



MCA DEGREE EXAMINATIONS: JUNE 2016

(Regulation 2014)

Second Semester

MASTER OF COMPUTER APPLICATIONS

P14MAT202: Probability and Applied Statistics

Course Outcomes:

- CO1: Compute measures of central tendency, dispersion and correlate the variables.
- CO2: Analyze random or unpredictable experiments and investigate important features of random experiments.
- CO3: Construct probabilistic models for observed phenomena through distributions.
- CO4: Analyze sample data and interpret the same for population using various tests for large and small samples.
- CO5: Analyze experiments based on one-way, two-way and Latin square classifications, understand the basics of quality control using control charts.

Time: Three Hours

Maximum Marks: 100

**Answer all the Questions:-
PART A (10 x 1 = 10 Marks)**

1. Which of the following statements are true? CO1 [K₂]
 1. The most widely used measure of dispersion is the arithmetic mean.
 2. The square root of variance is called standard deviation.
 3. The median of the numbers 45, 10, 24, 36 is 30
 4. The mode of the numbers 10,10,25,35,25,47,25,15 is 10.

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

2. Match list I with list II and select the correct answer using the codes given below. CO1 [K₃]

List I	List II
A. 1,2,3,4,5	1. Mean = 0
B. -1, -5, 6, 2, -2	2. Variance = 0
C. 2,2,2,2,2	3. Standard Deviation = 2
D. 2,3,4,5,6	4. Mean Deviation = 1.5

Codes:

a) A - 2 , B - 4 , C - 1 , D - 3 b) A - 3 , B - 2 , C - 4 , D - 1
c) A - 2 , B - 1 , C - 3 , D - 4 d) A - 3 , B - 1 , C - 2 , D - 4

3. The chance that a leap year, selected at random, will contain 53 Sundays is CO2 [K₃]

a) 1/7 b) 2/7
c) 3/7 d) 4/7

4. Examine the two statements carefully and select the answer using the codes given below. CO2 [K₄]

Assertion: The probabilities that A , B can solve a problem are 1/3 and 1/4 respectively. Then the probability that the problem is solved is 7/12
Reason: The above mentioned events are independent.

a) Both A and R are individually true and b) Both A and R are individually true but R

- R is the correct explanation of A is not the correct explanation of A
 c) A is true but R is false d) A is false but R is true.

5. Match list I with list II and select the correct answer using the codes given below. CO3 [K₂]
 Let X be a binomial random variable with parameters n ,p

List I	List II
A. E(X)	1. npq
B. Var(X)	2. p ⁿ
C. E(X ²)	3. np
D. P(X=n)	4. n ² p ² +npq

Codes:

- a) A – 3 , B - 4 , C - 2 , D - 1 b) A – 1 , B - 4 , C - 2 , D - 3
 c) A – 3 , B - 1 , C - 4 , D - 2 d) A – 1 , B - 3 , C - 2 , D - 4
6. Examine the two statements carefully and select the answer using the codes given CO3 [K₄]
 below:

Assertion: If X follows Poisson distribution with $\lambda = 1$, then $\text{Var}(X) = 1$

Reason: If X follows Poisson distribution with parameter λ , then $\text{Var}(X) = \lambda^2$

- a) Both A and R are individually true and R is the correct explanation of A b) Both A and R are individually true but R is not the correct explanation of A
 c) A is true but R is false d) A is false but R is true.
7. State the correct order of the procedure to test a hypothesis for mean of a small sample. CO4 [K₂]
1. Check whether the test is one-tailed or two-tailed and form the alternate hypothesis
 2. Form the null hypothesis.
 3. If $|t| < t_{\alpha}$, accept the null hypothesis, otherwise reject it.
 4. Find the value of the test statistic and the critical value corresponding to the LOS.
- a) 1-2-4-3 b) 1-2-3-4
 c) 2-1-3-4 d) 2-1-4-3

8. Which of the following statements are true? CO4 [K₂]
1. Rejecting a hypothesis when it should be accepted, leads to type I error .
 2. The probability α of making type I error is called the level significance.
 3. If the two given samples are independent, then we use paired t – test to test whether the means differ significantly .
 4. χ^2 test is used to test independence of attributes
- a) 1,2,3 b) 2,3,4
 c) 1,3,4 d) 1,2,4

9. Design for one way classification is called CO5 [K₁]
- a) Completely Randomised Design b) Randomised Block Design
 c) Latin Square Design d) Factorial Design
10. For a 4x4 Latin Square design , the degrees of freedom for error are CO5 [K₃]
- a) 4 b) 6
 c) 8 d) 12

PART B (10 x 2 = 20 Marks)

11. Ravi has scored 84, 65, and 76 marks in three math tests. What marks must he obtain CO1 [K₃]
 in the next test to have an average of exactly 80 for the four tests?
12. Find the median of the following distribution CO1 [K₁]

