2015

PIMS EDUCATIONAL ACADEMY Regd. No. : 130/10

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+2 MODEL EXAMINATION

PART III - BUNSINESS MATHEMATICS

[English Version]

Time : 3 Hrs.] **[Max. Marks : 200**

SECTION - A

Note : (i) All questions are compulsory.
(ii) Each question carries one mark.
(iii) Choose the most suitable answer from the given four alternatives. **40 x 1 = 40**

1. The adjoint of $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$ is

   a) $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ b) $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ d) $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$

2. If A is a square matrix of order 3 then $|\text{Adj } A|$ is

   a) $|A|^2$ b) $|A|$ c) $|A|^3$ d) $|A|^4$

3. For what value of k the matrix A where $A = \begin{pmatrix} 2 & k \\ 3 & 5 \end{pmatrix}$ has no inverse ?

   a) $\frac{3}{10}$ b) $\frac{10}{3}$ c) 3 d) 10

4. The rank of a non singular matrix of order $n \times n$ is

   a) n b) n^2 c) 0 d) 1

5. If $T = \begin{matrix} \\ A \\ B \end{matrix} \begin{matrix} \begin{matrix} A & B \end{matrix} \\ \begin{pmatrix} 0.7 & 0.3 \\ x & 0.8 \end{pmatrix} \end{matrix}$ is a transition probability matrix, then the value of x is

   a) 0.3 b) 0.2 c) 0.3 d) 0.7

6. Latus rectum of $y^2 = 4ax$ is

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

7. Equation of the directrix of $y^2 = -8x$ is

   a) $x + 2 = 0$ b) $x - 2 = 0$ c) $y + 2 = 0$ d) $y - 2 = 0$

8. Eccenticity of the hyperbola $\frac{x^2}{4} - \frac{y^2}{5} = 1$ is

   a) $\frac{3}{2}$ b) $\frac{9}{4}$ c) $\frac{5}{4}$ d) 4

9. Asymptotes of a hyperbola pass through

a) one of the foci
b) one of the vertices
c) the centre of the hyperbola
d) one end of its latus rectum

10. The average fixed cost of the function. $C = 2x^3 - 3x^2 + 4x + 8$ is

a) $\frac{2}{x}$ b) $\frac{4}{x}$ c) $\frac{-3}{x}$ d) $\frac{8}{x}$

11. Variable cost per unit is Rs. 40, fixed cost is Rs. 900 and unit selling price is Rs. 70. Then the profit equation is

a) P = 30x - 900 b) P = 15x - 70 c) P = 40x - 900 d) P - 70x + 3600

12. If $y = 2x^2 + 3x$, the instantaneous rate of change of y at $x = 4$ is

a) 16 b) 19 c) 30 d) 4

13. The slope of the normal to the curve $\sqrt{x} + \sqrt{y} = 5$ at $(9, 4)$ is

a) $\frac{2}{3}$ b) $-\frac{2}{3}$ c) $\frac{3}{2}$ d) $-\frac{3}{2}$

14. The tangent to the curve $y = 2x^2 - x + 1$ at $(1, 2)$ is parallel to the line

a) y = 3x b) y = 2x + 4 c) 2x + y + 7 = 0 d) y = 5x - 7

15. If $u = \log(e^x + e^y)$ then $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y}$ is equal to

a) $\frac{1}{e^x + e^y}$ b) $\frac{e^x}{e^x + e^y}$ c) 1 d) $e^x + e^y$

16. The elasticity of demand when marginal revenue is zero, is

a) 1 b) 2 c) -5 d) 0

17. If $z = x^3 + 3xy^2 + y^3$ then the marginal productivity of x is

a) $x^2 + y^2$ b) $6xy + 3y^2$ c) $3(x^2 + y^2)$ d) $(x^2 + y^2)^2$

18. If R = 5000 units / year, C_1 = 20 paise, C_3 = Rs. 20 then EOQ is

a) 1000 b) 5000 c) 200 d) 100

19. $\int_{-3}^{3} x \, dx$ is

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

20. The area bounded by y = x, y - axis and y = 1 is

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

21. The marginal revenue of a firm is MR = 15 - 8x. Then the revenue function is

a) $15x - 4x^2 + k$ b) $\frac{15}{x} - 8$ c) -8 d) $15x - 8$

22. The degree and order of the differential equation $\frac{d^2y}{dx^2} - 6\sqrt{\frac{dy}{dx}} = 0$ are

a) 2 and 1 b) 1 and 2 c) 2 and 2 d) 1 and 1

23. The solution of $\frac{dy}{dx} = e^{x-y}$ is

a) $e^y e^x = c$ b) $y = \log ce^x$ c) $y = \log (e^x + c)$ d) $e^{x+y} = c$

24. The integrating factor of $x\frac{dy}{dx} - y = e^x$ is

a) $\log x$ b) $e^{\frac{-1}{x}}$ c) $\frac{1}{x}$ d) $\frac{-1}{x}$

25. The solution of $\frac{d^2y}{dx^2} - y = 0$ is

a) $(A + B)e^x$ b) $(Ax + B)e^{-x}$ c) $Ae^x + \frac{B}{e^x}$ d) $(A + Bx)e^{-x}$

