JNU MCA - 2004

1. Let [.] denote the greatest integer function, then the value of $\int_0^{1.5} [x^2]\, dx$ is

(a) $2 - \sqrt{2}$ (b) $2 + \sqrt{2}$ (c) $1 + \sqrt{2}$ (d) 3

2. The value of real θ such that $\frac{3 + 2i \sin \theta}{1 - 2i \sin \theta}$ is purely imaginary is

(a) $n\pi$ (b) $n\pi \pm \frac{\pi}{2}$ (c) $n\pi \pm \frac{\pi}{3}$ (d) $n\pi \pm \frac{\pi}{6}$

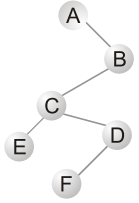
3. If the two circles $(x-1)^2 + (y-3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$, intersect at two distinct points, then

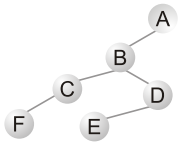
(a) $2 < r < 8$ (b) $r < 2$ (c) $8 < r$ (d) $r = 2$ or $r = 8$

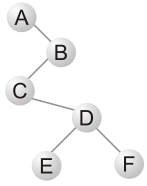
4. The coefficient of $X_1 X_2^2 X_3^3 X_4^4 X_5^5$ in the expansion of $(X_1 + X_2 + X_3 - X_4 + X_5)^5$ is

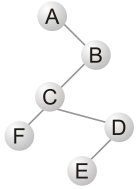
(a) 1!2!3!4!5 (b) 15.14.13.12.11 (c) $\frac{15!}{15}$ (d) $\frac{15!}{1!2!3!4!5!}$

5. Identify the binary tree for which the inorder and postorder traversals are as under
Inorder : AFCEDB
Postorder : FEDCBA

(a) 

(b) 

(c) 

(d) 

6. In a triangle *ABC*, the angle *A* is greater than the angle *B*. If the values of the angles *A* and *B* satisfy the equation $3 \sin x - 4 \sin^3 x - k = 0, 0 < k < 1$, then the value of *C* is

(a) $\frac{5\pi}{6}$ (b) $\frac{2\pi}{3}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{3}$

7. The angle between the lines given by the equation $Y^2 \sin^2 \theta - xy \sin^2 \theta + X^2 (\cos^2 \theta - 1) = 0$ is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{2}$ (d) $\frac{2\pi}{3}$

8. You are allowed to use 20 nodes to construct an AVL-tree (height balanced tree). What is its possible maximum height ?

(a) 4 (b) 5 (c) 6 (d) 7

9. The half-life of a radioactive substance is the time required for one-half of the substance to decay. The amount of ^{11}C, an isotope of carbon present at a future time t (in months) is given by $A(t) = 100 \exp[-0.0338\,t]$. The half-life of the material in months is

(a) $\ln 2$ (b) 0.0338 (c) $\dfrac{\ln 2}{0.338}$ (d) $2 \ln 2$

10. A file of size $n = 100$ takes 6 ms for sorting using Quicksort algorithm. Then approximately how much time would it take to sort a file of size $n = 100000000$?

(a) 24000000 ms (b) 24 ms (c) 240000 ms (d) 18000000 ms

11. Solve $z^5 = 1$, for z

(a) $z = e^{2\pi/m}$, $n = 0, 1, 2, \ldots$ (b) $z = e^{2\pi in/5}$, $n = 0, 1, 2, \ldots$

(c) $z = e^{\pi in/5}$, $n = 0, 1, 2, \ldots$ (d) $z = e^{5\pi in}$, $n = 0, 1, 2, \ldots$

12. On the interval [0, 1], the function $x^{25}(1 - x)^{75}$ takes its maximum value at the point

(a) $\dfrac{1}{4}$ (b) $\dfrac{1}{3}$ (c) $\dfrac{1}{2}$ (d) 0

13. The straight line $7x - 2y + 10 = 0$, $7x + 2y - 10 = 0$ and $y + 2 = 0$ form

(a) obtuse-angled triangle (b) acute-angled triangle

(c) right-angled triangle (d) isosceles triangle

14. Assume that an upper triangular matrix $a[0..99, 0..99]$ is stored in a linear array $h[0..5049]$ in lexicographical (row by row) order. If $a[0, 0]$ is stored in $h[0]$, where is $a[80, 90]$ stored in the array h ?

(a) 4851 (b) 4850 (c) 3330 (d) 4175

15. Consider the following *C* function :

```
unsigned try (unsigned x, int p, int n)
{
return (x >> (p − 1 − n)) and −(−0 << n);
}
```

What would be the output of try $(x, 8, 5)$ for $x = 1110111011101110$?

