)$ and $(P \vee \neg Q) \wedge (\neg P \vee R)$
D. None of the above

21. The surface area of the solid generated by the revolution of the curve

$x = a \cos^3 t$, $y = a \sin^3 t$ about x-axis is given by

A. $6\pi a^2 \int_0^{\pi/2} \sin^4 t \cos t \, dt$

B. $6\pi a^2 \int_0^{\pi/2} \sin^6 t \cos t \, dt$

C. $12\pi a^2 \int_0^{\pi/2} \sin^4 t \cos t \, dt$

D. None of these

22. The subtraction of $2A_{16}$ from 84_{16} results in
A. 68_{16}
B. $A6_{16}$
C. $5A_{16}$
D. $5B_{16}$

23. 'Joule' is related to energy and in the same way 'Pascal' is related to
A. volume
B. pressure
C. purity
D. beauty

24. If $x = \dfrac{2\sin\alpha}{1+\cos\alpha+\sin\alpha}$, then the value of $\dfrac{\cos\alpha}{1+\sin\alpha}$ is equal to
A. $1 - x$
B. $1 + x$
C. $\dfrac{1}{x}$
D. None of these

25. If $A = \begin{bmatrix} 2 & 4 & -1 \\ -1 & 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 4 & 5 \\ -1 & 2 & 7 \\ 2 & 1 & 0 \end{bmatrix}$

then $(AB)'$ is equal to

A. $\begin{bmatrix} 0 & 25 & 38 \\ 1 & -2 & -5 \end{bmatrix}$
B. $\begin{bmatrix} 0 & 15 & 38 \\ 1 & 2 & -5 \end{bmatrix}$
C. $\begin{bmatrix} 0 & 1 \\ 15 & -2 \\ 38 & -5 \end{bmatrix}$
D. $\begin{bmatrix} 0 & -1 \\ 15 & -2 \\ 38 & 5 \end{bmatrix}$

26. If $P(x, y)$ is a point on the line $y = -3x$ such that P and the point $(3, 4)$ are the opposite sides of the line $3x - 4y = 8$, then

A. $x > \dfrac{8}{15}, y < -\left(\dfrac{8}{5}\right)$

B. $x > \dfrac{8}{5}, y < -\left(\dfrac{8}{15}\right)$

C. $x = \dfrac{8}{15}, y = -\left(\dfrac{8}{5}\right)$

D. None of the above

27. The value of the integral

$$\int_0^\infty \frac{x \log x}{(1+x^2)^2} dx$$

is
A. 0
B. log 2
C. 2 log 5
D. ∞

28. Find the global minimizers of the following function:

$$f(x, y) = e^{x-y} + e^{y-x}$$

A. All points along the X-axis
B. All points along the Y-axis
C. Global minimum of the function $f(.)$ does not exist
D. None of the above

29. From the two statements:
(*i*) some cubs are tigers
(*ii*) some tigers are goats

We can conclude that
A. some cubs are goats
B. no cub is a goat
C. all cubs are goats
D. None of the above

30. Let X equal -1, 0 or 1 with equal probability and let $Y = |X|$. A simple calculation shows cov (X, Y) equals
A. 1
B. -1
C. 0
D. None of these

31. Let A and B be the matrices of the same order. Consider the following statements:

(i) The eigenvalues of A are equal to the eigenvalues of A', where A' is the transpose of A.

(ii) The eigenvalues of AB are the product of the eigenvalues of A and B.

(iii) The eigenvalues of $(A + B)$ are the sum of the individual eigenvalues of A and B.

Identify the correct statements.

A. Only (i) and (ii) B. Only (i) and (iii)
C. (i), (ii) and (iii) D. None of these

32. If $f(x) = x^2 + 2bx + 2c^2$ and $g(x) = -x^2 - 2cx + b^2$ are such that

$$\min f(x) > \max g(x)$$

then we will have

A. $c^2 > 2b^2$ B. $2c^2 < b^2$
C. $b^2 + c^2 < 2$ D. None of these

33. Find the matrix A^{50}, when the matrix A is

$$A = \begin{pmatrix} 2 & -1 \\ 0 & 1 \end{pmatrix}$$

A. $\begin{pmatrix} 2^{50} & (-1)^{50-1} \\ 0 & 1 \end{pmatrix}$ B. $\begin{pmatrix} 2^{50} & -3+2^{50} \\ 0 & 1 \end{pmatrix}$

