

GOVT. MODEL QUESTION PAPER

STATISTICS

12TH STD.

MAX. MARKS : 150

TIME : 3 HOURS

PART I (50 MARKS)

Note : (1) Answer all questions.

(2) Each question carries one mark

50 x 1 = 50

Choose the best answer :

- When two events A and B are mutually exclusive, then $P(A \cap B)$ is
(a) 1 (b) 0 (c) $P(A) \cdot P(B)$ (d) None of these
- An integer is chosen from 1 to 20. the probability that the number is divisible by 4 is
(a) $1/4$ (b) $1/3$ (c) $1/2$ (d) $1/10$
- In tossing three coins at a time, the probability of getting atmost one head is
(a) $3/8$ (b) $7/8$ (c) $1/2$ (d) $1/8$
- The probability of two persons being born on the same day in an ordinary year (ignoring date)
(a) $1/49$ (b) $1/365$ (c) $1/7$ (d) $1/366$
- The conditional probability of A given B is
(a) $\frac{P(A \cap B)}{P(B)}$ (b) $\frac{P(A \cap B)}{P(A)}$ (c) $\frac{P(A \cup B)}{P(B)}$ (d) $\frac{P(A \cup B)}{P(A)}$
- Probability of drawing a spade queen from a well shuffled pack of cards is
(a) $1/13$ (b) $1/52$ (c) $4/13$ (d) $8/13$
- If $P(A) = 0.4$, $P(B) = 0.5$ and $P(A \cap B) = 0.2$ then $P(B/A)$ is
(a) $1/2$ (b) $1/3$ (c) $4/5$ (d) $2/5$
- If $F(x)$ is distribution function, then $F(-\infty)$ is
(a) -1 (b) 0 (c) 1 (d) $-\infty$

9. The distribution of height of persons in a country is a random variable of the type:
- (a) Continuous random variable (b) Discrete random variable
 (c) Neither discrete nor continuous random variable (d) Continuous as well as discrete random variable
10. $\text{Var}(5x + 2)$
- (a) $25 \text{ var}(x)$ (b) $5 \text{ var}(x)$ (c) $2 \text{ var}(x)$ (d) 25
11. A random variable x has $E(x) = 2$ and $E(x^2) = 8$, its variance is
- (a) 4 (b) 6 (c) 8 (d) 2
12. If $f(x)$ is the p.d.f. of the continuous random variable X , then $E(x^2)$ is
- (a) $\int_{-\infty}^{\infty} f(x) dx$ (b) $\int_{-\infty}^{\infty} x f(x) dx$
 (c) $\int_{-\infty}^{\infty} x^2 \cdot f(x) dx$ (d) $\int_{-\infty}^{\infty} f(x^2) dx$
13. If X is a random variable with its mean \bar{x} , the expression $E(x - \bar{x})^2$ represents
- (a) the variance of x
 (b) second central moment
 (c) both (a) and (b)
 (d) none of (a) and (b)
14. If X is a random variable, $E(e^{tx})$ is known as
- (a) characteristic function
 (b) moment generating function
 (c) probability generating function
 (d) none of these
15. For Bernoulli distribution with probability p of a success and q of a failure, the relation between mean and variance that hold is
- (a) mean < variance (b) Mean > variance
 (c) mean = variance (d) None of the above