(a) 10111 (b) 11101 (c) 01110 (d) 11011

16. An observer at an anti-aircraft post A identifies an enemy aircraft due east of his post at an angle of elevation of 60^o. Ast the same instant a detection post D situated 4 km south of A reports the aircraft at an elevation of 30^o. The altitude at which the plane is flying is

(a) $4\sqrt{3}$ (b) $2/\sqrt{3}$ km (c) $\sqrt{6}$ (d) 6 km

17. A Winchester-style disc has its head currently located at track 64. Given the reference string (88, 90, 8, 11, 10, 4) representing the (ordered) sequence of requests for disc tracks, the total number of tracks traversed by the disc under the SSFT is

(a) 108 (b) 138 (c) 139 (d) 109

18. Let $f, g : R \to R^+$ defined by $f(x) = 2x + 3$ and $g(x) = x^2$. The value of $(gof)(x)$ is

(a) $2x^2 + 3$ (b) $2x + 3$ (c) $(2x + 3)^2$ (d) $4x^2 + 9$

19. Suppose that the expected number of accidents per week at an industrial plant is 4. The number of workers injured in each accident is intendant random variable with a common mean of 2. Assume also that the number of workers injured in each accident is independent of the number of accidents that occur. The expected number of injuries during a week is

(a) 2 (b) 4 (c) 6 (d) 8

20. The concept of virtual memory

(a) allows one user to use all the memory available

(b) allows Virtual Reality programs to run

(c) allows a user program to run on another computer which is connected on a network

(d) provides a user program with an address space larger than the amount of physical memory

21. If a, b, c are all different from zero, and $\Delta = \begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$ is equal to zero, then the value of $a^{-1} + b^{-1} + c^{-1}$ is

(a) abc (b) $a^{-1}b^{-1}c^{-1}$ (c) $-a-b-c$ (d) None of these

22. The ratio of the altitude of the cone of greatest volume which can be inscribed in a given sphere, to the diameter of the sphere is

(a) $\frac{1}{4}$ (b) $\frac{3}{4}$ (c) $\frac{1}{3}$ (d) $\frac{2}{3}$

23. Let $G = (V, E)$, $E = \{e1, e2, e3, e4, e5, e6, e7, e8, e10, e11, e12, e13\}$ be a graph with a circuit $C = \{e1, e2, e5, e6, e8, e9, e11\}$. Which of the following may be a cut-set of G ?

(a) $S = \{e1, e2, e3\}$ (b) $S = \{e3, e4, e5, e8\}$

(c) $S = \{e2, e3, e4, e7, e9\}$ (d) $S = \{e4, e5, e6, e10, e12\}$

24. If $y\sqrt{x^2+1} = \log[\sqrt{x^2+1} - x]$, then $\frac{dy}{dx}$ is

(a) $-\frac{xy+1}{x^2+1}$ (b) $\frac{xy+1}{x^2+1}$ (c) $-\frac{xy+1}{\sqrt{(x^2+1)}}$ (d) $xy\sqrt{(x^2+1)}$

25. Which of the following partially ordered sets is a tree ?

(a) The set of all binary strings of length ≤ 10, partially ordered by $v \le w$ if w is a substring of v.

(b) The set of all ternary strings of length ≤ 10, partially ordered by $v \le w$ if w is an initial substring of v.

(c) The set of all binary strings of length ≤ 2, partially ordered by $v \le w$ if w is a substring of v.

(d) The set of all ternary strings of length ≤ 2, partially ordered by $v \le w$ if v is an initial substring of w

26. Given that $\log_{10} x^2 y^2 = 6$ and $\log_{10}(x/y) = 2$, then x and y respectively are

(a) $\sqrt{10}$, $100\sqrt{10}$ (b) 100, 1 (c) $100\sqrt{10}$, $\sqrt{10}$ (d) 1000, 10

27. The number of common tangents to the circles $x^2 + y^2 + 2x + 8y - 23 = 0$ and $x^2 + y^2 - 4x - 10y + 19 = 0$ are

(a) 4 (b) 3 (c) 2 (d) 1

28. Which of the following is a group ?

(a) Rational numbers under × (b) Positive rational number under +

(c) (1, 3, 5, 7) under × mod 8 (d) (1, 2, 3, 4, 5, 6, 7) under × mod 8

29. If f is twice differentiable function such that $f''(x) = -f(x)$ and $f'(x) = g(x)$. Let $h(x) = [f(x)]^2 + [g(x)]^2$. Given that $h(5) = 11$, then $h(10)$ is

