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M.Com. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Commerce – Core

STATISTICS

(For those who joined in July 2021 – 2022)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. The Poisson distribution is applied in those cases where
 - (a) the event is rare and casual
 - (b) success becomes very small
 - (c) n is large
 - (d) all of these

2. In a normal distribution, the value of mean is equal to Median and the value of Median is equal to
- (a) Mode (b) Q.D.
(c) C.V. (d) Skewness
3. Large sample theory is applicable when
- (a) $N > 30$ (b) $N < 30$
(c) $N = 30$ (d) None of these
4. While testing significance of the difference of two sample means in case of small samples, the degree of freedom is calculated by
- (a) $V = n_1 + n_2$ (b) $V = n_1 + n_2 + 1$
(c) $V = n_1 + n_2 - 1$ (d) $V = n_1 - n_2 + 2$
5. This test is also known as the _____ named after the statistician who developed it.
- (a) Wilcoxon test
(b) Mann-Whitney U test
(c) Rank Sum test
(d) Wallis test

6. The technique was developed called the Kruskal Wallis _____ of variance or the H -test.
- (a) one-way analysis
(b) two-way
(c) three-way
(d) none of these
7. Pay off tables can also be constructed in terms of or _____.
- (a) Losses, costs
(b) Single, alternative
(c) Alternatives
(d) Decision
8. The _____ criterion is an expected value criterion.
- (a) Baye's (b) Prior
(c) Tree (d) None
9. Control limits are _____.
- (a) Limits defined by customers
(b) Limit driven by the natural variability of the process
(c) Statistical units
(d) None

10. The natural variability of the process is measured by _____.
- (a) Process mean
 - (b) Sample standard deviation
 - (c) Process standard deviation
 - (d) Sample mean

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) A coin is tossed six times. What is the probability of obtaining four or more heads?

Or

- (b) State the properties of normal distribution.

12. (a) What is two-tailed test of hypothesis?

Or

- (b) In a school there are 1,000 students. Out of 20,000 in the districts. In a study 200 were found to have smoker parents in the school and 1,000 in the whole district. Is there a significant difference between the proportion in the school and the district?

13. (a) What are the conditions for applying Z^2 test?

Or

- (b) The following data relate to the daily production of cement (in m.tonnes) a large plant for 30 days.

11.5	10.0	11.2	10.0	12.3	11.1	10.2	9.6	8.7	9.3
9.3	10.7	11.3	10.4	11.4	12.3	11.4	10.2	11.6	9.5
10.8	11.9	12.4	9.6	10.5	11.6	8.3	9.3	10.4	11.5

Use Sign test to test the null hypothesis that the plant's average daily production of cements is 11.2 m.tonnes against alternative hypothesis $\mu < 11.2$ m.tones at the 0.05 level of significance.

14. (a) What are the components of decision theory?

Or

- (b) An investor is given the following investment alternative and percentage rates of return?

Alternative	Market conditions (State of Nature)		
	Low	Mediums	High
Regular shares	7%	10%	15%
Risky shares	-10%	12%	25%
Property	-12%	18%	30

Over the past 300 days, 150 days have been medium market conditions and 80 days have had high market increases. On the basis of the data state the optimum investment strategy for the investment strategy for the investment.

15. (a) Explain how control chart are?

Or

- (b) A plant produces rolls of paper. The number of defects disclosed by the inspection of 20 rolls are as follows :

12, 6, 15, 4, 5, 2, 4, 7, 12, 14, 18, 11, 14, 21, 21, 10, 12, 9, 15, 10

Comment on the state of control using \bar{x} -chart.

PART C — (3 × 8 = 24 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) The number of defects per unit in a sample of 330 units of manufactured product was found as follows :

No. of defects :	0	1	2	3	4
No. of units :	214	92	20	3	1

Fit a Poisson distribution to the data and test for goodness of fit. (Given $e^{-0.408} = 0.66447$).

Or

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- (b) As a result of tests on 20,000 electric bulbs manufactured by a company it was found that the life time of the bulb was normally distributed with an average life of 2,040 hours and standard deviation of 60 hours. On the basis of the information, estimate the number of the bulbs that are expected to burn for

- (i) more than 2,150 hours
(ii) less than 1,960 hours.

