UNIVERSITY OF CALICUT
School of Distance Education

MTH2C06 - ALGEBRA II
II Semester (2019 Admn.)
Core Course of M.Sc. Mathematics

Multiple Choice Question Bank.

1. Which of the following is an example of a group
   A. $(R, -)$ B. $(Z, -)$ C. $(R, +)$ D. $(Q, -)$
2. Which of the following is a not a group
   A. $(R, +)$ B. $(Z, -)$ C. $(R^*, .)$ D. $(Q^*, .)$
3. Select Ring from the following
   A. $(R, +, .)$ B. $(Z, -, .)$ C. $(R^*, +, .)$ D. $(Q^*, +, .)$
4. Identity element of the group R under addition is
   A. 1 B. 2 C. 0 D. -1
5. Identity element of the group R^* under Multiplication is
   A. 1 B. 2 C. 0 D. -1
6. $\{1, i, -i, -1\}$ is......
   A. Semigroup B. Subgroup C. Cyclic group D. Abelian group
7. Cyclic group is always
   A. Semigroup B. Monoid C. Subgroup D. Abelian group
8. The inverse of -1 in the multiplicative group, $\{1, -1, i, -i\}$ is
   A. 1 B. -1 C. i D. -i
9. Every group of order 4 is
   A. Cyclic B. Abelian C. Non abelian D. None of the Above
10. Which of the following is an example of Integral Domain
    A. Z_4 B. Z_7 C. Z_6 D. Z_{10}
11. Which of the following is not an Integral Domain
    A. Z_4 B. Z_7 C. Z_5 D. Z_2
12. Which of the following is an example of Field
    A. Z_4 B. Z_7 C. Z_6 D. Z_{10}
13. Which of the following is not a Field
    A. Z_4 B. Z_7 C. Z_5 D. Z_2
14. Characteristic of Ring R is
    A. 3 B. 2 C. 1 D. 0
15. Characteristic of Ring Z_4 is
    A. 4 B. 2 C. 3 D. 0