16. X is a Binomial Variate with mean = 4, variance = $4/3$, then, $P(x = 0)$ is
(a) $(2/3)^6$ (b) $(2/3)^5 (1/3)$ (c) $(1/3)^6$ (d) $35 (2/3)^6$
17. An approximate relation between Q.D, M.D. and S.D. of normal distribution is
(a) 10 : 12 : 15 (b) 12 : 10 : 15 (c) 15 : 12 : 10 (d) 10 : 15 : 12
18. The mean of normal distribution is 60, then mode is equal to
(a) 60 (b) 40 (c) 50 (d) 30
19. The mean and variance of a binomial distribution $b(5, 1/3)$ is
(a) $5/3$ & $10/9$ (b) $5/2$ & $10/6$ (c) $5/3$ & $10/6$ (d) $5/2$ & $10/9$
20. Poisson distribution is a limiting case of binomial distribution when
(a) $n \rightarrow \infty, p \rightarrow 0; np = \sqrt{m}$
(b) $n \rightarrow 0, p \rightarrow \infty; np = 1/m$
(c) $n \rightarrow \infty, p \rightarrow \infty; np = m$
(d) $n \rightarrow \infty; p \rightarrow 0; np = m$
21. In normal distribution skewness is
(a) one (b) zero (c) 3 (d) -1
22. In normal distribution the value of Kurtosis is
(a) 1 (b) 3 (c) -3 (d) 0
23. The area p ($-\infty < Z < 0$) is
(a) 1 (b) 0.1 (c) 0.5 (d) 0
24. The hypothesis may be classified as
(a) Simple (b) Composite
(c) Null (d) All of the above
25. Critical value of $|Z_{\infty}|$ at 5% level of significance for two tailed test is
(a) 1.645 (b) 2.33 (c) 2.58 (d) 1.96
26. H_0 is rejected when H_0 is true is
(a) Type II error (b) Type I error

- (c) Simple error (d) none of the above
27. Whether a test is one sided or two sided depends on
- (a) alternative hypothesis (b) composite hypothesis
(c) null hypothesis (d) simple hypothesis
28. Standard error of number of success is given by
- (a) $\sqrt{pq/n}$ (b) \sqrt{npq} (c) npq (d) $\sqrt{np/q}$
29. Statistic $Z = \left| \frac{\bar{x} - \bar{y}}{\sigma \sqrt{1/n_1 + 1/n_2}} \right|$ is used to test the null hypothesis is
- (a) $H_0 : \mu_1 + \mu_2 = 0$ (b) $H_0 : \mu_1 - \mu_2 = 0$
(c) $H_0 : \mu = \mu_0$ (d) none of the above
30. The standard deviation of the sampling distribution is called
- (a) Probable error (b) Standard error
(c) Sampling error (d) Non-sampling error
31. The standard error of the sample mean is
- (a) $\frac{\sigma}{\sqrt{n}}$ (b) $\frac{\sigma^2}{\sqrt{n}}$ (c) $\frac{\sigma^2}{2n}$ (d) $\frac{\sigma}{\sqrt{2n}}$
32. Student s t-distribution ranges from
- (a) $-\infty$ to 0 (b) 0 to ∞ (c) $-\infty$ to ∞ (d) 0 to 1
33. While testing the significance of the difference between two sample mean in case of small samples, the degrees freedom is
- (a) $n_1 + n_2$ (b) $n_1 + n_2 - 1$ (c) $n_1 + n_2 - 2$ (d) $n_1 + n_2 + 2$
34. Equality of two population variances can be tested by
- (a) t-test (b) F-test (c) χ^2 -test (d) None of the above
35. Paired t-test is applicable, when the observations in the two samples are
- (a) Paired (b) Correlated
(c) Equal in number (d) all the above

36. Degrees of freedom for chi-square in case of contingency table of order 4 x 3 are
 (a) 12 (b) 9 (c) 6 (d) 8
37. The statistic χ^2 with usual notations in case of contingency table of order (r x s) is given by the formula
 (a) $\chi^2 = \sum_{i=1}^n \left(\frac{(O_i - E_i)^2}{E_i} \right)$
 (b) $\chi^2 = \sum_{i=1}^n \left(\frac{(O_i^2 - E_i^2)}{E_i} \right)$
 (c) $\chi^2 = \sum_{i=1}^n \left(\frac{(O_i - E_i)}{E_i} \right)^2$
 (d) all the above
38. The values of observed frequencies and expected frequencies are all equal then the value of χ^2 is
 (a) -1 (b) +1 (c) >1 (d) 0
39. In the case of one-way classification with N observations and 't' treatments, the degrees of freedom for error is
 (a) N - 1 (b) t - 1 (c) N - t (d) Nt
40. Analysis of variance utilises
 (a) F-test (b) χ^2 - test (c) Z-test (d) t-test
41. With 90, 35, 25 as SST, SSR and SSC respectively in case of two-way classification, SSE is
 (a) 50 (b) 40 (c) 30 (d) 20
42. A time series consists of
 (a) two components (b) three components
 (c) four components (d) five components
43. The component of a time series attached to long term variations is termed as
 (a) cyclic variation (b) secular trend
 (c) irregular variation (d) all the above