C. $\begin{pmatrix} 2^{50} & -1 \\ 0 & 1 \end{pmatrix}$ D. None of these

34. If the function $f: [1, \infty) \to [1, \infty)$ is defined by $f(x) = 2^{x(x-1)}$, then its inverse is

A. $\frac{1}{2}(1+\sqrt{1-2\log_2 x})$

B. $\frac{1}{2}(1+\sqrt{1+2\log_2 x})$

C. $\frac{1}{2}(1+\sqrt{1+4\log_2 x})$

D. None of the above

35. For a given real-valued function $h(t)$, $t \geq 0$, the Laplace transform denoted by $\bar{h}(s)$ is defined by

$$\bar{h}(s) = \int_0^\infty e^{-st} h(t)dt$$

The Laplace transform of $e^{-at} h(t)$ is

A. $\bar{h}(s+a)$ B. $\frac{\bar{h}(s)}{s+a}$
C. $a\bar{h}(s)$ D. None of these

36. Among the four groups of letters from A to D given, three of them are alike in a certain way while one is different. Identify the one that is different.

A. ALMZ B. BTUY
C. CPQX D. DEFY

37. How many ways can k distinguishable balls be distributed into n urns so that there are k_i balls in urn i?

A. $\frac{k!}{(k_1 + k_2 + ... + k_n)!}$

B. $\frac{k!}{k_1!k_2!...+k_n!}$

C. $k_1!k_2!... k_n!$

D. None of the above

38. $\lim_{n\to\infty}\left(\frac{1+i}{\sqrt{\pi}}\right)^n$ is equal to

A. 0 B. i
C. ∞ D. None of these

39. AB is a chord of the parabola $y^2 = 4ax$ with the end A at the vertex of the given parabola. BC is drawn perpendicular to AB meeting the axis of the parabola at C. The projection of BC on this axis is

A. a B. $2a$
C. $4a$ D. None of these

40. The probability that a number selected at random between 100 and 999 (both inclusive) will not contain the digit 7 is

A. 18/25 B. 16/25
C. 729/1000 D. 27/75

41. If the product of the roots of the equation $x^2 - 5kx + 2k^4 - 1 = 0$ is 31, then the sum of the roots is

A. 10 B. 8
C. 5 D. None of these

42. Let $f : Z \to Z$ be a function defined by $f(x) = 3x^3 - x$, where Z is the set of integers. Then the function f is
A. injective only
B. surjective only
C. bijective
D. None of these

43. Two circles $x^2 + y^2 = 6$ and $x^2 + y^2 - 6x + 8 = 0$ are given. Then the equation of the circle through their point of intersection and the point (1, 1) is
A. $x^2 + y^2 - 6x + 4 = 0$
B. $x^2 + y^2 - 3x + 1 = 0$
C. $x^2 + y^2 - 4y + 2 = 0$
D. None of these

44. If $s_n = \frac{1}{2}(1-(-1)^n)$ for $n \geq 1$, then as $n \to \infty$

$$\frac{s_1 + s_2 + \ldots + s_n}{n}$$

converges to
A. 0
B. 1
C. $\frac{1}{2}$
D. None of these

45. A triangle PQR is inscribed in the circle $x^2 + y^2 = 25$. If Q and R have coordinates (3, 4) and (–4, 3) respectively, then $\angle QPR$ is equal to
A. $\frac{\pi}{2}$
B. $\frac{\pi}{3}$
C. $\frac{\pi}{4}$
D. $\frac{\pi}{6}$

46. If $y = \int_1^{t^3} \sqrt[3]{z} \log z \, dz$ and $x = \int_{\sqrt{t}}^{t^3} z^2 \log z \, dz$,

then $\frac{dy}{dx}$ is
A. $-4t^{5/2}$
B. $35t^{5/2}$
C. $-36t^{5/2}$
D. None of these

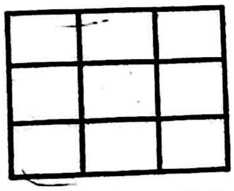
47. February 29, 1952 occurred on which day of the week?
A. Sunday
B. Wednesday
C. Friday
D. None of these