16. Which of the following ring is of Characteristic zero

A. Z_4 B. Z_7 C. R D. Z_2

17. Find Characteristic of $Z_3 \times 3Z$

A. 4 B. 2 C. 3 D. 0

18. Which of the following is an example of an Ideal of Ring R

A. Z B. $\{0\}$ C. Q D. $2Z$

19. Which of the following is not an ideal of Z

A. Z B. $\{0\}$ C. Q D. $2Z$

20. Which of the following is a Prime ideal of Z

A. Z B. Z_2 C. Q D. $2Z$

21. Which of the following is not a Prime ideal of Z

A. $5Z$ B. Z_2 C. $3Z$ D. $2Z$

22. Which of the following is a Maximal ideal of Z

A. $4Z$ B. Z_2 C. Q D. $2Z$

23. Which of the following is not a Maximal ideal of Z

A. $5Z$ B. $4Z$ C. $7Z$ D. $2Z$

24. Which of the following is an example of Prime ideal which is not a Maximal Ideal of Z

A. $13Z$ B. $11Z$ C. $\{0\}$ D. $2Z$

25. Which of the following is a prime field

A. Z B. R C. Q D. C

26. Which of the following is a field

A. Z B. $2Z$ C. Q D. $3Z$

27. Which of the following is not a field

A. Z B. R C. Q D. C

28. Which of the following is a finite field

A. Z_3 B. Z_4 C. Q D. Z

29. Example of a principal ideal of Z is

A. Z_3 B. Z_4 C. Q D. $2Z$

30. A polynomial of .... degree cannot be solvable by radical extension

A. 3 B. 4 C. 5 D. 2

31. Which of the following is an example of Transcendental number

A. $\sqrt{2}$ B. π C. i D. 2

32. Number of prime ideals of Z_6

A. 3 B. 2 C. 1 D. 5

33. Number of Maximal ideals of Z_6

A. 3 B. 2 C. 1 D. 5

34. Find the value of $c \in \mathrm{Z}_3$ for which $x^2 + c$ irreducible over Z_3

A. 0 B. 2 C. 1 D. 5

35. Number of ideals of a Field is

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

36. Number of Maximal ideals of a Field is

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

37. The polynomial $x^2 + 1$ is reducible over

A. R B. Q C. Z D. Z_2

38. The polynomial $x^2 + 1$ is irreducible over

A. C B. $Q(i)$ C. $Z[i]$ D. R

39. Find algebraic element over Q

A. $\sqrt{2}$ B. π C. e D. $\pi + 1$

40. Which of these are not constructible numbers

A. $\sqrt{2}$ B. π C. $\sqrt{3}$ D. 4

41. Which of the following regular n-gon is constructible

A. 3 B. 7 C. 9 D. 11

42. Which of the following regular n-gon is not constructible

A. 3 B. 4 C. 5 D. 7

43. Which of the following angle is not constructible

A. 72 B. 20 C. 36 D. 18

44. Which of the following is an order of a finite field

A. 16 B. 20 C. 26 D. 15

45. Which of the following is not an order of a finite field

A. 16 B. 20 C. 3 D. 5

46. Find generator of Z_{11}^*

A. 2 B. 4 C. 5 D. 3

47. Find dimension of $Q(\sqrt{2})$ over Q is

A. 2 B. 3 C. 5 D. 1

48. Find dimension of $Q(i)$ over Q is

A. 1 B. 3 C. 5 D. 2

49. Find dimension of R over Q is

A. 1 B. 3 C. ∞ D. 2

50. Find dimension of $Q(\sqrt{2}, \sqrt{3})$ over Q is

A. 1 B. 4 C. ∞ D. 2

51. Select the number which is not an element of $Q(\sqrt{2})$

A. 1 B. 4 C. $\sqrt[3]{2}$ D. 2

52. The field $Q(\sqrt{3}+\sqrt{7})$ is isomorphic to

A. Q B. R C. $Q(\sqrt{3},\sqrt{7})$ D. C

53. Highest Degree of irreducible polynomial over Real numbers is

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

54. Highest Degree of irreducible polynomial over Complex numbers is

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

55. Which of the following number is conjugate to $\sqrt{3}$

A. 1 B. 2 C. 3 D. -$\sqrt{3}$

56. Let E is $Q(\sqrt{3},\sqrt{7})$.Then number of automorphisms of E which leaves Q fixed is

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

57. Number of automorphisms from $Q(\sqrt{2})$ to $Q(\sqrt{3})$ is

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

58. Find the fixed field of $Q(\sqrt{2})$ of the mapping $\sqrt{2}$ goes to -$\sqrt{2}$

A. Q B. R C. C D. Z

59. Let E is $Q(\sqrt{3},\sqrt{7})$ and F is Q.Then index of E over F is

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

60. Find splitting field of $\{x^2-2, x^2-3\}$ over Q

A. $Q(\sqrt{3},\sqrt{2})$ B. $Q(\sqrt{3})$ C. $Q(\sqrt{2})$ D. R

61. Find the inverse of 3 in Z_5

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

62. Find the splitting field of x^3-2 over Q

A. $Q(i\sqrt{3},\sqrt[3]{2})$ B. $Q(\sqrt{3})$ C. $Q(\sqrt{2})$ D. R

63. Find a zero of x^3-2 in Z_5

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

64. Find Galois group of the polynomial x^4-5x^2+6 over Q

A. Z_2 B. Z_3 C. Klein 4 group D. Z_5

65. Find Galois group of the polynomial x^2-3 over Q

A. Z_2 B. Z_3 C. R D. Z_5

66. Find Galois group of the polynomial x^2-1 over Q

A. Z_2 B. Z_3 C. Q D. Z_5

67. Find splitting of x^3-1 over Q

A. $Q(i\sqrt{3},\sqrt[3]{2})$ B. $Q(\zeta)$ C. $Q(\sqrt{2})$ D. R

68. Number of elements in the Galois group of pth cyclotomic polynomial over Q is

A. 2 B. p C. $p-1$ D. $p+1$

69. Which of the following is a Fermat prime

A. 2 B. 6 C. 5 D. 8

70. Which of the following is not a Fermat prime

A. 3 B. 5 C. 17 D. 8

71. Find the number of elements less than and relatively prime to 10

A. 3 B. 5 C. 4 D. 8

72. Find the polynomial which is irreducible over Q

A. $x^2 + 3$ B. $x^2 + 5x + 4$ C. x^4 D. $x^2 - 1$

73. Find the polynomial which is reducible over Q

A. $x^2 + 3$ B. $x^2 + 5x$ C. $x^4 - 2$ D. $x^2 + 1$

74. Find the number of Quadratic polynomials which is irreducible over Z_2

A. 3 B. 1 C. 4 D. 8

75. Which of the following is a cyclic group

A. $Z_3 \times Z_3$ B. $Z_3 \times Z_9$ C. $Z_2 \times Z_4$ D. $Z_3 \times Z_5$

76. Which of the following is a not a cyclic group

A. $Z_3 \times Z_3$ B. $Z_3 \times Z_2$ C. $Z_5 \times Z_4$ D. $Z_3 \times Z_5$

77. Find the order of the element $(1, 2)$ in $Z_3 \times Z_3$

A. 9 B. 2 C. 3 D. 8

78. Find the order of the element $(1, 2, 3)$ in $Z_3 \times Z_3 \times Z_5$

A. 9 B. 2 C. 3 D. 15

79. Which of the following is an Abelain group

A. A_3 B. A_4 C. S_3 D. D_4

80. Which of the following is a Non Abelain group

A. A_3 B. A_4 C. Z_3 D. Z_4

81. Find the order of $(123)(45)$ in S_5

A. 2 B. 6 C. 3 D. 15

82. Find the maximum order of an element in the group S_5

A. 2 B. 6 C. 3 D. 10

83. Find number of elements of order 2 in S_3

A. 2 B. 6 C. 3 D. 5

84. Find the number of units in the ring Z_5

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

85. Find the number of subgroups of S_3 of order 2

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

86. Find the number of normal subgroups of S_3

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

87. Find number of proper normal subgroups of Z_6

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

88. Find number of generators of the group Z_{10}

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

89. Find number of proper subgroups of S_3

A. 5 B. 4 C. 3 D. 1

90. In the group $G = \{2, 4, 6, 8\}$ under multiplication modulo 10, the identity element is

A. 2 B. 4 C. 6 D. 8

91. Number of identity elements in a Ring is

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

92. Number of elements in D_4 is

A. 2 B. 1 C. 8 D. 4

93. Number of elements in S_n is

A. $n!$ B. $\frac{n!}{2}$ C. n D. $n+1$

94. The number of normal subgroups in a nontrivial simple group

A. 2 B. 1 C. 0 D. 4

95. In any Abelian group every subgroup is

A. Normal B. Finite C. Cyclic D. $\{0\}$

96. Index of S_n in A_n is

A. 1 B. 2 C. 0 D. 4

97. Number of Abelain subgroups of S_3 is

A. 1 B. 0 C. 5 D. 4

98. Number of elements of order 5 in S_4 is

A. 1 B. 0 C. 5 D. 4

99. Number of zero divisors of Q is

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

100. Number of units in the Integral Domain Z

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

ANSWERS OF MULTIPLE CHOICE QUESTIONS-ALGEBRA II									
1.C	2.B	3.A	4.C	5.A	6.C	7.D	8.B	9.B	10.B
11.A	12.B	13.A	14.D	15.A	16.C	17.D	18.B	19.C	20.D
21.B	22.D	23.B	24.C	25.C	26.C	27.A	28.A	29.D	30.C
31.B	32.B	33.B	34.C	35.B	36.D	37.D	38.D	39.A	40.B
41.A	42.D	43.B	44.A	45.B	46.A	47.A	48.D	49.C	50.B
51.C	52.C	53.B	54.A	55.D	56.D	57.D	58.A	59.C	60.A
61.D	62.A	63.C	64.C	65.A	66.A	67.B	68.C	69.C	70.D
71.C	72.A	73.B	74.B	75.D	76.A	77.C	78.D	79.A	80.C
81.B	82.B	83.C	84.B	85.C	86.D	87.C	88.B	89.A	90.C
91.B	92.C	93.A	94.C	95.A	96.B	97.C	98.B	99.D	100.C

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MTH2C09 - ODE & CALCULATIONS
M.Sc. Mathematics II Semester (2019 Admn.)
Multiple Choice Question Bank

1. Which of the following are two independent solutions of the differential equation $y^{11}+y=0$
   a. Cos x, sin x
   b. Cos x, e^x
   c. Sin x, e^x
   d. e^x, e^{-x}
2. Which of the following forms a basis of solutions of the differential equation $y^{11}+2y^1+y=0$.
   a. e^{-x}, xe^{-x}
   b. e^x, e^{-x}
   c. cos x, sin x
   d. xe^{-x}, sin x
3. Which of the following forms a basis of the differential equation $4x^2y^{11}–3y=0$.
   a. x^2, x^3
   b. $x^{-1/2}$, $x^{-3/2}$
   c. $x^{-1/2}$, $x^{3/2}$
   d. e^x, sin x
4. Which of the following pair of functions are linearly independent
   a. 0, tan x ($|x|<\pi/4$)
   b. In x, In x^4
   c. Sin^2x, sin x^2
   d. Cos x, 4 cos x
5. The general solution of the differential equation $4y^{11}+4y^1–3y=0$ is
   a. $y=Ae^{x/2} + Be^{-3x/2}$
   b. $y=Ae^x + Be^{-x}$
   c. $y=Ae^{x/4} + Be^{-x}$
   d. y=A sin x + B cos x

6. The general solution of the differential equation $y^{11}–4y^{1}+4y=0$ is
   a. $y=(c_1 + c_2 x)e^x$
   b. $y=(c_1 + c_2 x)e^{2x}$
   c. $y= c_1e^x + c_2e^{2x}$
   d. $y=A \cos x + Be^x$
7. A basis for the solution of the differential equation $y^{11}–2y^{1}+10y=0$ is
   a. e^x, e^{2x}
   b. $e^x \cos x, e^{2x} \cos x$
   c. e^x, e^{-x}
   d. $e^x \cos 3x, e^x \sin 3x$
8. A basis for the solution of the differential equation $y^{11}+4y=0$ is
   a. Cos x, sin x
   b. Cos 2x, sin 2x
   c. e^{2x}, e^{-x}
   d. e^{2x}, e^{-2x}
9. The general solution of the differential equation $x^2y^{11}–4xy^{1}+6y=0$ is
   a. $y=Ax^2 + Bx^3$
   b. $y=Ae^{2x} + Be^{3x}$
   c. $y=A \sin 3x + B \cos 2x$
   d. $y=A \cos 3x + B \sin 2x$
10. A general solution of the differential equation $xy^{11}+y^{1}=0$ is
   a. $y=c_1x+c_2x$
   b. $y=(c_1+c_2x)$ In x
   c. $y=c_1x+c_2x^{-1}$
   d. $y=c_1+c_2$ in x
11. the radius of convergence of the series $\sum_{n=0}^{\infty}(-1)^n \frac{x^{2n}}{(2n)!}$ is
   a. 0

b. 1

c. ½

d. ∞

12. The radius of convergence of the series $\sum_{n=0}^{\infty} \frac{x^n}{n!}$ is

a. 0

b. ∞

c. 1

d. 1/n!