(a) 22 (b) 11 (c) 16 (d) 0

30. Let X and Y be independent random variables μ_x and μ_y, and σ_x^2 and σ_y^2. Then Var (XY) equals

(a) $\sigma_x^2\ \sigma_y^2$ (b) $\sigma_x^2\ \sigma_y^2 + \mu_x^2\ \sigma_x^2 + \mu_x^2\ \sigma_y^2$

(c) $\mu_y^2\ \sigma_x^2 + \mu_x^2\ \sigma_y^2$ (d) $(\sigma_x + \sigma_y)^2$

31. The value of $\lim_{x \to 0} \frac{\int_0^{5x^3} e^t dt}{x^3}$ is

(a) 0 (b) 1 (c) 5 (d) ∞

32. Fetching, decoding and executing of an instruction is broken down into several time intervals. Each of these intervals involving one or more clock periods is called a/an

(a) instruction cycle (b) interpretation cycle

(c) machine cycle (d) process cycle

33. The area bounded by the curve $y = f(x)$, x-axis and the coordinates $x = 1$ and $x = b$ is $(b - 1)\sin(3b + 4)$. The $f(x)$ equals

(a) $(x - 1)\cos(3x - 4)$ (b) $\sin(3x + 4) + 3(x - 1)\cos(3x + 4)$

(c) $\sin(3x + 4)$ (d) $(3x + 4)\sin(x - 1) + \cos(3x + 4)$

34. The value of $I = \int_0^{\pi} \log(\sin x)\, dx$ is

(a) $-2\log 2$ (b) $2\log 2$ (c) $\pi \log 2$ (d) $-\pi \log 2$

35. The value of $\lim_{x \to 0} \dfrac{\sin x - x + \dfrac{1}{6}x^2}{x^5}$ is

(a) ∞ (b) $\dfrac{1}{120}$ (c) $\dfrac{1}{20}$ (d) $\dfrac{1}{2}$

36. The round-off error when the number 8.987652 is rounded to five significant digits is

(a) – 0.00043 (b) – 0.000048 (c) 0.00048 (d) 0.04800

37. The addressing mode used in instruction LDA 0345.H is

(a) direct (b) indirect (c) induced (d) immediate

38. If the points $(2a, a)$, $(a, 2a)$ and (a, a) enclose a triangle of are 18 sq units, the centroid of the triangle is

(a) (6, 4) (b) (4, 6) (c) (– 8, 8) (d) (8, 8)

39. Let α and x_0 be positive numbers and define the sequence $(x_n)_{n=1}^{\infty}$ recursively by $x_n = \dfrac{1}{2}\left(x_{n-1} + \dfrac{\alpha}{x_{n-1}}\right)$

The sequence $y_n = \dfrac{x_n}{\sqrt{\alpha}}$ converges. Its limit is

(a) 1 (b) – 1 (c) $\sqrt{\alpha}$ (d) 4α

40. Which of the following is not a DBA function ?

(a) User coordination (b) Backing-up the database

(c) Writing queries (d) Database design

41. The principle value of $\sin^{-1}\left[\sin\left(\dfrac{2\pi}{3}\right)\right]$ is

(a) $\dfrac{\pi}{3}$ (b) $-\dfrac{2\pi}{3}$ (c) $\dfrac{2\pi}{3}$ (d) $\dfrac{5\pi}{3}$

42. The three lines : $ax + by + c = 0$; $bx + cy + a = 0$ and $cx + ay + b = 0$ are congruent only when

(a) $a + b + c = 0$ (b) $a^2 + b^2 + c^2 - ab - bc - ca = 0$

(c) $a^3 + b^3 + c^3 + 3abc = 0$ (d) $a^3 + b^3 + c^3 - a^2b - b^2c - c^2a = 0$

43. $\int \dfrac{10x^9 + 10^x \log_e 10}{10^x + x^{10}}\, dx$ equals

(a) $10^x - x^{10}$ (b) $10^x + x^{10}$ (c) $(10^x - x^{10})^{-1}$ (d) $\log(10^x + x^{10})$

44. Referential integrity in SQL is represented by

(a) foreign key (b) primary key (c) candidate key (d) super key

45. The disadvantage of passing parameters by value into sub-programs is

(a) shallow binding and ad hoc binding

(b) additional storage for the formal parameter and the data transfer cost

(c) pass-by-value-result ambiguity and additional recursive overhead

(d) prototype overloading and garage collection overhead.