48. Let $f(x)$ be a polynomial function and satisfy the conditions

$$f(x)\,f(1/x) = f(x) + f(1/x) \text{ and } f(3) = 28$$

Then the value of $f(4)$ is given by
A. 65
B. 62
C. 60
D. None of these

49. How many squares are there in the given figure?



A. 12
B. 14
C. 16
D. None of these

50. For any three vectors a, b, c if $a + b + c = 0$ and $|a| = 3$, $|b| = 5$ and $|c| = 7$, then the angle between a and b is
A. $\frac{5\pi}{3}$
B. $\frac{2\pi}{3}$
C. $\frac{\pi}{3}$
D. $\frac{\pi}{6}$

51. Ganesh appeared for mathematics examination. He tried to solve correctly all the 100 problems given but some of them went wrong and scored 85. The score was calculated by subtracting two times the number of wrong answers from the correct answers. Then the number of problems solved correctly is
A. 95
B. 92
C. 90
D. None of these

52. If the sum of the lengths of the hypotenuse and another side of a right-angled triangle is given, then the area of the triangle is maximum when the angle between those sides is
A. 30 degrees
B. 60 degrees
C. 90 degrees
D. None of these

53. Determine the probability that after $2n$ tosses of a fair coin, there have been the same number of heads as tails.
A. $\binom{2n}{n}\frac{1}{2^{2n}}$
B. $\binom{2n}{n}\frac{1}{2^n}$
C. $\frac{1}{2^{2n}}$
D. None of these

54. Let a, b be positive integers and let p be a prime number such that $gcd(a, p^2) = p$ and $gcd(b, p^3) = p^2$ are satisfied, where $gcd(.\,.\,.)$ denotes the greatest common divisor. Then $gcd(ab, p^4)$ will be equal to

A. p
B. p^2
C. p^3
D. None of these

55. Let n be a positive integer such that $(1 + i)^n = 4096$ is true, where $i^2 = -1$. Then the value of n is

A. 20
B. 24
C. 28
D. None of these

56. Identify the correct statements from the following:

(i) The diagonal entries of a skew-symmetric matrix are zero.

(ii) The determinant of a skew-symmetric matrix of order 3 will be always equal to zero.

(iii) The determinant of an orthogonal matrix of order 3 will be always equal to zero.

A. (i) and (ii) only
B. (ii) and (iii) only
C. (i) and (iii) only
D. None of the above

57. By the transformation

$$u = x - ct,\ v = x + ct$$

the partial differential equation

$$\frac{\partial^2 z(x,t)}{\partial t^2} = c\frac{\partial^2 z(x,t)}{\partial x^2}$$

will reduce to

A. $\dfrac{\partial^2 z(u,v)}{\partial u \partial v} = u^2 + v^2$

B. $\dfrac{\partial^2 z(u,v)}{\partial u \partial v} = uv$

C. $\dfrac{\partial^2 z(u,v)}{\partial u \partial v} = 0$

D. None of the above

58. Imagine that you have two empty stacks of integers, $s1$ and $s2$. Draw a picture of each stack after the execution of the following pseudocode:

```
pushStack(s1, 3);
pushStack(s1, 5);
pushStack(s1, 7);
pushStack(s1, 9);
pushStack(s1, 11);
while(!emptyStack(s1))
{
    popStack(s1, x);
    x = x + 1;
    pushStack(s2, x);
}
```

A.

s1	s2
3	4
5	6
7	8
9	10

B.

s1	s2
3	
5	
7	
9	

C.

s1	s2
	4
	6
	8
	10

D. None of these

59. Let X denote a random variable that tak[es] any of the values -1, 0, 1 with respe[ctive] probabilities

$$P\{X = -1\} = 0.2,$$
$$P\{X = 0\} = 0.5$$
and
$$P\{X = 1\} = 0.3$$

Compute the expected value of $E(X^2)$.