26. E =

a) $1 + \Delta$ b) $1 - \Delta$ c) $\nabla + 1$ d) $\nabla - 1$

27. Five data relating to x and y are to be fit in a straight line. It is found that $\Sigma x = 0$ and $\Sigma y = 15$. Then the y - intercept of the line of best fit is,

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

28. If adiscrete random variable has a probability mass function as

x	0	1	2	3
p(x)	k	2k	3k	5k

then the value of k is

a) $\frac{1}{11}$ b) $\frac{2}{11}$ c) $\frac{3}{11}$ d) $\frac{4}{11}$

29. The normal distribution curve is

a) Bimodal b) Unimodal c) Skewed d) none of these

30. The $X \sim N(\mu, \sigma^2)$, the points of inflection of normal distribution curve are

a) $\pm\mu$ b) $\mu \pm \sigma$ c) $\sigma \pm \mu$ d) $\mu \pm 2\sigma$

31. The $X \sim N(5, 1)$, the probability density function for the normal variate X is

a) $\frac{1}{5\sqrt{2\pi}} e^{-\frac{1}{2}(\frac{x-1}{5})^2}$ b) $\frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(\frac{x-1}{5})^2}$ c) $\frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(x-5)^2}$ d) $\frac{1}{\sqrt{\pi}} e^{-\frac{1}{2}(x-5)^2}$

32. A hypothesis complementary to the null hypothesis is called

a) primary hypothesis b) satistical hypothesis c) alternative hypothesis d) confidence hypothesis

33. The Z-value that is used to establish a 95% confidence interval for the estimation of a population parameter is

a) 1.28 b) 1.65 c) 1.96 d) 2.58

34. The number of ways in which one can select 2 customers out of 10 customers is

a) 90 b) 60 c) 45 d) 50

35. Which of the following statements is true ?

a) Point estimate gives a range of values b) Sampling is done only to estimate a statistic

c) Sampling is done to estimate the population parameter

d) Sampling is not possible for an infinite population

36. A time series consists of

a) two components b) three components c) four components d) none of these

37. Cyclic variations in a time series are caused by

a) lock out in a factory b) war in a country c) floods in the states d) none of these

38. Most frequently used index number formulae are

a) weighted formulae b) unweighted formulae c) fixed weighted formulae d) none of these

39. Control charts in satistical quality consist of

a) three control lines b) upper and lower control limits

c) the level of process d) all the above

40. Scatter diagram of the variate values (X , Y) give the idea about

a) functional relationship b) regression model

c) distribution of errors d) none of these

SECTION - B

Note : (i) Answer any *ten* questions.
(ii) Question No.55 in compulsory and choose any nine questions from the remaining.
(iii) Each question carries six marks. 10 x 6 = 60

41. Verify $(AB)^{-1} = B^{-1} A^{-1}$, when $A = \begin{pmatrix} 3 & 1 \\ 2 & -1 \end{pmatrix}$ and $B = \begin{pmatrix} -6 & 0 \\ 0 & 9 \end{pmatrix}$

42. Solve the equations $2x - 3y - 1 = 0$, $5x + 2y - 12 = 0$ by Cramer's rule.

43. Find the equation to the hyperbola which passes through (2,3) and has for its asymptotes the line $4x + 3y - 7 = 0$ and $x - 2y = 1$.

44. Find the elasticity of demand when the demand is $q = \frac{20}{p+1}$ and $p = 3$. Interpret the result.

45. Find the points on the curve $y = (x-1)(x-2)$ at which the tangent makes an angle 135^0 with the positive direction of the x-axis.