46. If $f(9) = 9$, $f'(9) = 4$, then $\dfrac{\{\sqrt{f(x)} - 3\}}{\{\sqrt{x} - 3\}}$ equals

(a) 0.50 (b) 1 (c) 2 (d) 4

47. If $\cos^{-1} p + \cos^{-1} q + \cos^{-1} r = \pi$, then $p^2 + q^2 + \ldots = 1$

(a) $2p^2q^2 + r^2 + 4pqr$ (b) $r^2 + 2pqr$

(c) $r^2 + 2pqr - 1$ (d) None of these

48. $f(x) = k, \exp\left(-\frac{1}{2}x^2\right)$ for all $x \in R$; can be a probability density function for

(a) $k = 1$ (b) $k = 2\pi$ (c) $k = (2\pi)^{-1/2}$ (d) $k(2\pi)^{-1}$

49. Let $A_i = \{1, 2, 3, \ldots, i\}$ for $i = 1, 2, 3, \ldots$. Then $\bigcup_{i=1}^{n} Ai$ and $\bigcap_{i=1}^{n} A_i$ respectively are

(a) {1, 2, 3, ..., n} and {n} (b) {1, 2, 3, ... n} and {1}

(c) {1, 2, 3, ...} and {1, 2, 3, ... n} (d) {1, 2, 3, ... n} and {1, 2, 3, ..., n}

50. Identify the error in the following :

int myfunc (float var1, int k, int i = 0, int j)

(a) int $i = 0$ should not be used

(b) the function cannot return int and therefore the return type be void

(c) since i has been given the default value, all other variables also must have the same default value

(d) since i has been given the default value, j also should have a default value

51. If $f(x) = x^3 - 2x^2 + x + 6$, then which one of the following is correct ?

(a) $f(x)$ has maximum at $x = \frac{1}{3}$ (b) $f(x)$ has a maximum at $x = 1$

(c) $f(x)$ has a minimum at $x = 1$ (d) $f(x)$ has a no maxima or minima

52. Solution of $x_n = x_{n-1} + 12n^2$, where $x_0 = 5$, is

(a) $x_n = 5 + n(n + 1)$ (b) $x_n = 5 + 2n(n + 1)(2n + 1)$

(c) $x_n = 3 + (n + 2)$ (d) $x_n = 3n + 2n(n + 1)$

53. Let x and y be independent random variables with binomial distribution $B\left(10, \frac{1}{3}\right)$ and $B\left(20, \frac{1}{3}\right)$ respectively.

$E[x + y]$ is

(a) 5 (b) 10 (c) 15 (d) 30

54. Consider the three lines :

$$L1 : x + y = 1, L2 : x - y = -1, L3 : 7x - y = 6$$

A maximum of how many circles can be drawn each touching al these lines ?

(a) Three (b) Two (c) One (d) None (zero)

55. A SRS (Software Requirement Specification) describes

(a) functional requirements (b) non-functional requirements

(c) the information flow (d) All of these

56. The imitation of the BNF is that

(a) It always defines ambiguous syntactic features (terms) of a language

(b) syntax diagrams are simpler alternative tool to define syntax of a language

(c) It cannot specify the context free aspects of the syntax of a language

(d) It can only the context free aspects of the syntax of a language

57. The smallest positive value of x (in degree) for which $\tan(x + 100^\circ) = \tan(x + 50^\circ)\tan(x)\tan(x - 50^\circ)$ is

(a) 75° (b) 60° (c) 45° (d) 30°

58. If a, b, c are distinct and $\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix}$, then x is equal to

(a) 0 (b) a (c) b (d) abc

59. If p, q, r be three positive numbers, then the value of $(p+q)(q+r)(r+p)$ is

(a) $< 4pqr$ (b) $< 8pqr$ (c) $> 8pqr$ (d) $> 4pqr$ but $< 8pqr$

60. Observe the following program carefully and select the appropriate printf () statement from the options :

```
struct month
{
char * month;
}
void main ()
{
struct month m = ("may") ;
}
```

(a) printf ("\n month : %s", m.month); (b) printf ("\n Month : %s", m → month);

(c) printf ("\n Month : %s", m.*month); (d) printf ("\n Month : %s", *m.month);

61. If $x_r = \cos(\pi/2^r) + \sin(\pi/2^r)$, then $x_1\ x_2\ x_3 \ldots$ to ∞ is

(a) -3 (b) -2 (c) -1 (d) 0

62. If $A \cap B = \phi$ and $B \cap C = \phi$, then $P(A \cup B \cup C) =$

(a) $P(A) + P(B) + P(C)$ (b) $P(A)\,P(B)\,P(C)$

(c) $P(A)\,P(B) + P(B)\,P(C) + P(C)\,P(A)$ (d) $P(A \cap B) + P(B \cap C)$

63. There exists a function $f(x)$ satisfying $f(0) = 1$, $f'(0) = -1$ and $f(x) > 0$ for all x, then which of the following is correct ?