A. 0.35
B. 0.5
C. 0.625
D. None of the a[bove]

60. If $\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$, then Δ^2 is given by

A. $\begin{vmatrix} A_1 & B_1 & C_1 \\ A_2 & B_2 & C_2 \\ A_3 & B_3 & C_3 \end{vmatrix}$

B. $\begin{vmatrix} A_1 & C_1 & B_1 \\ A_2 & C_2 & B_2 \\ A_3 & C_3 & B_3 \end{vmatrix}$

C. $\begin{vmatrix} A_3 & B_3 & C_3 \\ A_2 & B_2 & C_2 \\ A_1 & B_1 & C_1 \end{vmatrix}$

D. None of these

Where A_1, B_1, C_1, ... etc. are cofactors of $a_1, b_1, c_1, ...$

61. If $\sin^{-1} x + \sin^{-1} y = \frac{2\pi}{3}$, then we have $\cos^{-1} x + \cos^{-1} y =$

A. $\frac{\pi}{3}$ B. $\frac{\pi}{6}$

C. $\frac{\pi}{8}$ D. None of these

62. Find a third equation that can be solved if $x + y + z = 0$ and $x - 2y - z = 1$.

A. $3x + z = 2$ B. $3y + 2z = 4$

C. $2x - y = 1$ D. None of these

63. For any real number a, $\lim_{x\to\infty} \sqrt{x}\{\sqrt{x+a} - \sqrt{x}\}$ is equal to

A. ∞ B. 0

C. a D. None of these

64. In a group of cows and hens, the number of legs are 14 more than twice the number of heads. Then the number of cows will be

A. 5 B. 7

C. 10 D. None of these

65. Evaluate the following integral:

$$\int_0^\infty \frac{dx}{(1+x)^2}$$

A. 0

B. 1

C. Integral does not exist

D. None of the above

66. With a 100 kHz clock frequency, eight bits can be serially entered into a shift register in

A. 8 ms B. 80 ms

C. 8 μs D. 80 μs

67. The probability that a man who is 85 years old will die before attaining the age of 90 is 1/3. Four persons A_1, A_2, A_3 and A_4 are 85 years old. The probability that A_1 will die before attaining the age of 90 and will be the first to die is

A. $\frac{31}{228}$ B. $\frac{13}{282}$

C. $\frac{65}{324}$ D. None of these

68. Which one of the following formats of a digital image is odd-one-out?

A. BMP B. JPEG

C. RLE D. TIFF

69. In a triangle ABC, line BP is drawn perpendicular to BC to meet CA in P such that $CA = AP$. Then $\frac{BP}{AB}$ is equal to

A. $2 \sin A$

B. $2 \sin B$

C. $2 \sin C$

D. None of these

70. Suppose a matrix A is invertible and by exchanging its first two rows, you get the matrix B. Then B is invertible and is obtained from the inverse of A by

A. exchanging the first two rows of the inverse of A and keeping its remaining entries fixed

B. exchanging the first two columns of the inverse of A and keeping its remaining entries fixed

C. exchanging the first two rows and columns of the inverse of A and keeping its remaining entries fixed

D. None of the above

71. What is the decimal representation of the octal number $(51735)_8$?

A. 21469 B. 21220

C. 21008 D. None of these

72. Find the shortest distance from the origin to the surface defined by

$$x^2 + 8xy + 7y^2 = 225$$

A. 0 B. 12

C. 22 D. None of these

73. A and B are brothers. C and D are sisters. A's son is D's brother. How is B related to C?

A. Father B. Brother

C. Grandfather D. Uncle

74. If A and B are subsets of a set X, then $[A \cap (X - B)] \cup B$ is equal to

A. $A \cup B$ B. $A \cap B$

C. A D. B

75. In a 4-variable Karnaugh map, a 2-variable product term is produced by
A. a 2-cell group of 1^s
B. an 8-cell group of 1^s
C. a 4-cell group of 1^s
D. a 4-cell group of 0^s

76. If z is a complex number and lies in the second quadrant, then in which quadrant of the complex plane, the complex number $i\bar{z}$ lies, where $\bar{z}$ is the complex conjugate of z and $i^2 = -1$?
A. First quadrant B. Second quadrant
C. Third quadrant D. Fourth quadrant

77. The sum of the roots of the equation $4^x - 3(2^{x+3}) + 128 = 0$ is
A. 0 B. 5
C. 8 D. None of these

78. In Gauss elimination method, the coefficient matrix is reduced into a
A. diagonal matrix B. triangular matrix
C. unit matrix D. null matrix