13. The radius of convergence of the series $\sum_{n=0}^{\infty} x^n$ is

a. ∞

b. 0

c. ½

d. 1

14. Solution of the differential equation $y^1=y$ is

a. $y= \sin x$

b. $y=\cos x$

c. $y=\tan^{-1}x$

d. $y=e^x$

15. $y=(1+x)^p$ is a solution of the differential equation

a. $y^1=2xy$

b. $y^1+y=1$

c. $y^1=\frac{py}{(1+x)}$

d. $y^1=1+y^2$

16. The series $1-\frac{x^2}{2!}+\frac{x^4}{4!}-$ ….. is the expansion of the function

a. Sin x

b. Cos x

c. e^x

d. none of these

17. The series $x - \frac{x^3}{3!} + \frac{x^5}{5!} - + \ldots$ is the expansion of the function

a. Sin x

b. Cos x

c. $Tan^{-1}x$

d. $Sin^{-1}x$

18. The series $1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \frac{x^4}{4!} - \frac{x^5}{5!} + \ldots$.is the expansion of the function

a. Sin x

b. Cos x

c. e^x

d. e^{-x}

19. Origin is a ………..point of the differential equation $(1-x^2)\, y^{11} - 2xy^1 + 2y = 0$

a. ordinary

b. singular

c. regular singular

d. limit

20. Which of the following points is not an ordinary point of the differential equation $x^2y^{11} + (\sin x)\, y = 0$

a. x=1

b. x=2

c. x=0

d. x=4

21. Which of the following is a linear differential equation?

a. $y^{11} + (y^1)^2 = \sin x$

b. $(y^{11})^2 + 3y = e^x$

c. $y^{11} + 3y^{1}+y=0$

d. $y^{11}+yy^{1} + y=0$

22. If $y_1(x)$ and $y_2(x)$ are two linearly independent solutions of the differential equation $y^{11} + p(x)\, y^{1} + q(x)\, y=0$, then which of the following is always a solution.

a. $y_1(x)\, y_2(x)$

b. $y_1(x)/y_2(x)$

c. $y_1^2(x)+y_2^2(x)$

d. $y_1(x) + y_2(x)$

23. The differential equation $y^{11}–5y^{1}+6y=0$ has

a. Two linearly independent solutions

b. Three linearly independent solutions

c. Four linearly independent solutions

d. Infinite number of linearly independent solutions

24. The differential equation $y^{11} + 7y^{1} – 8y = 0$ has

a. Only one independent solution

b. Two independent solutions

c. Three independent solutions

d. Infinite number of independent solutions

25. The general solution of the differential equation $y^{11} + y = 0$ is

a. $y=c_1 \cos x + c_2 \sin x$

b. $y=c_1 \cos 2x + c_2 \sin 2x$

c. $y=\cos x$

d. $y=c_1e^{x} + c_2x\, e^{x}$

26. The general solution of the differential equation $y^{11} + 4y^{1} + 7y = 0$ is

a. $y = c_1 e^{-2x} + c_2 e^{\sqrt{3}x}$

b. $y \left[c_1 \sin\sqrt{3}\, x + c_2 \cos\sqrt{3}x\right] e^{-2x}$

c. $y=c_1 \cos\sqrt{5}\, x + c_2 \sin\sqrt{5}\, x$

d. None of the above

27. The general solution of $y^{11}–6y^{1}+9y=0$ is

a. $y=(c_1 + c_2x^2)e^{3x}$

b. $y=(c_1x+c_2x^2)e^{3x}$

c. $y=(c_1+c_2x)e^{3x}$

d. $y=c_1e^{3x} + c_2 e^{-3x}$

28. The general solution of the differential equation $y^{11} – y^{1} – 2y=0$ is

a. $y=c_1 e^{–2x} + c_2 e^{–x}$

b. $y=c_1 e^{-x} + c_2 e^{2x}$

c. $y=c_1 e^{x} + c_2 e^{2x}$

d. $y=e^{x}$

29. Let $y_1(x)$ and $y_2(x)$ be two linearly independent solutions of the differential equation $y^{11}+4y=0$. Then the wronskain $w(y_1, y_2)$ is

a. 0

b. 1

c. 2

d. ∞

30. The general solution of the differential equation $y^{1}=\cos x$ is

a. $y=\sin x$

b. $y=\cos x$

c. $y=c \sin x$

d. $y=\sin x + c$

31. The series $\sum_{n=0}^{\infty} x^n$ converges

a. For all values of x

b. Never converges

c. Converges when |x|<|

d. Converges when |x|>|

32. The indicial equation of the differential equation $2x^2y^{11}+x(2x+1)y^{1}–y=0$ is

a. $m^2 + \frac{1}{2} m - \frac{1}{2} = 0$

b. $m^2 - \frac{1}{2} m - \frac{1}{2} = 0$

c. $m^2 + \frac{1}{2} m + \frac{1}{2} = 0$

d. $m^2 - \frac{1}{2} m + \frac{1}{2} = 0$

33. The Legendre's equation $(1-x^2) y^{11} - 2xy^1 + p(p+1)y = 0$ has

a. A singularity at the origin

b. Origin as a regular singular point

c. 1, –1 as singular points

d. None of the above

34. Let m_1 and m_2 be the real roots of the indicial equation of the differential equation $y^{11} + p(x)y^1 + q(x) y=0$, with $m_1 \geq m_2$. Then

a. $y^{11}+p(x)y^1 + q(x) y = 0$ has a Frobenius series solution with exponent m_1

b. $y^{11}+p(x)y^1 + q(x) y = 0$ always has a Frobenius series solution with exponent m_2

c. m_1-m_2 is always an integer

d. m_1-m_2 is always an irrational number

35. The singular points of the Gauss's hyper geometric equation are

a. x=0 and x=1

b. x=0 and x=-1

c. x=0 and x=2

d. x=1 and x=-1

36. F(-P, b, b, -x) equals

a. $(1+x)^p$

b. $\mathrm{Sin}^{-1}x$

c. e^x

d. log(1+x)

37. x F(1,1,2,-x) equals

a. $(1+x)^p$

b. $\sin^{-1}x$

c. e^x

d. log (1+x)

38.x F(½, ½, $^3/_2$, x^2) equals

a. $(1+x)^p$

b. $\text{Sin}^{-1}x$

c. e^x

d. log (1+x)

39.$\lim_{b \to \infty}$ F(a, b, a, $\frac{x}{b}$) equals

a. $(1+x)^p$

b. $\text{Sin}^{-1} x$

c. Log (1+x)

d. e^x

40.$\lim_{a \to \infty}$ F(a, a, ½, $\frac{-x^2}{4a^2}$) equals

a. $(1+x)^p$

b. Sin x

c. Cos x

d. $\text{Sin}^{-1}x$

41.The n^{th} Legendre polynomial is obtained from

a. $F\left(-n, n, 1, \frac{1-x}{2}\right)$

b. $F\left(n, n, 1, \frac{1-x}{2}\right)$

c. $F\left(-n, n, 0, \frac{1-x}{2}\right)$

d. None of the these

42.If m=n, then $\int_{-1}^{1} P_m(x)\, P_n(x)\, dx =$

a. 0

b. 2

c. $\frac{2n+1}{2}$

d. $\frac{2}{2n+1}$

43.If m≠n, then $\int_{-1}^{1} P_m(x)\, P_n(x)\, dx =$

a. 2

b. 0

c. $\frac{2}{2n+1}$

d. 2n+1

44.Using Rodrigue's formula, the n^{th} Legendre polynomial $P_n(x)$ is exposed as