(a) $f''(x) > 0$ for all x (b) $-1 < f''(x) < 0$ for all x

(c) $-2 \le f''(x) \le -1$ for all x (d) $f''(x) < -2$ for all x

64. The encoding scheme that uses both polarities and zero to represent binary 1 and 0 is

(a) bi-phase (b) bipolar (c) polar (d) unipolar

65. In a triangle ABC, if cot A, cot B and cot C are in AP, then $a^2 b^2 c^2$ are in

(a) AP (b) GP (c) HP (d) None of these

66. The value of the determinant $\Delta = \begin{vmatrix} a^2 & a & 1 \\ \cos(nx) & \cos((n+1)x) & \cos((n+2)x) \\ \sin(nx) & \sin((n+1)x) & \sin((n+2)x) \end{vmatrix}$ is independent of

(a) n (b) a (c) x (d) None of these

67. For $n \in N$, $3^{2n+2} - 8n - 9$ is divisible by

(a) 81 (b) 72 (c) 64 (d) 49

68. A point P is chosen at random on a line AB of length $2l$. The probabiity $P[AP \times BP) > l^2/2]$ is

(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) $\left(1 - \frac{1}{\sqrt{2}}\right)l$ (d) $\frac{1}{\sqrt{2}}\,l$

69. In a cellular network, the distance between two adjacent hexagonal cells with radius R is

(a) R (b) $R\sqrt{2}$ (c) $R\sqrt{3}$ (d) $R\sqrt{\frac{3}{2}}$

70. Solution of equation $e^{\sin x} - e^{-\sin x} = 4$ is

(a) $\sin^{-1} \ln\left(\frac{4+\sqrt{17}}{2}\right)$ (b) $\sin^{-1} \ln\left(\frac{4-\sqrt{17}}{2}\right)$ (c) $\sin^{-1}\left(\frac{4+\sqrt{17}}{2}\right)$ (d) $\sin^{-1}\left(\frac{4-\sqrt{17}}{2}\right)$

71. Two towns A and B are 60 km apart. A school is to be built to serve 150 students from town A and 50 students from town B. If the total distance travelled by all 200 students is to be as small as possible, then the school should be built at

(a) 45 km from town A (b) 45 km from town B

(c) town A (d) town B

72. Consider the following inequality $\frac{1}{\sqrt{k}}\int_1^k\left(\frac{3}{2}\sqrt{x}+1-\frac{1}{\sqrt{x}}\right)dx < 4$. The value of k for which the above inequality is satisfied, lie in the interval

(a) (0, 4) (b) (8, 12) (c) (32, 48) (d) $(-\infty, 0)$

73. Given the points $A(0, 4)$ and $B(0, -4)$, the equation of the locus of the point $P(x, y)$ such that $|AP - BP| = 6$ is

(a) $9x^2 + 7y^2 + 63 = 0$ (b) $9x^2 - 7y^2 - 63 = 0$ (c) $x^2 + y^2 - 9 = 0$ (d) $x^2 + y^2 - 1 = 0$

74. AAL2 protocol in ATM supports

(a) connectionless, constant-bit rate real-time applications
(b) connection-oriented, variable-bit rate non real-time applications
(c) connection-oriented, constant-bit rate non real-time applications
(d) connection-oriented, variable-bit rate real-time applications

75. The value of $\frac{1}{\sin 10^o} - \frac{\sqrt{3}}{\cos 10^o}$ is

(a) 2 (b) 4 (c) $2\sqrt{2}$ (d) $\sqrt{2}$

76. The solution set of the equation $\log_2(3 - x) + \log_2(1 - x) = 3$ is

(a) $\{-1\}$ (b) $\{5\}$ (c) $\{-1, 5\}$ (d) $\varnothing$

77. The real solution of the following simultaneous equations is

$$xy + 3y^2 - x + 4y - 7 = 0$$
$$2xy + y^2 - 2x - 2y + 1 = 0$$

(a) $x = 0, y = 1$ (b) $x = 1, y = 0$ (c) $x = -2, y = 3$ (d) $x = 2, y = -3$

78. Which of the following is the function of mid-term scheduler in a time-sharing system ?

(a) Swapping (b) Controlling degree of multiprogramming
(c) Context-switching (d) Process creation

79. In a triangle ABC, $a:b:c = 4:5:6$. The ratio of the radius of the circumcircle to that of the incircle is

(a) $\frac{7}{16}$ (b) $\frac{9}{16}$ (c) $\frac{16}{9}$ (d) $\frac{16}{7}$

80. The polar exponential form of the complex number $\frac{1}{2} + \frac{\sqrt{3}}{2}i$ is

(a) $e^{(3\pi i/2)+2\pi ik}, k = 0, \pm 1, \pm 2, \ldots$ (b) $e^{(\pi i/3)+2\pi ik}, k = 0, \pm 1, \pm 2, \ldots$