Expenditure:	0-20	20-40	40-60	60-80	80-100
No. of families:	14	21	27	23	15

13. A problem is given to 3 students A, B, C whose chances of solving it are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ respectively. What is the probability that the problem is solved? CO2 [K₃]
14. A continuous random variable X that can assume any value between $x = 2$ and $x = 5$ has the density function given by $f(x) = k(1+x)$. Determine $P(X < 4)$. CO2 [K₄]
15. The mean and variance of a binomial distribution are 4 and $\frac{4}{3}$ respectively. Find $P(X = 2)$. CO3 [K₃]
16. If X is a normal variate with $\mu = 30$ and $\sigma = 5$, estimate $P(26 \leq X \leq 40)$. CO3 [K₄]
17. The mean lifetime of a sample of 100 light bulbs produced by a company is found to be 1580 hours with standard deviation of 90 hours. Test the hypothesis that the mean lifetime of the tubes produced by the company is 1600 hours. CO4 [K₄]
18. Write two uses of t-test. CO4 [K₂]
19. What are the basic principles of Experimental Design? CO5 [K₁]
20. Write the Lower control limit and Upper control limit for p chart. CO5 [K₂]

PART C (6 x 5 = 30 Marks)

21. An analysis of monthly wages paid to the workers of two firms A and B belonging to the same industry gives the following results: CO1 [K₅]

	Firm A	Firm B
No. of workers	500	600
Average daily wages (Rs.)	186	175
Variance of distribution of wages	81	100

- (i) Which firm, A or B has a larger wage bill?
- (ii) In which firm, A or B, is there greater variability in individual wages?
- (iii) Calculate the average daily wages of all the workers in the firms A and B taken together.
22. The chances of three candidates A, B and C becoming the manager of a company are in the ratio 3: 5: 4. The probability that a special bonus scheme will be introduced by them if selected are 0.6, 0.4 and 0.5 respectively. If the bonus scheme is introduced, what is the probability that A, B, C have become the manager? CO2 [K₄]
23. A discrete random variable has the following probability distribution CO2 [K₄]
- | | | | | | | | | | |
|-------|---|----|----|----|----|-----|-----|-----|-----|
| x : | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| P(x): | a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a |
- Determine (i) the value of a (ii) $P(2 \leq X < 6)$
- (iii) $P(X > 3)$ (iv) distribution function of X.
24. In a certain factory manufacturing razor blades, there is small chance of $\frac{1}{500}$ for any blade to be defective. The blades are in packets of 10. Use Poisson distribution to estimate the approximate number of packets containing (i) no CO3 [K₅]

defective (ii) one defective
 (iii) 2 defective blades respectively in a consignment of 10,000 packets.

25. The following table gives the number of aircraft accidents that occur during the various days of a week. Find whether the accidents are uniformly distributed over the week. CO4 [K_L]

Days	Sun	Mon	Tue	Wed	Thu	Fri	Sat
No. of accidents:	14	16	8	12	11	9	14

26. Given below are the values of sample mean \bar{X} and sample range R for 10 samples, each of size 5, draw the appropriate mean and range charts and assess the state of control of the process. CO5 [K₅]

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

PART D (4 x 10 = 40 Marks)

27. Find Karl Pearson's correlation coefficient for the following heights in inches of fathers (x) and their sons (y). Also find the equations of the two regression lines CO1 [K₅]

X:	65	66	67	67	68	69	70	72
Y:	67	68	65	68	72	72	69	71

28. Formulate a Binomial distribution for the following data and predict the expected frequencies: CO3 [K₆]

x :	0	1	2	3	4	5	6	Total
f :	5	18	28	12	7	6	4	80

29. (i) A buyer of electric bulbs bought 100 bulbs each of two famous brands. Upon testing these he found that brand A had a mean life of 1500 hours with a standard deviation of 50 hours whereas brand B had a mean life of 1530 hours with a standard deviation of 60 hours. Can it be concluded at 5% level of significance, that the two brands differ significantly in quality? (5) CO4 [K₅]

- (ii) Ten persons were appointed in the officer cadre in an office. Their performance was noted by giving a test and the marks were recorded out of 100. (5) CO4 [K₅]

Before:	80	76	92	60	70	56	74	56	70	56
After:	84	70	96	80	70	52	84	72	72	50

By applying paired t-test, can it be concluded that the employees have been benefited by the training?

30. A farmer wishes to test the effects of four different fertilizers. A, B, C, D on yield of wheat. In order to eliminate sources of error due to variability in soil fertility, he uses the fertilizers in a Latin Square arrangement as indicated in the following table, where the numbers indicate yields in bushels per unit area. CO5 [K₅]

A18	C21	D25	B11
D22	B12	A15	C19
B15	A20	C23	D24
C22	D21	B10	A17

Perform an analysis of variance to determine if there is a significant difference between the fertilizers at $\alpha = 0.05$ levels of significance.