79. Suppose $f : A \to B$ and $g : B \to C$ are functions. Consider the following statements:
(i) If $(g \circ f)$ is one-to-one and the function f is onto, then the function g is one-to-one.
(ii) If $(g \circ f)$ is one-to-one, then the function f is one-to-one.
(iii) If $(g \circ f)$ is onto and the function g is one-to-one, then the function f is onto.
Among the above statements, identify the correct statements.
A. (i) and (ii) only B. (ii) and (iii) only
C. (i), (ii) and (iii) D. None of these

80. Arrange the following numbers in ascending order:
log(2 + 4), log2 + log4, log(6 – 3), log6 – log3
A. log(2 + 4), log 2 + log 4, log 6 – log 3, log(6 – 3)
B. log2 + log4, log(2 + 4), log(6 – 3), log6 – log 3
C. log 6 – log 3, log(6 – 3), log2 + log4, log(2 + 4)
D. None of the above

81. If 1, Z_1, Z_2, ... Z_{11} are the 12 roots of unity forming the cyclic group under multiplication, then Z_9 generates a cyclic subgroup of the above containing
A. 12 elements B. 9 elements
C. 8 elements D. 4 elements

82. A computer science class consists of 13 females and 12 males. Six class members are to be chosen at random to plan a picnic. What is the probability that exactly 4 females and 2 males are chosen?
A. 0·1 B. 0·2
C. 0·3 D. 0·4

83. If E and F are independent events such that $0 < P(E) < 1$ and $0 < P(F) < 1$ then
A. E and F^o (complement of the event F) are independent.
B. E and F are mutually exclusive
C. $P(E/F) + P(E^o/F) = 1$
D. E^o and F^o are independent

84. If a circle passes through the point (3, 4) and cuts the circle $x^2 + y^2 = a^2$ orthogonally, the equation of the locus of its centre is
A. $3x + 4y = a^2 + 25$ B. $x + 8y = a^2 + 25$
C. $6x + 8y = a^2 + 25$ D. None of the above

85. A vector c perpendicular to the vectors $2i + 3j - k$ and $-i - 2j + k$ satisfying the condition $c\cdot(2i - j + k) = -6$, where i, j and k are unit vectors along the X-, Y- and Z-axis respectively, is
A. $-2i + j - k$ B. $2i - 3j + 4k$
C. $-3i + 3j + 3k$ D. None of these

86. Let $R = \{(x, y) : x, y \in A, x + y = 4\}$ be a relation, where $A = \{1, 2, 3, 4, 5\}$. Then R is
A. reflexive, symmetric but not transitive
B. symmetric but not reflexive and not transitive
C. not reflexive, not symmetric and not transitive
D. None of the above

87. Which of the following operators in C++ can be overloaded?
A. Conditional operator (? :)
B. Scope resolution operator (::)
C. Member access operator (. *)
D. Relational operator (< =)

88. Let $r \neq 0$ be a real number. Then the sum of the series

$$r^2 + \frac{r^2}{1+r^2} + \frac{r^2}{(1+r^2)^2} + \ldots$$

is equal to

A. ∞ B. $1 + r^2$

C. $\frac{1}{1+r^2}$ D. None of these

89. How many even numbers in the range of 100–999 have no repeated digits?

A. 298 B. 328

C. 368 D. None of these

90. A frog starts climbing a 30 ft wall. Each hour it climbs 3 ft and slips back 2 ft. How many hours does it take to reach the top and get out?

A. 30 B. 29

C. 28 D. None of these

91. A continuous random variate X has the probability density function (pdf)

$$f(x) = \frac{c}{1+x^2}, -\infty < x < \infty$$

Then the value of c is

A. 1 B. $\frac{1}{2}$

C. $\frac{1}{\pi}$ D. None of these

92. If an integer needs two bytes of storage, then the maximum value of an unsigned integer is

A. $2^{16} - 1$ B. $2^{15} - 1$

C. 2^{16} D. 2^{15}

93. The expression $X = (A + B + C)(A + B + C')(A + B' + C)(A + B' + C')(A' + B' + C)$ is equivalent to

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

C. $AB' + BC'$ D. None of these

94. The output of the program

```
main( )
{int i = 5; i = (++i)/(i++); printf ("%d",i)';}
```

is

A. 5 B. 1

C. 6 D. 2

95. Two finite sets have m and n elements respectively. The total number of subsets of the first set is 12 more than the total number of subsets of the second set. Then the values of m and n respectively are

A. 5, 3 B. 6, 4

C. 4, 2 D. None of these

96. Among the following statements, identify the number of correct statements:

(i) Let A be a set and suppose that $x \in A$. Then $x \subseteq A$ is possible.