(c) $e^{2\pi ik}, k = 0, \pm 1, \pm 2, \ldots$ (d) $\sqrt{2e^{(\pi i/4)+2\pi ik}}, k = 0, \pm 1, \pm 2, \ldots$

81. A random variate has the following distribution :

x	0	1	2	3	4	5	6	7
$p(x)$	0	k	$2k$	$3k$	k^2	$2k^2$	$7k^2$	$7k^2 + k$

The value of k is

(a) 0.1 (b) -0.1 (c) -1 (d) 1

82. If $\sin\alpha$, $\cos\alpha$ are the roots of the equation $px^2 + qx + r = 0$, then

(a) $p^2 - q^2 + 2pr = 0$ (b) $p^2 + q^2 - 2pr = 0$ (c) $(p + r)^2 = q^2 - r^2$ (d) $(p - r)^2 = q^2 + r^2$

83. A normal of a curve is drawn at $P(x, y)$ which meets the x-axis at G. Let PG be of constant length k. If the differential equation describing the curve be $y.\frac{dy}{dx} = \pm\sqrt{k^2 - y^2}$

a curve that passes through $(0, k)$ is a

(a) equilateral hyperbola (b) hyperbola
(c) ellipse (d) circle

84. The chord joining the points where $x = p$ and $x = q$ on the curve $y = ax^2 + bx + c$ is parallel to the tangent at the point on the curve whose abscissa is

(a) $\frac{p-q}{2}$ (b) $\frac{p+q}{2}$ (c) $\frac{pq}{2}$ (d) $a(p+q)$

85. Which one of the following file allocation methods is used by Unix operating system ?

(a) Contiguous allocation (b) Indexed allocation

(c) Linked allocation (d) Bit Vector

86. The voltage across a register is a random variable E uniform between 5V and 10V. given the resistance of the register $R = 1000\,\Omega$, the probability density function of the power $W = E^2/R$ dissipated in R is

(a) $\frac{1}{5}, 5 \le w \le 10$ (b) $\frac{1}{75}, 25 \le w \le 100$ (c) $w^{-\frac{1}{2}}, \frac{1}{40} < w < \frac{1}{10}$ (d) $\sqrt{10}w^{-\frac{1}{2}}, \frac{1}{40} < w < \frac{1}{10}$

87. If $x = \log_3 5$, $y = \log_{17} 25$, which of the following is correct ?

(a) $x < y$ (b) $x = y$ (c) $x > y$ (d) Not comparable

88. The minimum number of page frames that must be allocated to a process is defined by

(a) Average page fault rate (b) paging hardware

(c) instruction-set (d) Large number of addressing modes

89. If $A + B + C = 2S$, then $\cos^2 S + \cos^2(S - A) + \cos^2(S - B) + \cos^2(S - C) = 2 + \ldots$

(a) $\cos A \cos B \cos C$ (b) $2\cos A \cos B \cos C$

(c) $\cos(B + C)\cos(B - C)$ (d) None of these

90. In which of the following cases overflow is detected by observing carry into the sign bit position and carry out of the sign bit position in fixed-point representation ?

(a) Adding two numbers of the same sign (b) Adding two opposite sign numbers

(c) Adding two unsigned numbers (d) Subtracting unsigned numbers

91. If $\tan\chi = \frac{a-b}{a+b}\cot\frac{c}{2}$, then $c = \frac{\ldots\ldots}{\cos\chi}$

(a) $(a+b)\sin\frac{c}{2}\tan\frac{c}{2}$ (b) $(a-b)\sin\frac{c}{2}$ (c) $(a+b)\sin\frac{c}{2}$ (d) $(a-c)\tan\frac{c}{2}\operatorname{cosec}\frac{c}{2}$

92. $\lim_{x\to 0}\left[\frac{x(5^x - 1)}{1 - \cos x}\right]$ is equal to

(a) $\frac{1}{2}\log 5$ (b) $\frac{1}{5}\log 2$ (c) $2\log 5$ (d) $5\log 2$

93. The value of x for which $\log_3 2$, $\log_3(2^x - 5)$ and $\log_3(2^x - 7/2)$ are in arithmetic progression, is

(a) 2 (b) 3 (c) 5 (d) 7

94. A random variate X has the following p.m.f.

$P(X = j) = (1 - p)\,p^j$, $j = 0, 1, 2, \ldots$

$0 < p < 1$

for any two positive integers m and n, $P(X > m + n \mid X > m)$, equals

(a) $P(X < m + n)$ (b) $P(X > m)$ (c) $P(X > n)$ (d) $P(X \ge n)$

95. If $\tan A = \frac{(1 - \cos B)}{\sin B}$, then B equals

(a) $\frac{A - n\pi}{2}$ (b) $n\pi - 4$ (c) $2(A - n\pi)$ (d) $\frac{A}{2} - n\pi$