44. Business forecasts are made on the basis of
- (a) Present data (b) Past data
(c) Policies and circumstances (d) All the above
45. In case of two attributes A and B $(\alpha\beta) < \frac{(\alpha)(\beta)}{N}$, then the attributes are
- (a) independent (b) positively associated
(c) negatively associated (d) none of the above
46. With the two attributes the total number of class frequencies is
- (a) Two (b) Four (c) Eight (d) Nine
47. In case of two attributes A and B the class frequency $(AB) = 0$ the value of Q is
- (a) 1 (b) -1 (c) 0 (d) $-1 \leq Q \leq 1$
48. A business who is said to be averse to risk
- (a) Prefers to take large risks to earn large gains.
(b) Prefers to act any time the expected monetary value is positive
(c) Avoids all situations but those with very high expected values.
(d) None of these
49. The criterion which selects the action for which maximum pay-off is lowest is known as
- (a) Max – min criterion
(b) Min – max criterion
(c) Max – max criterion
(d) None of these
50. Decision theory is concerned with
- (a) the amount of information that is available.
(b) Criteria for measuring the 'goodness' of a decision.
(c) Selecting optimal decision in sequential problems
(d) All the above

PART II (30 MARKS)

**Note: (1) Answer any 15 questions
(2) Each question carried 2 marks**

15 x 2 = 30

51. State the axioms of probability
52. Find the probability that a leap year selected at random will contain 53 Sundays.
53. A random variable X has the following probability distribution. Find

$$P(x \geq z)$$

Value of X	0	1	2	3	4
P (X = x)	3a	4a	6a	7a	8a

54. Define mathematical expectation for discrete random variable.
55. Let X be a continuous random variable with probability density function given by $f(x) = \begin{cases} 2x, & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$. Find the expected value of X.
56. Comment on the following: 'The mean of a binomial distribution is 5 and its variance is 9'.
57. Find the Binomial distribution whose mean is 3 and the variance is 2.
58. State any four properties of normal distribution.
59. In a test of significance, the calculated value is less than the critical value. What is your inference?
60. State type – one error and type – two error.
61. What 'test statistic' is to be used to find the test of significance for the following problem? '1000 articles from a factory A are examined and found to have 3% defectives. 1500 similar articles from a second factory B are found to have only 2% defectives. Can it be reasonably concluded that the product of the first factory is inferior to the second?'
62. State the assumptions of students t – test
63. Explain the term 'degrees of freedom'.
64. What are the precautions are necessary while applying chi-square test?
65. What are the components of time series?

66. Write any two merits and demerits of semi – average method.
67. Write the Yule' s coefficient of association.
68. Verify whether the given data $N = 100$ $(A) = 75$, $(B) = 60$, and $(AB) = 15$ are consistent.
69. Explain the statistical decision theory.
70. Find the minimax regret for the following pay – off table

Act	States of Nature	
	S_1	S_2
A_1	10	15
A_2	20	12
A_3	30	11

PART III (30 MARKS)

