

Assignment

Course Code: AST-01
Assignment Code: AST-01/TMA/2021
Maximum Marks: 100

1. a) Following is the distribution of marks (out of 25) obtained by 10 students in Physics and Mathematics.

No.	Physics (X_i)	Mathematics (Y_i)	X_i^2	Y_i^2	$X_i Y_i$
1	18	21	324	441	378
2	20	23	400	529	460
3	11	14	121	196	154
4	20	23	400	529	460
5	14	17	196	289	238
6	15	18	225	324	270
7	13	16	169	256	208
8	16	19	256	361	304
9	17	20	289	400	480
10	20	23	400	529	460
Total	164	194	2780	3854	3412

Draw a scatter diagram for all the 10 students and calculate the correlation between marks of Physics and Mathematics. (6)

- b) Two cards are drawn simultaneously or successively without replacement from a well-shuffled deck of 52 cards. Find the probability distribution of number of aces (x). Give a graphical representation of probability distribution. (4)
2. a) There are two samples of 1200 and 900 people drawn from populations respectively, which have 30% and 25% of fair-haired people. Test whether the samples drawn from this population maintain difference or not. (Use $\alpha = 0.05$) (5)
- b) A bicycle shop sells the following number of bicycles from 1990 to 2000.

Year	Number sold (thousands)
1990	3
1991	3
1992	3
1993	3
1994	6
1995	6
1996	6
1997	6
1998	9
1999	10
2000	12

Compute the first three moving averages of length 3 for the bicycle sales data and place them in line with the corresponding year. (5)

3. a) Two samples of 9 and 8 sizes give the sum of squares of deviations from respective means equal to 160 and 91 inches squares. Test whether these samples have been drawn from same normal population or not? (Use $\alpha = 0.05$) (5)

b) In a locality of 18,000 families, a random sample of 840 families was taken. Of these 840 families, 206 families were found to have a monthly income of Rs. 500 or less. Give the confidence interval for the families having income Rs. 500 or less. (5)

4. a) Plating of gold on wrist watches requires a chemical called AuCl_3 . Concentration of the chemical that is added to the solution is an important factor. The objective is to choose that concentration for which plating is uniform. Three concentration of AuCl_3 chosen were 5%, 15% and 20%. These were added in the solution and plating was done and thickness (in units) measured on 5 samples is gives below.

Sample →	1	2	3	4	5
↓ Conc. of AuCl_3					
5%	3	2	4	2	4
15%	4	4	3	2	4
25%	3	3	4	4	2

Use ANOVA to comment on whether the concentration of AuCl_3 gives same result or not. (Use $\alpha = 0.05$) (7)

b) Consider a population of 11 schools from which a sample of size 3 is to be selected. List all the possible samples by circular systematic sampling. (3)

5. a) Consider the case of tossing two dices. Let

A: be the event of getting an odd total

B: the event of getting on the first dice, and

C: the event of getting a total of seven on two dices.

Then

(i) Find $P(A \cap C)$, $P(A \cap B)$ and $P(B \cap C)$.

Check whether A, B and C are independent or not. Give reasons for your answers. (5)

b) It is desired to estimate average annual wool yield per sheep for a herd of 150 at a certain farm house using stratified simple random sampling. Sheeps in the herd are to be grouped into three strata on the basis of first shaving in days. Optimum method sample allocation is said to be used for selecting the overall sample of 25 sheeps from the three strata. Determine approximately optimum strata boundaries using the information on first shaving given below. (5)

Shaving days	No. of Sheep (f)	\sqrt{f}
30-70	6	2.45
70-110	2	1.414
110-150	1	1
150-190	4	2
190-230	2	1.414
230-270	7	2.646
270-310	8	2.828
310-350	20	4.472
350-390	10	3.162
390-430	25	5
430-470	40	6.325
470-510	25	5

6. a) Find the probability that at most 5 defective fuses will be found in a box of 200, if experience shows that 20% of such fuses are defective. (2)

- b) The following table gives the hours spent by 50 students in the playground in a week:

Hours	0	2	4	6	8	10
No. of students	10	6	8	6	10	10

Calculate the mean median and standard deviation of the hours required by students. (4)

- c) In a television appearance, an MLA from a state asks voters in that state to indicate whether the MLA should vote against or for a particular piece of legislation. The MLA office receives 4100 replies. Since voters from western part tends to be democrats while those from eastern parts tend to e communists, the MLA divides the replies on the basis of their geographical origin. 68% of the replies from the western part are against the legislation and 36% of the replies from the eastern part are against it.

- (i) Did the MLA carry out a stratified sampling?
(ii) Did the MLA carry out a stratified random sampling?
(iii) How would you justify the sample design?
(iv) What improvements would you suggest? (4)

7. a) At a call centre, callers have to wait till an operator is ready to take their call. To monitor this process, 5 calls were recorded every hour for the 8-hour working day. The data below shows the waiting time in weeks:

Time	Sample number				
	1	2	3	4	5
9 a.m.	8	9	15	4	11
10	7	10	7	6	8
11	11	12	10	9	10
12	12	8	6	9	12
1 p.m.	11	10	6	14	11
2	7	7	10	4	11
3	10	7	4	10	10
4	8	11	11	11	7

Compute the control limits for \bar{x} and R -charts. Draw the control charts for \bar{x} and R, and comments. (7)

b) Write three advantage and three disadvantage of using a sampling approach instead of a census approach for studying a characteristic. (3)

8. a) A shop manufacturer is trying to determine whether or not to market a new type of soap. It chooses a random samples of equivalent size in England and France. It asks each of the people in each sample to try the new soap, and see whether he or she likes it better than other soaps. The results are as follows:

	United States	England	France
Prefer new soap	81	43	26
Do not prefer it	219	257	274

Test the hypothesis that there are international difference in the proportion of people who prefer the new soap, using 5% level of significance. (5)

b) Suppose from a total of 120 guava trees, 5 clusters of 4 trees each selected and the yield (in kg) is recorded below:

Cluster	Trees			
	1	2	3	4
1	5	4	2	15
2	11	1	4	7
3	26	10	19	11
4	7	15	12	10
5	2	22	8	6

Estimate the average yield per tree and its standard error. (5)

9. a) A manufacture of rayon wants to compare that the yield strength of 11.5 kg/mm^2 is met or not at 5% level of significance. The manufacturer draws a sample and calculates the mean to be 12.8 kg/mm^2 and the standard derivation is known to be 2.0 kg/mm^2 . Carry out the statistical test appropriate for this. (4)

b) A box contains 10 screws, 3 of which are defective. Two screws are drawn at random. Find the probability that none of them is defective, if the sample is drawn

(i) with replacement,

(ii) without replacement. (4)

c) A researcher measures the temperature of a solution 5 times. The observations are 25, 32, 27, 29, 30°C . Determine an unbiased estimate of the temperature. (2)

10. Which of the following statements are true? Give reasons for your answer. (10)

(i) F-distribution is always used in goodness of fit.

(ii) Measure of central tendency in a data set refers to the extent to which the observations are scattered.

- (iii) A process is said to be under assignable cause when the points are above the VCL link of (\bar{X}, R) chart.
- (iv) Simple random sampling is done by using random number tables where the probability of drawing a digit is 0.1.
- (v) All time series have a trend.