96. A set contains $(2n + 1)$ elements. The number of subsets of the set which contain at most n elements is

(a) 2^{2n} (b) 2^n

(c) 2^{n-1} (d) 2^{n+1}

97. Given the difference equation $y_{k+3} - 2y_{k+2} - 5y_{k+1} + 6y_k = 0$ for all k. Set $X_k = \begin{bmatrix} y_k \\ y_{k+1} \\ y_{k+2} \end{bmatrix}$. The difference equation can be rewritten as $X_{k+1} - AX_n$, where A is

(a) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ -6 & 0 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 1 \\ 6 & -5 & 2 \end{bmatrix}$ (c) $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & 5 & 2 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 1 \\ -6 & 5 & 2 \end{bmatrix}$

98. Which of the following is NOT a characteristic of RISC architecture ?

(a) One instruction per cycle (b) Emphasis on register-to-register operations

(c) Small instruction size (d) Large number of addressing modes

99. Given the following program segment :

```
switch (num)
{
case 0 : printf (''%d'', num + 1); break ;
case 1 : printf (''%d", num + 2); break ;
case 2 : printf ("%d", num + 1) ;
case 3 : printf ("%d", num + 2) ;
case 4 : printf ("%d", num + 3) ; break ;
defalut : printf ("%d", num);
}
```

The value(s) printed by this segment for initial value of num = 2 is/are

(a) 3 4 5 (b) 2 3 4 (c) 3 4 5 2 (d) 2 3 4 2

100. The area of the quadrilateral with vertices at (2, – 1), (4, 3), (– 1, 2) and (– 3, – 2) is

(a) 30 (b) 366 (c) 15 (d) 18

101. Consider a pair of differential equations $\frac{dw}{dt} = w(1 - m)$, $\frac{dm}{dt} = m(w - 1)$. Eliminating t in the two equations results in

(a) $\left(\frac{1}{m} - 1\right)dm + \left(\frac{1}{w} - 1\right)dw = 0$ (b) $\left(\frac{1}{m} - 1\right)dm - \left(\frac{1}{w} - 1\right)dw = 0$

(c) $\left(\frac{1}{m} + 1\right)dm + \left(\frac{1}{w} + 1\right)dw = 0$ (d) $\left(\frac{1}{m} - 1\right)dm - \left(\frac{1}{w} - 1\right)dw = 0$

102. The a, b, c be non-zero real numbers such that

$$\int_0^1 (1 + \cos^8 x)(ax^2 + bx + c)\,dx = \int_0^1 (1 - \cos^8 x)(ax^2 + bx + c)\,dx$$

Then quadratic equation $ax^2 + bx + c = 0$ has

(a) no root in (0, 2) (b) at least one root in (0, 2)

(c) a double root in (0, 2) (d) None of these

103. The length of the subnormal to the parabola $y^2 = 4ax$ at any point is equal to

(a) $2a$ (b) $2\sqrt{2}\,a$ (c) $\sqrt{2}\,a$ (d) $\frac{a}{\sqrt{2}}$

104. If $\omega, \omega^2, \ldots \omega^{n-1}$ are nth root of unity, then $(2 - \omega)(2 - \omega^2)\ldots(2 - \omega^{n-1})$ equals

(a) 0 (b) n (c) $2^n - 1$ (d) $\sum_{i=1}^{n} r\binom{n}{r}$

105. The tangents of the circle $x^2 + y^2 = 169$ at the points (5, 12) and (12, – 5)

(a) coincide (b) are parallel

(c) are perpendicular (d) None of these

106. In a triangle, the lengths of the two larger sides are 10 and 9 respectively. If the angles are in *AP*, then the length of the third side is

(a) $5+\sqrt{6}$ (b) 5 (c) $3\sqrt{3}$ (d) $5\sqrt{6}$

107. If a, b, c are co-planar vectors and a, b are non-collinear, then

$$\begin{vmatrix} c\cdot a & b\cdot a \\ b\cdot a & b\cdot b \end{vmatrix} a + \begin{vmatrix} a\cdot a & c\cdot a \\ a\cdot b & c\cdot b \end{vmatrix} b - ?$$