a. $P_n(x) = \frac{1}{2^n\, n!} \frac{d^n}{dx^n}\left(x^2-1\right)^n$

b. $P_n(x) = \frac{1}{n^2\, n!} \frac{d^n}{dx^n}\left(x^2-1\right)^n$

c. $P_n(x) = \frac{d^n}{dx^n}\left(x^2-1\right)^n$

d. $P_n(x) = \frac{1}{n!}\left(x^2-1\right)^n$

45.If $P_n(x)$ is the n^{th} Legendre polynomial then $P_n(1) =$

a. 1

b. $(-1)^n$

c. 0

d. ∞

46.If $P_n(x)$ is the n^{th} Legendre polynomial then $P_n(-1) =$

a. 1

b. 0

c. ∞

d. $(-1)^n$

47. If $P_n(x)$ is the n^{th} Legendre polynomial then $P_0(x)$ =

a. $(-1)^n$

b. 0

c. 1

d. x

48. If $P_n(x)$ denotes the n^{th} Legendre polynomial, then $P_1(x)$ =

a. x

b. 0

c. 1

d. $(-1)^n$

49. $P_2(x)$, the Legendre polynomial of order '2' is

a. x

b. $\frac{1}{2}(3x^2-1)$

c. 1

d. $3x^2$

50. If $P_n(x)$ is the n^{th} Legendre polynomial, then, $P_2(-1)$ =

a. 0

b. -1

c. 1

d. 2

51. If '⌈' denotes the gamma function, then $\Gamma 1$ equals

a. 0

b. -1

c. 1

d. ∞

52. For any non negative integer n, $\sqrt{n+1}$ =

a. n $\sqrt{n-1}$

b. n $\sqrt{n}$

c. (n+1) $\sqrt{n}$

d. None of these

53. $\sqrt{1/2}$ equals

a. π

b. 1

c. $\sqrt{\pi}$

d. π^2

54. The Bessel function of the first kind of order 'P' is given by $J_p(x)$ =

a. $\sum_{n=0}^{\infty} \frac{(-1)^n (x/2)^{2n+p}}{n!(p+n)!}$

b. $\sum_{n=0}^{\infty} \frac{(x/2)^{2n+p}}{n!(n+p)!}$

c. $\sum_{n=0}^{\infty} \frac{(-1)^{n+p} (x/2)^{n+p}}{n!(p+n)!}$

d. $\sum_{n=0}^{\infty} \frac{(-1)^n (x/2)^{2p+n}}{n!(n+p)!}$

55. If, λ_n^1 S are positive zeros of $J_p(x)$, the Bessel function of first kind of order 'P', and m≠n, then $\int_0^1 x\, J_p(\pi_m x) J_p(\lambda_n x)$ dx equals

a. $J_{p+1}(\lambda_n)^2$

b. ∞

c. $\frac{1}{2} J_{p+1}(\lambda_n)^2$

d. 0

56. If to is any point in [a, b], and if x_0 and y_0 are given numbers, then the number of solutions of solutions of the system $\frac{dx}{dt}$ =$a_1(t)x + b_1(t)y+f_1(t)$ and $\frac{dy}{dt}$ =$a_2(t)\ x+b_2(t)\ y+f_2(t)$, valid in [a, b] such that x (to) = x_0, $y(t_0)=y_0$ is

a. 2

b. 0

c. Infinite

d. 1

57. The wronskain of two solutions of the system $\frac{dx}{dt}$ =$a_1(t)x + b_1(t)y$, $\frac{dy}{dt}$ =$a_2(t)x + b_2(t)y$

a. always zero in [a,b]

b. no where zero in [a,b]

c. either identically zero or nowhere zero in [a,b]

d. None of these

58. The general solution of the system $\frac{dx}{dt}$ =x+y, $\frac{dy}{dt}$ =4x-2y is

a. $x=c_1e^{-3t}+c_2e^{2t}$, $y=^{-}4c_1e^{-3t}+c_2e^{2t}$

b. $x=c_1e^{-t}+c_2e^{2t}$, $y=4c_1e^{-t}+c_2e^{2t}$

c. $x=c_1e^{3t}+c_2e^{-2t}$, $y=4c_1e^{3t}+c_2e^{-2t}$

d. $x=c_1e^{t}+c_2e^{2t}$, $y=4c_1e^{t}+c_2e^{2t}$

59. Which of the following system of equations is homogeneous

a. $\frac{dx}{dt}=x, \frac{dy}{dx}=y+t^2$

b. $\frac{dx}{dt}=x, \frac{dy}{dt}=y$

c. $\frac{dx}{dt}=x+1, \frac{dy}{dt}=y+t$

d. $\frac{dx}{dt}=1, \frac{dy}{dt}=1$

60. Which of the following system is an example for a non homogeneous system of equations.

a. $\frac{dx}{dt}=x, \frac{dy}{dt}=y$

b. $\frac{dx}{dt}=x\,t, \frac{dy}{dt}=y$

c. $\frac{dx}{dt}=x\,t, \frac{dy}{dt}=y\,t$

d. $\frac{dx}{dt}=x+1, \frac{dy}{dt}=y$

61. Which of the following is an example for an autonomous system

a. $\frac{dx}{dt}=x^2+t, \frac{dy}{dt}=t$

b. $\frac{dy}{dt}=x^2+y^2, \frac{dy}{dt}=y^2$

c. $\frac{dx}{dt}=1+t, \frac{dy}{dt}=t$

d. $\frac{dx}{dt}=x\,t, \frac{dy}{dt}=yt$

62. The only critical point of the system $\frac{dx}{dt}=x, \frac{dy}{dt}=-x+2y$ is

a. x=1, y=1

b. x=1, y=-1

c. Origin

d. x=0, y=1

63. The only critical point of the system $\frac{dx}{dt}=-y, \frac{dy}{dt}=x$ is

a. x=1, y=1

b. x=2, y=2

c. x=-1, y=-1

d. x=0, y=0

64. A saddle point is always

a. Stable

b. Asymptotically stable
c. Unstable
d. Sometimes stable and sometimes unstable

65. A spiral is
a. Asymptotically stable
b. Unstable
c. Oscillates
d. None of the above

66. Suppose that -1+i and 2 are the roots of the auxillary equation of a linear system of differential equations and if origin is a critical point of the system, then it is
a. Stable
b. Unstable
c. Asymptotically stable
d. None of these

67. The critical point centre is
a. Stable
b. Unstable
c. Always asymptotically stable
d. None of these

68. In a physical system, if the total energy has a local minimum at certain equilibrium point, then it is
a. Unstable
b. Always origin
c. Total energy always zero at that point
d. Stable

69. The function $E(x,y) = x^2+y^2$ is
a. Positive definite
b. Negative definite

c. Negative semi definite

d. None of these

70.The function $E(x,y) = -18x^8 - 12y^4$ is

a. Positive definite

b. Negative definite

c. Positive semi definite

d. None of these

71.Two solutions of the equation $y^{11} + y = 0$ are

a. Sin x, 2 sin x

b. Sin x, e^x

c. e^x, log x

d. e^x, $2e^x$

72.If $y_1(x)$ and $y_2(x)$ are two independent solutions of $y^{11}+P(x)y^1+Q(x)y=0$, then the zeros of these functions are

a. Distrinct and occur alternately

b. Not distinct

c. Orthogonal

d. None of the above

73.If $q(x)<0$, and if U(x) is a nontrivial solution of $u^{11}+q(x)u=0$, then,

a. U(x) has exactly one zero

b. U(x) has atleast one zero

c. U(x) has atmost one zero

d. None of the above

74.If u(x) is a nontrivial solution of $u^{11}+q(x)u=0$, $q(x)>0$ for all $x>0$ and if $\int_1^\infty q(x)\,dx=\infty$, then u(x) has ……….. zeros on the positive x-axis –

a. Exactly one

b. No

c. Exactly two

d. Infinitely may

75. Whenever ad-bc≠0, the zeros of the functions a sin x + b cos x and c sin x + d cos x are

a. Not distict
b. Orthogonal
c. Distinct and occur alternately
d. None of the above

76. Let y(x) be a nontrivial solution of y^{11}+q(x) y=0 on a closed interval [a,b], q(x) being a positive function. Then y(x) has

a. Infinite number of solutions
b. Atmost a finite number of zeros
c. Atleast one solution
d. None of the above

77. Which of the following is true about the solutions of the equations y^{11} + 4y=0-(1) and y^{11}+y=0 – (2)

a. zeros of the solutions of (1) and (2) are same
b. zeros of solutions of (1) oscillate more rapidly that the zeros of solution of (2)
c. zeros of solutions of (1) and (2) are finite
d. none of the above

78. If y(x) and z(x) are nontrivial solutions of y^{11} + q(x) y = 0 and z^{11} + y(x) z = 0 where q(x) and r(x) are positive functions such that q(x) > r(x). Then y(x) vanishes

a. Exactly twice between any two successive zeros of z(x)
b. Exactly once between any two successive zeros of z(x)
c. Atleast once between any two successive zeros of z(x)
d. Atmost once between any two successive zeros of z(x)