Proportion of Area under the Normal curve

Z	Area	Z	Area	Z	Area
1.28	0.3907	1.38	0.4082	1.48	0.4236
1.68	0.4484	1.78	0.4582	1.88	0.4664

17. (a) A tea company appoints four salesmen A, B, C and D and observes their sales in three seasons - Summer, Winter and Monsoon. The figures are given in the following table :

Seasons	Salesman				Total seasons
	A	B	C	D	
Summer	36	36	21	35	128
Winter	28	29	31	32	120

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Seasons	Salesman				Total seasons
	A	B	C	D	
Monsoon	26	28	29	29	112
Salesmen's total	90	93	81	90	360

Carry out analysis of variance.

Or

- (b) 12 students were given intensive coaching and 5 tests were conducted in a month. The scores of tests 1 and 5 are given below. Do the scores from test 1 to 5 show an improvement?

No. of students :	1	2	3	4	5	6	7	8	9	10	11	12
Marks in 1 st test :	50	42	51	26	35	42	60	41	70	55	62	38
Marks in 5 th test :	62	40	61	35	30	52	68	51	84	63	72	50

(The value of t for 11 degrees of freedom at 5% level of significance is 2.20)

18. (a) A movie producer is bringing out a new movie. In order to map out his advertising campaign, he wants to determine whether the movie will appeal most to a particular age group or whether it will appeal equally to all age groups. The producer takes a random sample from persons attending a preview of the new movie and obtain the following results :

	Age groups				Total
	Under 20	20-39	40-59	60 and over	
Liked the movie	116(a)	78(d)	43(g)	28(j)	300
Disliked the movie	54(b)	22(e)	42(h)	22(k)	140
Indifferent	20(c)	10(f)	10(i)	20(l)	60
Total	220	110	100	70	500

What inference will you draw from this data?

Or

- (b) Use the sign test to see if there is a difference between the number of days until collection of an account receivable before and after a new collection policy. Use the 0.05 significance level.

Before : 30 28 34 35 40 42 33 38

After : 32 29 33 32 37 43 40 41

Before : 34 45 28 27 25 41 36

After : 37 44 27 33 30 38 36

19. (a) A stall at a certain railway station sells for 80 paise a copy of daily newspaper for which it pays 50 p. unsold papers are returned for a refund of 25 p. a copy. Daily sales and corresponding probabilities are as follows :

Daily Sales : 500 600 700

Probability : 0.5 0.3 0.2

- (i) How many copies should it order each day to get maximum expected profit?
- (ii) If unsold, copies cannot be returned and are useless, what should be the optimal order each day? use in increment analysis.

Or

- (b) XYZ company manufactures parts for passenger cars and sells them in lots of 10,000 parts each. The company has a policy of inspecting each lot before it is actually shipped to the retailer. Five inspection categories established for quality control represent the percentage items contained in each lot. These are given in the following table. The daily inspection chart for past 100 inspections shows the following rating or break down inspection :

The Management is considering two possible courses of action.

- (i) Shut-down the entire plant operations and thoroughly inspect each machine.

Rating	Proportion of defective items	Frequency
Excellent (A)	0.02	25
Good (B)	0.05	30
Acceptable (O)	0.10	20
Fair (D)	0.15	20
Poor (E)	0.20	05
		100

- (ii) Continue production as it now exists but offer the customer a refund for defective items that are discovered and subsequently returned. The first alternative will cost Rs.600 while the second alternative will cost the company Rs.1 for each defective item that is returned.

What is the optimum decision for the company?

20. (a) From a factory producing metal sheets, a sample 5 sheets is taken every hour and the data obtained are as under :

Sample number	Mean thickness of sheets	Sample range
1	0.025	0.025
2	0.032	0.048
3	0.042	0.012
4	0.022	0.019
5	0.028	0.019
6	0.010	0.010
7	0.025	0.006
8	0.040	0.046
9	0.026	0.010
10	0.029	0.032

Or

- (b) Quality control is maintained in a factory with the help of mean (\bar{X}) and standard deviation (σ) charts. Ten items are chosen in every sample. 18 samples in all were chosen $\sum \bar{X}$ was 595.8 and $\sum \sigma$ was 8.28. Determine the 3 σ limits for \bar{X} and σ charts. You may use the following factors for finding the 3 σ limits.

n	A_1	B_2	B_4
10	1.03	0.28	1.72