(a) $\begin{vmatrix} c\cdot a & b\cdot a \\ b\cdot a & b\cdot b \end{vmatrix} c$ (d) $\begin{vmatrix} a\cdot a & a\cdot b \\ a\cdot b & b\cdot b \end{vmatrix} c$ (c) c (d) 0

108. If a, b, c are in GP, and $(\log a - \log 2b)$, $(\log 2b - \log 3c)$ and $(\log 3c - \log a)$ are in AP, then a, b, c are the length of the sides of a triangle which is

(a) equilateral (b) acute-angled (c) right-angled (d) obtuse-angled

109. The newton's method for finding the root of an equation $f(x) = 0$ converges if $f'(x_n)$ is

(a) 1 (b) 0 (c) large (d) small

110. The value of a for which the system of equations

$$a^3 x + (a+1)^3 y + (a+2)^3 z = 0$$
$$ax + (a-1) y + (a+2) z = 0$$
$$x + y + z = 0$$

has a non-zero solution is

(a) 1 (b) 0 (c) -1 (d) None of these

111. If $\angle A = 45^\circ$ and $\angle B = 75^\circ$, what is the value of side b ?

(a) $(a + c\sqrt{2})$ (b) $\left(\frac{a}{2} + c\sqrt{2}\right)$ (c) $\frac{a+c}{2}$ (d) $\frac{a+c\sqrt{2}}{2}$

112. $\binom{m+n}{k} = A \sum_{i=0}^{k} \binom{m}{i}\binom{n}{k-i}$, where A is

(a) $\binom{n}{k}$ (b) 2^{m+n} (c) 2^n (d) 1

113. If $\vec{\mathbf{a}} = i + 2j + 2k$ and $\vec{\mathbf{b}} = 3i + 6j + 2k$, the vector in the direction of a and having a magnitude as $|\vec{\mathbf{b}}|$ is

(a) $7(i + 2j + 2k)$ (b) $\frac{7}{9}(i + 2j + 2k)$ (c) $\frac{7}{5}(i + 2j + 2k)$ (d) $\frac{7}{3}(i + 2j + 2k)$

114. In a committee of 47 persons 13 take tea but not coffee and 28 take tea. The number of persons taking coffee but not tea is

(a) 6 (b) 19 (c) 32 (d) 34

115. The radius of a sphere is decreasing at the rate of 0.02 cm per minute. The rate at which the weight of the sphere is varying when the radius is 15 cm and the material weights 0.3 kg/cc is

(a) 5π kg/min (b) $\frac{5}{4\pi}$ kg/min (c) 6π kg/min (d) 4.8π kg/min

116. Consider the language $L = \{0^n\ 1^m \mid n, m \geq 1\}$. Which of the following sets of production rules generate L ?

I. $E \rightarrow 0E1 \mid 0E \mid E1 \mid 01$

II. $S \rightarrow 0A \mid B1;\ A \rightarrow 0A \mid B \mid 0;\ B \rightarrow B1 \mid A \mid 1$

III. $A \rightarrow 0A1 \mid 01$

IV. $S \rightarrow 0X \mid X1 \mid 01$

(a) only I (b) I and II

(c) I, II and III (d) I, II, III and IV

117. If $\frac{3+5+7+\ldots+n \text{ terms}}{5+8+11+\ldots+10 \text{ terms}} = 7$, the value of n is

(a) 49 (b) 42 (c) 37 (d) 35

118. If an m/m/1 queue, the inter-arrival time distribution is

(a) Erlang (b) General (c) Deterministic (d) Exponential

119. The value of $\cos\frac{2\pi}{15}\cos\frac{4\pi}{15}\cos\frac{8\pi}{15}\cos\frac{16\pi}{15}$ is

(a) $\frac{1}{8}$ (b) $\frac{3}{16}$ (c) $\frac{1}{16}$ (d) 3

120. Consider L-C-R circuit which is governed by the differential equations

$$L\frac{d^2Q}{dt} + R\frac{dQ}{dt} + \frac{Q}{C} = 0$$

$$I = \frac{dQ}{dt}$$

Writing $\omega^2 = (LC)^{-1}$, $2b = RL^{-1}$, $\omega_0 = \sqrt{\omega^2 - b^2}$ and imposing initial condition $Q(0) = Q_0$ $I(0) = 0$ leads to the current

(a) $I(t) = \frac{-Q_0}{LC\omega_0}\sin\omega_0 t$ (b) $I(t) = \frac{Q_0 C}{L\omega_0} - tR/2L$

(c) $I(t) = \frac{Q_0}{LC\omega_0} - tR/2L$ (d) $I(t) = \frac{-Q_0}{LC\omega_0}e^{-tR/2L}\sin\omega_0 t$