79. Let $y_p(x)$ be a nontrivial solution of Bessel's equation on the positive x-axis. If $0 \leq p < 1/2$, then every interval of length π contains

a. Atmost one zero of $y_p(x)$

b. Exactly one zero of $y_p(x)$

c. Atleast one zero of $y_p(x)$

d. None of the above

80. Let $y_p(x)$ be a nontrivial solution of Bessel's equation on the positive x axis. If p>1/2, then every interval of length π contains

a. Atleast one zero of $y_p(x)$

b. Exactly one zero of $y_p(x)$

c. Atmost one zero of $y_p(x)$

d. None of the above

81. The formula for Picard's method of successive approximation is

a. $y_n(x) = y_0 + \int_{x0}^{x} f[t, y_{n-1}(t)]dt$

b. $y_n(x) = y_{n-1} + \int_{x0}^{x} f[t, y_{n-1}(t)]dt$

c. $y_n(x) = \int_{x0}^{x} f[t, y_{n-1}(t)]dt$

d. None of the above

82. First approximation to the solution of the problem $y^1=y$, y (0)=1, by Picard's method is

a. $y_1(x) = 1+x$

b. $y_1(x) = 1+x^2$

c. $y_1(x) = 1+\frac{x^2}{2!}$

d. $y_1=1$

83. First approximation to the solution of the problem $y^1=x+y$, y(0)=1, by Picard's method is

a. $y_1(x) = 1+x$

b. $y_1(x) = 1$

c. y_1 (x) = 1+x+$\frac{x^2}{2!}$

d. y_1 (x) = 0

84. The equation in which an unknown function occurs under the integral sign is called

a. Differential equation

b. Integral equation

c. Euler's equation

d. Reciprocal equation

85. First approximation to the solution of the initial value problem $y^1 = y^2$, y(0)=1 is

a. y_1=1

b. y_1=1+x

c. y_1=1+x+x^2

d. y_1=0

86. first approximation to the solution of the initial value problem y^1=2x(1+y) with y(0)=0 is

a. y_1=1

b. y_1=1+x

c. y_1=x^2

d. y_1=1+x^2

87. Necessary conditions required for Picard's theorem are

a. f(x,y) and $\frac{\partial f}{\partial y}$ are continuous

b. only f(x,y) need to be continuous

c. only $\frac{\partial f}{\partial y}$ need to be continuous

d. f(x,y) and $\frac{\partial f}{\partial y}$ are piecewise continuous.

88. Which of the following is a solution of the initial value problem

$$\begin{cases} \frac{dy}{dx} = z, y(0) = 1 \\ \frac{dz}{dx} = -y, z(0) = 0 \end{cases}$$

a. y=sin x, z = sin x

b. y = cos x, z = cos x

c. y = cos x, z = sin x

d. y = cos x, z = -sin x

89. Number of solutions of the initival value problem $y^1=f(x,y)$, $y(x_0) = y_0$ on the interval $a \leq x \leq b$, if f(x,y) satisfy $|f(x,y_1) - f(x, y_2)| \leq k |y_1 - y_2|$ on a strip defined by $a \leq x \leq b$ and $-\infty < y < \infty$ and (x_0, y_0) being an interior point of the strip.

a. At least one

b. At most one

c. Two

d. Exactly one

90. Exact solution of the problem $y^1 = y$, y(0)=1 is

a. $y=e^{2x}$

b. y=in x

c. y=x

d. $y=e^{x}$

91. The closed plane curve of given length that endoses largest area is

a. Rectangle

b. Parallelogram

c. Circle

d. Triangle

92. The shortest curve joining two points in a plane is

a. Parabola

b. Straight line

c. Ellipse

d. Cycloid

93.The curve joining two points in the (x,y) plane that yields a surface of revolution of minimum area when revolved around the x-axis is

a. Straight line

b. Parabola

c. Catenary

d. Hyperbola

94.Area of the surface of revolution obtained by revolving a curve y=f(x) with end points at (x_1,y_2), (x_2, y_2) is

a. $\int_{x_2}^{x_2} 2\pi\, y \sqrt{1+\left(y^1\right)^2}\, dx$

b. $2\pi \int_{x_1}^{x_2} x \sqrt{1+\left(y^1\right)^2}\, dx$

c. $\int_{x_1}^{x_2} \sqrt{1+\left(y^1\right)^2}\, dx$

d. $\int_{x_1}^{x_2} 2\pi \sqrt{1+\left(y^1\right)^2}\, dx$

95.Euler's differential equation for an extremal is

a. $\frac{d}{dx}\left(\frac{\partial f}{\partial y^1}\right)-\frac{\partial f}{\partial y}=0$

b. $\frac{d}{dx}\left(\frac{\partial^2 f}{\partial x \partial y^1}\right)-\frac{\partial f}{\partial y}=0$

c. $\frac{d}{dx}\left(\frac{\partial f}{\partial x}\right)-\frac{\partial f}{\partial y}=0$

d. $\frac{d}{dx}\left(\frac{\partial f}{\partial y}\right)-\frac{\partial^2 f}{\partial y^2}=0$

96.The length of a curve expressed in the parametric form x=x(t), y=y(t) as 't' increases from t_1 to t_2 is given by

a. $\int_{t_1}^{t_2} \sqrt{\left(\frac{dx}{dt}\right)^2}\, dt$

b. $2\int_{t_1}^{t_2} \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$

c. $\pi\int_{t_1}^{t_2} \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$

d. $\int_{t_1}^{t_2} \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$

97. Geodesics on a sphere are

a. arcs of great circles

b. Lines

c. arcs of any circles

d. None of the above

98. The curve of quickest descent is

a. Hyperbola

b. Circle

c. Parabola

d. Cycloid

99. If ‘x’ and ‘y’ are missing from the function $f(x,y,y^1)$, then the Euler’s equation reduces to

a. $f_{y^1y^1}\frac{d^2y}{dx^2}=0$

b. $f_{yy^1}\frac{d^2y}{dx^2}=0$

c. $f_{xy}\frac{d^2y}{dx^2}=0$

d. $f_{xx}\frac{d^2y}{dx^2}=0$

100. If ‘y’ is missing from the function $f(x, y, y^1)$, then the Euler’s equation reduce to

a. $\frac{d}{dx}\left(\frac{\partial f}{\partial y^1}\right)=0$

b. $\frac{d}{dy}\left(\frac{\partial f}{\partial y^1}\right)=0$

c. $\frac{d}{dx}\left(\frac{\partial f}{\partial y}\right)=0$

d. $\frac{d}{dx}\left(\frac{\partial f}{\partial x}\right)=0$

SOLUTIONS

1. a	16. b	31. c	46. d	61. b	76. b	91. c
2. a	17. a	32. b	47. c	62. c	77. b	92. b
3. c	18. d	33. c	48. a	63. d	78. c	93. c
4. c	19. a	34. a	49. b	64. c	79. c	94. a
5. a	20. c	35. a	50. c	65. a	80. c	95. a
6. b	21. c	36. a	51. c	66. b	81. a	96. d
7. d	22. d	37. d	52. b	67. a	82. a	97. a
8. b	23. a	38. b	53. c	68. d	83. c	98. d
9. a	24. b	39. d	54. a	69. a	84. b	99. a
10. d	25. a	40. c	55. d	70. b	85. b	100. a
11. d	26. b	41. a	56. d	71. a	86. c	
12. b	27. c	42. d	57. c	72. a	87. a	
13. d	28. b	43. b	58. a	73. c	88. d	
14. d	29. c	44. a	59. b	74. d	89. d	
15. c	30. c	45. a	60. d	75. c	90. d	

UNIVERSITY OF CALICUT
School of Distance Education

MTH2C10 - OPERATIONS RESEARCH
M.Sc. Mathematics II Semester (2019 Admn.)