(ii) $\phi \in \{x, y, \phi\}$ and $\phi \subseteq \{x, y\ \phi\}$, where ϕ is the empty set.

(iii) The number of elements of the power set of the power set of the empty set is 2.

A. 1

B. 2

C. 3

D. None of these

97. If $\bar{a}$ and $\bar{b}$ are two vectors of different directions, then the points whose P.V. are $\lambda_1\bar{a} + \mu_1\bar{b}$, $\lambda_2\bar{a} + \mu_2\bar{b}$ and $\lambda_3\bar{a} + \mu_3\bar{b}$ are collinear, if

A. $\begin{vmatrix} \lambda_1 & \mu_1 & \lambda_3 \\ \mu_2 & \lambda_2 & \mu_3 \\ 1 & 1 & 1 \end{vmatrix} = 0$

B. $\begin{vmatrix} \lambda_1 & \lambda_2 & \lambda_3 \\ \mu_1 & \mu_2 & \mu_3 \\ 1 & 1 & 1 \end{vmatrix} = 0$

C. $\begin{vmatrix} 1 & \lambda_1 & \lambda_2 \\ \mu_1 & 1 & \lambda_3 \\ \mu_2 & \mu_3 & 1 \end{vmatrix}$

D. None of these

98. Suppose u_n and v_n are sequences defined recursively by

$u_1 = 0$, $v_1 = 1$ and for $n > 1$, $u_{n+1} = (u_n + v_n)/2$, $v_{n+1} = (u_n + 3v_n)/4$

Then the sequences $\{u_n\}$ and $\{v_n\}$ will become

A. both increasing

B. both decreasing

C. one increasing and the other decreasing

D. None of the above

99. Consider the function $f(x) = \dfrac{e^{1/x}}{1+e^{1/x}}$ for $x \neq 0$. Then the values of the limit of the function $f(x)$ when $x \to 0^+$ and $x \to 0^-$ will be

A. Both the limits do not exist
B. 0, 0 respectively
C. 0, 1 respectively
D. None of the above

100. If $u = \arctan x$, then

$$(1+x^2)\frac{d^2u}{dx^2} + 2x\frac{du}{dx}$$

will be equal to

A. x B. u
C. 1 D. None of these

101. The period of the function $f(x) = \cos^2 3x + \tan 4x$ is

A. π B. $\pi/3$
C. $\pi/6$ D. None of these

102. Find the binary representation of the number 2159.

A. 100 001 101 101
B. 110 011 101 111
C. 101 101 001 100
D. None of the above

103. The error quantity which must be added to the true representation of the quantity in order that the result is exactly equal to the quantity we are seeking to generate is called

A. truncation error
B. round-off error
C. relative error
D. absolute error

104. Demorgan and Bertrand's test for testing the convergence or divergence of a series Σu_n of positive terms is applied when ..... fails.

A. Comparison ratio test
B. Cauchy's root test
C. Raabe's test
D. Logarithmic test

105. Find the sum of all the numbers between 100 and 1000 which are divisible by 14.

A. 32388 B. 35392
C. 38396 D. None of these

106. Solution of $24x^3 - 14x^2 - 63x + 45 = 0$, one root being double another, is given by

A. $\frac{3}{4}, \frac{3}{2}, -\frac{5}{3}$ B. $-\frac{3}{4}, -\frac{3}{2}, \frac{5}{3}$
C. $\frac{3}{5}, -\frac{3}{5}, \frac{5}{3}$ D. None of these

107. Let $\{s_n\}$ be a sequence defined by the recurrence relation

$$s_n = \sqrt{\frac{ab^2 + s_n^2}{a+1}}, \text{ for } n \geq 1$$

where $b > a$ and $s_1 = a > 0$.