46. Find the points of inflection of the curve $y = x^4 - 4x^3 + 2x + 3$.

47. Evaluate : $\int_0^2 \frac{\sqrt{x}\, dx}{\sqrt{x} + \sqrt{2-x}}$

48. Solve : $(\sin x + \cos x)\, dy + (\cos x - \sin x)\, dx = 0$

49. Solve $\cos x \frac{dy}{dx} + y \sin x = 1$

50. From the following data, find f(3) :

x :	1	2	3	4	5
f(x) :	2	5	-	14	32

51. Fit the line of best fit if $\Sigma x = 75$, $\Sigma y = 115$, $\Sigma x^2 = 1375$, $\Sigma xy = 1875$, and $n = 6$

52. Find the mean, variance and the standard deviation for the following probability distribution.

Values of X, x :	1	2	3	4
probability, p(x) :	0.1	0.3	0.4	0.2

53. A random sample of size 50 with mean 67.9 is drawn from a normal population. If it is known that the standard error of the sample mean is $\sqrt{0.7}$, find 95% confidence interval for the population mean.

54. Calculate the correlation co-efficient from the following data :

x :	12	9	8	10	11	13	7
Y :	14	8	6	9	11	12	3

55. Find trend values to the following data by the method of semi-averages.

Year	1980	1981	1982	1983	1984	1985	1986
Production	102	105	114	110	108	116	112

SECTION - C

Note : (i) Answer any *ten* questions.

(ii) Question No.70 is compulsory and choose any nine questions from the remaining.

(iii) Each question carries ten marks. 10 x 10 = 100

56. Solve by matrix method the equations $x - 2y + 3z = 1$, $3x - y + 4z = 3$, $2x + y - 2z = -1$

57. The data below are about an economy of two industries P and Q. The values are in lakhs of rupees.

Producer	User		Final Demand	Total Output
	P	Q		
P	16	12	12	40
Q	12	8	4	24

58. Find the centre, eccentricity, foci and latus rectum of the hyperbola $9x^2 - 16y^2 - 18x - 64y - 199 = 0$

59. Find the equation of the tangent and normal to the curve $y(x-2)(x-3) - x + 7 = 0$ at the point where it cuts the x axis.

60. Find EOQ for the data given below. Also verify that carrying costs is equal to ordering costs at EOQ.

Item	Monthly Requirments	Ordering cost per order	Carrying cost per unit
A	9000	Rs. 200	Rs. 3.60
B	25000	Rs. 648	Rs. 10.00
C	8000	Rs. 100	Rs. 0.60

61. The demand for the quantity A is $q_1 = 16 - 3p_1 - 2p^2_2$. Find (i) the partial elasticities $\frac{Eq_1}{Ep_1}$, $\frac{Eq_1}{Ep_2}$ (ii) the partial elasticities for $p_1 = 2$ and $p_2 = 1$.

62. The elasticity of demand with respect to price p for a commodity is $\frac{x-5}{x}$, $x > 5$ when the demand is 'x'. Find the demand function if the price is 2 when demand is 7. Also find the revenue function.

63. In a perfect competition the demand and supply curves of a commodity are given by $p_d = 40 - x^2$ and $p_3 = 3x^2 + 8x + 8$. Find the consumer's surplus and producers' surplus at the market equilibrium price.

64. Suppose that the quantity demanded $Q_d = 42 - 4P - 4\frac{dp}{dt} + \frac{d^2p}{dt^2}$ and quantity supplied $Q_s = -6 + 8p$ where p is the price. Find the equilibrium price for market clearance.

65. Fit a straight line to the following data :

x :	4	8	12	16	20	24
Y :	7	9	13	17	21	25

66. It is given that 3% of the electric bulbs manufactured by a company are defective. Find the probability that a sample of 100 bulbs will contain (i) no defective (ii) exactly one defective. ($e^{-3} = 0.0498$)

67. In a sample of 1000 candidates the mean of certain test is 45 and S.D. 15. Assuming the normality of the distribution find the following (i) How many candidates score between 40 and 60 ? (ii) How many candidates score above 50 ? (iii) How many candidates score below 30 ?

68. The income distribution of the population of a village has a mean of Rs. 6000 and a variance of Rs. 32400. Could a sample of 64 persons with a mean income of Rs. 5950 belong to this population ? (Test at both 5% and 1% levels of significance)

69. Solve the following, using graphical method

Maximize $z = 45x_1 + 80x_2$

subject to the constraints

$5x_1 + 20x_2 < 400$

$10x_1 + 15x_2 < 450$

$x_1, x_2 > 0$

70. Using the following data, construct Fisher's Ideal index and show that it satisfies Factor Reversal test and Time Reversal test.

Commodity	Price		Quantity	
	Base year	Current year	Base year	Current year
A	6	10	50	56
B	2	2	100	120
C	4	6	60	60
D	10	12	30	24
E	8	12	40	36