Multiple Choice Question Bank

1. In a Linear Programming Problem, the constraints are

   a. Linear b. Quadratic c. Cubic d. Constants

   Ans: (a)

2. An $\in$-nbd of $x_0 \in R^1$ is

   a. $\{x_0\}$

   b. $(x_0 - \in, x_0 + \in)$

   c. $(x_0 + \in, x_0 - \in)$

   d. $(-\in, \in)$

   Ans: (b)

3. The solution of maximize $z=2x_1 + 3x_2$

   subject to the constraints:

   $x_1 + 2x_2 \leq 10$

   $x_1 + x_2 \leq 6$

   $x_1 \leq 4$

   $x_1, x_2 \geq 0$ is

   a. 2, 4

   b. 2, 3

   c. 2, 5

   d. 2, 9

   Ans: (a)

4. In a General Linear Programming Problem, the objective function is

   a. Cubic

   b. Quadratic

   c. Linear

d. Linear

e. Constant

Ans: (c)

5. If the constraints of a General Linear Programming Problem is $\sum_{j=1}^{n} a_{ij} x_j \le b_i, i =$ 1, 2, …., k. then the slack variables x_{n+i} satisfy.

a. $\sum_{j=1}^{n} a_{ij} x_j + x_{n+i} = b_i,\ _i = 1, 2, \ldots\ldots., k$

b. $\sum_{j=1}^{n} a_{ij} x_j + x_{n+i} \neq b_i,\ _{i\,j} = 1, 2, \ldots\ldots., k$

c. $\sum_{j\le 1}^{n} a_{ij} x_j + x_{n+i} \le b_i,\ _i = 1, 2, \ldots\ldots., k$

d. $\sum_{j=1}^{n} a_{ij} x_j + x_{n+i} \ge b_i,\ _i = 1, 2, \ldots\ldots., k$

Ans: (a)

6. If the constraints of a General Linear Programming Problem is $\sum_{j=1}^{n} a_{ij} x_j \ge b_i, i$ =1,2,….,k, then the surplus variables x_{n+i} satisfy.

a. $\sum_{j=1}^{n} a_{ij} x_j + x_{n+i} = b_i,\ _i = 1, 2, \ldots\ldots., k$

b. $\sum_{j=1}^{n} a_{ij} x_j - x_{n+i} \neq b_i,\ _i = 1, 2, \ldots\ldots., k$

c. $\sum_{j\le 1}^{n} a_{ij} x_j - x_{n+i} \le b_i,\ _i \equiv 1, 2, \ldots\ldots., k$

d. $\sum_{j=1}^{n} a_{ij} x_j - x_{n+i} = b_i,\ _i = 1, 2, \ldots\ldots., k$

Ans: (d)

7. A feasible solution to the General Linear Programming Problem is

a. Any solution to a General L.P.P.

b. A particular solution to a General L.P.P

c. Any solution to a General L.P.P. which satisfies the non-negative restrictions
d. A particular solution to a General L.P.P. which satisfies the non-negative restrictions.

Ans: (c)

8. An optimum solution to the General Linear Programming Problem is
   a. Any feasible solution to a General L.P.P.
   b. Any feasible solution which optimizes the objective function
   c. Any solution to a General L.P.P. which satisfies the non-negative restrictions
   d. A particular solution to a General L.P.P. which satisfies the non-negative restrictions.

   Ans: (b)

9. The standard form of L.P.P. is
   a. Maximize $z = c^T x$ subject to constraints: $A x \geq b$, $x \geq 0$
   b. Maximize $z = c^T x$ subject to constraints: $A x \leq b$, $x \geq 0$
   c. Minimize $z = c^T x$ subject to constraints: $A x = b$, $x \geq 0$
   d. Maximize $z = c^T x$ subject to constraints: $A x = b$, $x \geq 0$

   Ans: (d)

10. The canonical form of L.P.P. is
    a. Maximize $z = c^T x$ subject to constraints: $A x \geq b$, $x \geq 0$
    b. Maximize $z = c^T x$ subject to constraints: $A x \leq b$, $x \geq 0$
    c. Minimize $z = c^T x$ subject to constraints: $A x = b$, $x \geq 0$
    d. Maximize $z = c^T x$ subject to constraints: $A x = b$, $x \geq 0$

    Ans: (b)

11. In the iteration of simplex method, if $z_j - c_j \geq 0$ for all j, then the initial basic feasible solution is.
    a. Not a solution
    b. Not optimal

c. An optimum solution

d. None of the above

Ans: (c)

12. A degenerate solution to the system A x = b is

a. A basic solution with one or more basic variables vanish

b. A solution with one or more basic variables vanish

c. A particular solution with one or more basic variables vanish

d. A basic solution with no basic variable vanish

Ans: (a)

13. A feasible solution to an L.P.P. which is also a basic solution to the problem is called

a. An optimum solution to the L.P.P.

b. A standard solution to the L.P.P.

c. A basic feasible solution to the L.P.P.

d. A feasible solution to the L.P.P.

Ans: (c)

14. Let x_B and x_B^* be two basic feasible solutions to the standard L.P.P., then x^*_B is said to be an improved basic feasible solution as compared to x_B, if

a. $c_B^{T*}.x_B^* \leq c_B^T.x_B$, where c_B^* is constituted of cost components corresponding to x_B^*

b. $c_B^{T*}.x_B^* \neq c_B^T.x_B$, where c_B^* is constituted of cost components corresponding to x_B^*

c. $c_B^{T*}.x_B^* = c_B^T.x_B$, where c_B^* is constituted of cost components corresponding to x_B^*

d. $c_B^{T*}.x_B^* \geq c_B^T.x_B$, where c_B^* is constituted of cost components corresponding to x_B^*

Ans: (d)

15. A basic feasible solution x_B to the L.P.P., Maximize $z = c^T x$ subject to constraints: $Ax = b$, $x \geq 0$ is called an optimum basic feasible solution if

a. $z_0 = c_B^T . x_B \geq z^*$, where z^* is the value of the objective function for any feasible solution.

b. $z_0 = c_B^T . x_B \leq z^*$, where z^* is the value of the objective function for any feasible solution.

c. $z_0 = c_B^T . x_B \neq z^*$, where z^* is the value of the objective function for any feasible solution.

d. $z_0 = c_B^T . x_B < z^*$, where z^* is the value of the objective function for any feasible solution.

Ans: (a)

16. The set of feasible solutions to an L.P.P. is

a. an open set

b. not a convex set

c. a convex set

d. a cone

Ans: (c)

17. The number of extreme points of the convex set of feasible solutions of an L.P.P. is

a. Infinite

b. Finite

c. 1

d. 3

Ans: (b)

18. L.P.P.s involving artificial variables can be solved by using

a. Simplex algorithm

b. Graph

c. Simplex method

d. Two-phase simplex method

Ans: (d)

19. Big M method is used to solved an L.P.P., if it contains

a. Artificial variables

b. Variables

c. Surplus variables

d. Slack variables

Ans: (a)

20. A variable x is called unrestricted if

a. x is zero only

b. x is negative only

c. x is positive, negative or zero

d. x is positive only

Ans: (c)

21. The dual of L.P.P., Maximize $z = c^T x$ subject to constraints: $A x \leq b$, $x \geq 0$, $x, c \in R^n$, $b \in R^m$, A is an m x n matrix, is

a. Maximize $z^* = b^T w$ subject to constraints: $A^T w \geq c$, $w \geq 0$, $c \in R^n$, $w, b \in R^m$, A^T is the transpose of an m x n matrix A.

b. Minimize $z^* = b^T w$ subject to constraints: $A^T w \geq c$, $w \geq 0$, $c \in R^n$, $w, b \in R^m$, A^T is the transpose of an m x n matrix A.

c. Minimize $z^* = b^T w$ subject to constraints: $A^T w \leq c$, $w \geq 0$ $w, c \in R^n$, $b \in R^m$, A^T is the transpose of an m x n matrix A.

d. Maximize $z^* = b^T w$ subject to constraints: $A^T w \leq c$, $w \geq 0$, $w, c \in R^n$, $b \in R^m$, A^T is the transpose of an m x n matrix A.