Then $\lim_{n\to\infty} s_n$ is equal to

A. ∞ B. b
C. $a + b$ D. None of these

108. The age of a father is twice that of the elder son. Ten years hence the age of the father will be three times that of the younger son. If the difference of ages of the two sons is 15 years, the age of the father will be

A. 50 years B. 60 years
C. 65 years D. None of these

109. A five-figure number is formed by the digits 0, 1, 2, 3, 4 without repetition. The probability that the number formed is divisible by 4 is

A. 9/16 B. 5/16
C. 7/16 D. None of these

110. Consider the following statements:

(*i*) Suppose A is a matrix such that det(A) = 0. Then at least one of the cofactors must be zero.
(*ii*) Suppose A is a matrix in which all its entries are either 0 or 1. Then det(A) will be equal to 1, 0 or –1.
(*iii*) Suppose A is a matrix in which det(A) = 0. Then all its principal minors will be zero.

Identify the wrong statements.

A. Only (*i*) and (*ii*)
B. Only (*i*) and (*iii*)
C. (*i*), (*ii*) and (*iii*)
D. None of these

111. One of the disadvantages of raster scan display is
A. it cannot display colour images
B. lines may appear jaggy
C. it cannot take advantages of technological research and mass production of the television industry
D. None of the above

112. What are the next two terms in the sequence 17, 15, 26, 22, 35, 29, ...?
A. 42, 50
B. 48, 40
C. 46, 38
D. None of these

113. A ball is drawn from an urn containing three white and three black balls. After the ball is drawn, it is then replaced and another ball is drawn. This goes on indefinitely. What is the probability that of the first four balls drawn, exactly two are white?
A. $\frac{3}{8}$
B. $\frac{2}{9}$
C. $\frac{5}{11}$
D. None of these

114. If $ab \neq 0$, the equation
$$ax^2 + 2xy + by^2 + 2ax + 2by = 0$$
represents a pair of straight lines, if
A. $a^2 + b^2 = 2$
B. $ab = 2$
C. $a + b = 2$
D. None of these

115. If $f(x) = x^4 - 2x^3 - 3$ and $g(x) = x + 1$ be polynomials with real numbers as coefficients, then which of the following is false?
A. $f(-1) = 0$
B. $g(x)$ divides $f(x)$
C. $g(x)$ does not divide $f(x)$
D. $f(x) = 0$ has at least two real roots

116. Bill and Gates go target shooting together. Both shoot at a target at the same time. Suppose, Bill hits the target with probability 0.7, whereas Gates, independently, hits the target with probability 0.4. Given that the target is hit, what is the probability that Gates hits it?
A. $\frac{19}{45}$
B. $\frac{11}{21}$
C. $\frac{13}{27}$
D. None of these

117. If $\cos\theta = \cos\alpha\cos\beta$, then the product
$$\tan\left(\frac{\theta+\alpha}{2}\right)\tan\left(\frac{\theta-\alpha}{2}\right)$$
is equal to
A. $\tan^2\left(\frac{\alpha}{2}\right)$
B. $\tan^2\left(\frac{\beta}{2}\right)$
C. $\tan^2\left(\frac{\theta}{2}\right)$
D. None of these

118. Suppose the roots of a quadratic equation are (8/5) and −(7/3). What is the value of the coefficient of the x-term, if the equation is written in the standard form $ax^2 + bx + c = 0$ with $a = 1$?
A. 2/5
B. 7/5
C. 11/5
D. None of these

119. Find the number of ways a postman can deliver four letters, each to the wrong address.
A. 7
B. 8
C. 9
D. 10

120. If $f(x)$ is a rational integral function of x then $f(x + h)$ is given by
A. $f(x) + hf'(x) + \frac{h^2}{\angle 2} f''(x) + \_\_ + \frac{h^n}{\angle n} f^n(x)$
B. $f(x) - hf'(x) + \frac{h^2}{\angle 2} f''(x) + \_\_ + (-1)^{1n} \frac{h^n}{\angle n} f^n(x)$
C. $f(x) + hf'(x) - \frac{h^2}{\angle 2} f''(x) + \_\_ + \frac{h^n}{\angle n} f^n(x)$
D. None of these