Note: (1) Answer any 6 questions

(2) Each question carries 5 marks

6 x 5 = 30

71. An urn contains 5 red and 7 green balls. Another urn contains 6 red and 9 green balls. If a ball is drawn from any one of the two urns, find the probability that the ball drawn is green.
72. A random variable X has the density function $f(x) = Ax^2$, $0 < x < 1$. Determine A and find the probability between 0.2 and 0.5
73. Eight coins are tossed simultaneously. Find the probability of getting atleast six heads.
74. Suppose on an average 1 house in 1000 in a certain district has a fire during a year. If there are 2000 houses in that district, what is the probability that exactly 5 houses will have a fire during the year? ($e^{-2} = 0.1353$)
75. A car company decided to introduce a new car whose mean petrol consumption is claimed to be lower than that of the existing car. A sample of 50 new cars we taken and tested for petrol consumption. It was found that mean petrol consumption for the 50 cars was 30 km per litre. Test at 5% level of significance whether the company's claim that he new car petrol consumption is 28 km per litre on the average is acceptable.
76. A soap manufacturing company was distributing a particular brand of soap through a large number of retail shops. Before a heavy advertisement campaign, the mean sales per week per shop was 140 dozens. After the campaign, a sample of 26 shops was taken and the mean sales was found to be 147 dozens with standard deviation 16. Can you consider the advertisement effective?

77. Construct a four yearly centered moving average from the following data.

Year	1940	1950	1960	1970	1980	1990	2000
Imported cotton consumption in thousands	129	131	106	91	95	84	93

78. Following data relate to literacy and unemployment in a group of 500 persons. Calculate Yule's coefficient of association between literacy and unemployment and interpret it

$$\text{Literate unemployed} = 220$$

$$\text{Literate employed} = 20$$

$$\text{Illiterate employed} = 180$$

79. Given the following pay – off of 3 acts A_1, A_2, A_3 and their events E_1, E_2, E_3 .

Act	A_1	A_2	A_3
States of Nature			
E_1	35	-10	-150
E_2	200	240	200
E_3	550	640	750

The probabilities of the states of nature are respectively 0.3, 0.4, 0.3. Calculate and tabulate EMV and conclude which of the acts can be chosen as the best.

PART IV (40 MARKS)

Note: (1) Answer any 4 questions

(2) Each question carries 10 marks

4 x 10 = 40

80. In a bolt factory machines A_1, A_2, A_3 manufacture respectively 25%, 35% and 40% of the total output. Of these 5, 4 and 2 percent are defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine A_2 ?
81. A sample of 100 dry cells tested to find the length of life produced the following results $\mu = 12$ hours $\sigma = 3$ hours. Assuming the data to be normally distributed, what percentage of battery cells are expected to have a life (i) more than 15 hours (ii) between 10 and 14 hours (iii) less than 6 hours?
82. In a random sample of 1000 persons from town A, 400 are found to be consumers of wheat. In a sample of 800 from town B, 400 are found to be consumers of wheat. Do these data reveal a significant difference between

town A and town B, so far as the proportion of wheat consumers is concerned?

83. An automobile manufacturing firm is bringing out a new model. In order to map out its advertising campaign, it wants to determine whether the model will appeal most to a particular age – group or equal to all age groups. The firm takes a random sample from persons attending a pre-view of the new model and obtained the results summarized below:

Person who	Age groups				
	Under 20	20 – 39	40 – 50	60 & above	Total
Liked the car	146	78	48	28	300
Disliked the car	54	52	32	62	200
	200	130	80	90	500

What conclusions would you draw from the above data?

84. The following are the defective pieces produced by four operators working in turn, on four different machines:

Machine	Operator			
	I	II	III	IV
A	3	2	3	2
B	3	2	3	4
C	2	3	4	3
D	3	4	3	2

Perform analysis of variance at 5% level of significance to ascertain whether variability in production is due to variability in operator's performance or variability in machine's performance.

85. Fit a straight line trend by the method of least squares for the following data

Year	1983	1984	1985	1986	1987	1988
Sales In Lacs.	3	8	7	9	11	14

Also estimate the sales for the year 1991.

86. A manufacturing company has to select one of the two products A or B for manufacturing. Product a required investment of Rs.20,000 and product B, Rs.40,000. Market research survey shows high, medium and low demands with corresponding probabilities and returns from sales in Rupees thousands for the two products in the following table.

Market demand	Probability		Return from sales	
	A	B	A	B
High	0.4	0.3	50	80
Medium	0.3	0.5	30	60
Low	0.3	0.2	10	50

Construct an appropriate decision tree. What decision the company should take?