Ans: (b)

22. If the number of dual variables are m and primal constraints are n, then

a. $m \neq n$

b. $m > n$

c. m<n

d. m=n

Ans: (d)

23. If A is the constraint coefficient matrix associated with primal and B is the constraint coefficient matrix associated with dual, then

a. $B=A^T$

b. B=A

c. $B=A^{-1}$

d. $A=B^{-1}$

Ans: (a)

24. The objective function in primal problem is

a. Minimization type only

b. Maximization and minimization type

c. Maximization or minimization type

d. Maximization type only

Ans: (c)

25. The dual of dual problem is

a. The unsymmetric dual problem

b. The unsymmetric primal problem

c. The dual problem

d. The primal problem

Ans: (d)

26. A transportation problem is

a. Not an L.P.P.

b. An L.P.P.

c. A dual problem only

d. A primal problem only

Ans: (b)

27. In a transportation problem, let $a_i > 0$, i=1,2,……,m be the availability at the i^{th} origin and $b_j>0$, j=1,2,…..,n be the requirement at the j^{th} destination, then the problem is said to be balanced, if

a. $\sum_{i=1}^{m} a_i \neq \sum_{j=1}^{n} b_j$

b. $\sum_{i=1}^{m} a_i \leq \sum_{j=1}^{n} b_j$

c. $\sum_{i=1}^{m} a_i \geq \sum_{j=1}^{n} b_j$

d. $\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$

Ans: (d)

28. A balanced transportation problem has

a. An optimal solution always
b. No solution
c. No feasible solution
d. No optimal solution

Ans: (a)

29. In a transportation problem, the coefficients of constraints are

a. 2 only
b. 1 only
c. Either 0 or 1
d. 0 only

Ans: (c)

30. If there are m origins and n destinations in a transportation problem, then the order of the matrix containing the coefficients of constraints is

a. (m+n) x mn
b. (m–n) x mn
c. (m+n) x (m+n)

d. mn x (m+n)

Ans: (a)

31. A system of n linear equtions Ax = b is called a triangular system if the matrix A is

a. Unit matrix
b. Zero matrix
c. Diagonal matrix
d. Triangular matrix

Ans: (d)

32. The column coefficients of the dual constraints are

a. The coefficients of the primal objective function
b. The column coefficients of the primal constraints
c. The row coefficients of the primal constraints
d. None of the above

Ans: (c)

33. If the primal is of maximization type, then the dual is

a. Minimization type
b. Maximization type
c. Either maximization or minimization type
d. None of the above

Ans: (a)

34. An initial feasible solution to a T.P. is obtained by

a. Method of penalties
b. North-west corner rule
c. Two-phase simplex method
d. Big M method

Ans: (b)

35. An initial basic feasible solution to a T.P. is obtained by

a. Method of penalties

b. Two-phase simplex method
c. Row minima method
d. Big M method

Ans: (c)

36. An initial basic feasible solution to a T.P. is obtained by

a. Method of penalties
b. Column minima method
c. Two-phase simplex method
d. Big M method

Ans: (b)

37. In a transportation problem, let $a_i>0$, $i=1,2,\ldots,m$ be the availability at the i^{th} origin and $b_j>0$, $j=1,2,\ldots,n$ be the requirement at the j^{th} destination, then the problem is said to be unbalanced, if

a. $\sum_{i=1}^{m} a_i \neq \sum_{j=1}^{n} b_j$
b. $\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$
c. $\sum_{i=1}^{m} a_i + \sum_{j=1}^{n} b_j = 1$
d. $\sum_{i=1}^{m} a_i - \sum_{j=1}^{n} b_j = 1$

Ans: (a)

38. An L.P.P. can be solved using graphical method if it has

a. More than four variables
b. Only two variables
c. More than two variables
d. Three variables

Ans: (b)

39. In a transportation problem there is more demand than the availability, then the problem is said to be
    a. Unbalanced
    b. Balanced
    c. Degenerate
    d. Non degenerate

    Ans: (a)
40. A General Linear Programming Problem consists of
    a. An objective function
    b. A set of constraints
    c. An objective function and a set of constraints
    d. None of the above

    Ans: (c)
41. In graphical method for solving an L.P.P., the solution space is in
    a. First quadrant
    b. Second quadrant
    c. Third quadrant
    d. Fourth quadrant

    Ans: (a)
42. In graphical method for solving an L.P.P., the solution space is
    a. Not a convex set
    b. A convex set
    c. Unbounded
    d. None of the above

    Ans: (b)
43. In a Linear Programming Problem, if the objective function is of minimization type, then it can be converted into maximization type by
    a. Multiplying the objective function by 2
    b. Multiplying the objective function by 3

c. Multiplying the objective function by -1

d. Multiplying the objective function by -2

Ans: (c)

44. In a Linear Programming Problem, all the variables are

a. Non negative

b. Negative

c. 0

d. None of the above

Ans: (a)

45. The optimal solution to an L.P.P. is

a. Always infinite

b. Always finite

c. Unique

d. Either unique or infinite

Ans: (d)

46. Let f be a linear function of n variables, then by Minimax theorem,

a. Minimum f(x) = Maximum {f(x)}

b. Minimum f(x) = Maximum {-f(x)}

c. Minimum f(x) = -Maximum {-f(x)}

d. Minimum f(x) = -Maximum {f(x)}

Ans: (c)

47. The simplex method is

a. An iterative method

b. A direct method

c. Both direct and iterative method

d. None of the above

Ans: (a)

48. The objective function in dual problem is

a. Maximization type only

b. Maximization or minimization type

c. Minimization type only

d. None of the above

Ans: (b)

49. In a transportation problem the number of origins and destinations are

a. Equal

b. Not equal

c. Need not be equal

d. None of the above

Ans: (c)

50. Loop is associated with

a. Two-phase simplex method

b. Big M method

c. Assignment problem

d. Transportation problem

Ans: (d)

51. A feasible solution to a T.P. is basic if and only if the corresponding cells in the transportation table.

a. Do not contain a loop.

b. Contain a loop

c. Contain zero vectors

d. None of the above

Ans: (a)

52. An unbalanced transportation problem can be solved by

a. Introducing dummy destinations or sources

b. Introducing dummy destinations only

c. Introducing dummy source only

d. None of the above

Ans: (a)

53. In the iteration of simplex method, if there are more than one negative $z_j - c_j$, then we may choose.

a. The most negative of them
b. The largest of them
c. Any one of them
d. None of the above

Ans: (a)

54. A connected graph with atleast two vertices and no cycles is called

a. Arborescence
b. Tree
c. Cycle
d. Chain

Ans: (b)

55. If for every pair of vertices, there is a chain connecting the two, then the graph is said to be

a. Tree
b. Arborescence
c. Cycle
d. Connected

Ans: (d)

56. If v_a is a vertex of a graph, then the set formed by v_a and all other vertices which are connected to v_a by chains, and the set of arcs connecting them, forms a ………. of the graph.

a. Circuit
b. Arborescence
c. Component
d. Centre

Ans: (c)

57. Which of the following statement is not true

a. Every path is a chain
b. Every chain is a path
c. Every chain is not a path
d. Every circuit is a cycle

Ans: (b)

58. If we delete an arc from a tree, the resulting graph is

a. Connected
b. Strongly connected
c. Not connected
d. A tree

Ans: (c)

59. A vertex which is connected to every other vertex of the graph by a path is called a …………….of the graph.

a. Centre
b. Arborescence
c. Cycle
d. Circuit

Ans: (a)

60. A tree with a centre is called

a. An arborescence
b. A cycle
c. A circuit
d. A chain

Ans: (a)

61. A graph is said to be finite when

a. Vertex set is finite
b. Edge set is finite
c. Vertex set and edge set are finite
d. Vertex set is countable

Ans: (c)

62. A vector $x \in E_n$ shall be called an integer vector if its components x_i for $i=1,2,\ldots,n$ are

a. Red numbers

b. Rational numbers

c. Complex numbers

d. Integers

Ans: (d)

63. An activity between two or more persons involving moves by each person according to a set of rules, at the end of which each person receives some benefit or satisfaction or suffers loss is called

a. A transportation problem

b. Game

c. Move

d. Strategy

Ans: (b)

64. If in a game the moves are determined by skill, it is called a

a. Game of chance

b. Game of strategy

c. Partial game

d. Sports

Ans: (b)

65. Number of moves in a game is

a. Finite

b. Inifinte

c. May be finite or infinite

d. Denumerable

Ans: (c)

66. A quantitative measure of the satisfaction a person gets at the end of the play is called.

a. Motivation
b. Prize
c. Pay off
d. Strategy

Ans: (c)

67. Let P_i be the pay off to the person P_i i=1,2,….,n in an n-person game. Then if $\sum_{i=1}^{n} p_i = 0$, the game is said to be

a. Balanced
b. Unbalanced
c. Zero-sum
d. Neutral

Ans: (c)

68. A matrix game is

a. Zero-sum
b. Two-person
c. A zero-sum two person game
d. Un-balanced

Ans: (c)

69. In a game if the pay off matrix $\{a_{ij}\}$ is such that $\max_i \min_j a_{ij} = \min_j \max_i a_{ij} = a_{rs}$, the matrix is said to have a ……….. at (r,s)

a. Centre
b. Determinant
c. Value
d. Saddle point

Ans: (d)

70. In a game if the pay off matrix $\{a_{ij}\}$ is such that $\max_i \min_j a_{ij} = \min_j \max_i a_{ij} = a_{rs}$, then the value of the game is

a. a_{rs}

b. (r,s)

c. Has no value

d. Zero

Ans (a)

71. For an m x n matrix game

a. Only $\max_x \min_y E(x,y)$ exists

b. Only $\min_x \max_y E(x,y)$ exists

c. Both $\max_x \min_y E(x,y)$ and $\min_y \max_x E(x,y)$ exist but not equal

d. Both $\max_x \min_y E(x,y)$ and $\min_y \max_x E(x,y)$ exist and are equal

Ans: (d)

72. The quadratic form $x^2 + 2y^2 + 3z^2$ is

a. Positive definite

b. Negative definite

c. Negative semi definite

d. None of the above

Ans: (a)

73. Let $X \in E_n$ and let $f(x) = x^1Ax$ be a quadratic form. If f(x) is positive semi definite, then f(x) is

a. Concave function

b. Convex function

c. Concave or convex

d. Constant

Ans: (b)

74. Let $K \subseteq E_n$ be a convex set $x \in k$, and f(x) a convex function. Then which of the following may not be tree.

a. If f(x) has a relative minimum, it is also a global minimum.

b. If f(x) has a minimum at more than one point, the minimum is attained at the convex linear combination of all such points.
c. f(x) has only one relative minimum
d. f(x) may or may not have a relative minimum

Ans: (c)

75. Let $x \in E_n$ and let $g_i(x)$ $i=1,2,\ldots,m$ be convex functions in E_n. Let $S \subseteq E_n$ be the set of points satisfying the constraints $g_i(x) \leq 0$, $i=1,2,\ldots,m$. Then
a. S is a concave set
b. S is a convex set
c. S is either concave or convex
d. None of these

Ans: (b)

76. Which of the following functions is not always a convex function.
a. $f(x)=x^2$, $x \in R$
b. sum of two convex functions
c. $f(x) = \|x\|$, $x \in E_n$
d. $f(x) = cx$, $x \in E_n$

Ans: (d)

77. The set of feasible solutions, if not empty, is
a. Concave set
b. Open set
c. No vertex
d. Closed convex set

Ans: (d)

78. If in the optimal solutions of the primal and dual, a primal variable is positive, then the corresponding dual slack variable is
a. Negative
b. Positive

c. Infinite

d. Zero

Ans: (d)

79. If, in the optimal solution of the primal and dual, a primal slack variable is positive, then the corresponding dual variable is

a. Zero

b. Positive

c. Negative

d. Infinite

Ans: (a)

80. A set of cells L in the transportation array is said to constitute a loop if in every row or column of the array the number of cells belonging to the set is

a. Zero

b. One

c. Two

d. Either zero or two

Ans: (d)

81. If the k^{th} constraint of the primal is an equality, then the dual variable y_k is

a. Positive

b. Unrestricted in sign

c. Negative

d. Zero always

Ans: (b)

82. In which of the following problems, linear programming methods can be applied

a. Transportation problem

b. Game theory

c. Flow in networks

d. None of the above

Ans: (d)

83.A subset $S \subset E_n$ in said to be convex if

a. For each pair of points x, $y \in S$, the line segment joining x,y belongs to S.
b. S is closed
c. S is open
d. S is bounded

Ans: (a)

84.For any two points x and y in E_n, the set $\{\lambda x+(1-\lambda)y, 0 \leq \lambda \leq 1\}$ is called

a. The circle through x and y
b. A parabola through x and y
c. A halfspace containing x and y
d. Line segment joining the points x and y

Ans: (d)

85.In R^3, $\{(x_1, x_2\ x_3) \in R^3, x_1^2 + x_2^2 + x_3^2 \leq 1\}$ is

a. Convex
b. Concave
c. A half space
d. Unbounded

Ans: (a)

86.The intersection of a finite number of convex sets is

a. Concave
b. Convex
c. Sometimes concave and sometimes convex
d. Always unbounded

Ans: (b)

87.The sets $\{x|cx \geq z\}$ and $\{x|cx \leq z\}$ are called

a. Hyperplanes
b. Circles

c. Half spaces
d. Line segments

Ans: (c)

88. The closed half spaces are
   a. Concave
   b. Convex
   c. Either concave or convex
   d. Cones

   Ans: (b)

89. If $A \subset En$, then the convex hull of A is the
   a. Largest convex set containing A
   b. Intersection of all convex set containing A
   c. Union of all convex set containing A
   d. Complement of A

   Ans: (b)

90. Union of convex sets
   a. Is concave
   b. Is convex
   c. Need not be convex
   d. A cone always

   Ans: (c)

91. The set of all convex linear combinations of a finite number of points in En is
   a. Convex set
   b. Concave set
   c. A cone
   d. A hyperplane

   Ans: (a)

92. A set is said to be closed if its,
   a. Complement is open

b. Complement is not open

c. Complement is convex

d. Complement is concave

Ans: (a)

93. Interior of [0,1] is

a. (0,2)

b. [0,1]

c. (0,1)

d. (-1,1)

Ans: (c)

94. A point is called a boundary point of a set S, if every neighborhood of that point contains

a. A point of S and a point not in S

b. A point of S only

c. A point, not in S only

d. A point of S or a point not in S

Ans: (a)

95. A circular disc in a plane is

a. Concave set

b. Convex set

c. A half space

d. A hyperplane

Ans: (b)

96. Boundary of the set (0,1) is

a. {0}

b. {0,1}

c. {1}

d. {0,2}

Ans: (b)

97. If $f(y_0, z) \leq f(y_0, z_0) \leq f(y, z_0)$ for all (y,z) in the neighborhood of (y_0, z_0), then the function f(y,z) is said to have a ………….. point at (y_0, z_0).

a. Extreme

b. Accumulation

c. Boundary

d. Saddle

Ans: (d)

98. The function $x^2 + y^2$ is

a. Negative definite

b. Negative semidefinite

c. Always constant

d. Positive definite

Ans: (d)

99. Spanning tree of a graph is

a. Unique

b. Infinite

c. Not a tree

d. Not unique

Ans: (d)

100. Cutting plane method is applied in

a. Transportation problem

b. Game theory

c. Integer linear programming

d. Flow problems

Ans: (c)

101. The mathematical expectation E(x,y) in the game whose payoff matrix is A is defined as

a. X^1AY

b. X^1A

c. AY

d. X^1Y

Ans: (a)