Sampling Theory (CO-3)

<table>
<tr><td>S. No</td><td>QUESTION</td></tr>
<tr><td></td><td>Estimation</td></tr>
<tr><td>1</td><td>A random sample of 625 items from a normal population of unknown mean has mean 10 and standard deviation 1.5. What are 95% and 99% fiducial limits for the population mean?</td></tr>
<tr><td>2</td><td>The mean value of random sample of items was found to be 145 with standard deviation of 40. Find the 95% confidence limits for the population mean. What size of sample is required to estimate the population mean with error of 5 units with 95% or more confidence using the sample mean</td></tr>
<tr><td>3</td><td>A random sample 16 values from population with unknown μ has variance 1.5 and mean20. Estimate 95% confidence limits for the population mean.</td></tr>
<tr><td>4</td><td>Two samples are drawn from two different population gave the following results
<table>
<tr><td></td><td>Size</td><td>Mean</td><td>S.D</td></tr>
<tr><td>Sample I</td><td>400</td><td>124</td><td>14</td></tr>
<tr><td>Sample II</td><td>250</td><td>120</td><td>12</td></tr>
</table>
Find 95% confidence limits for the difference between the population means</td></tr>
<tr><td>5</td><td>A random sample 16 values from a normal population showed a mean of 41.6 inches and the sum of the squares of the deviations from this mean equals to 135. Obtain 95% fiducial limits for the mean.</td></tr>
<tr><td></td><td>Difference between sample mean and population means for large samples</td></tr>
<tr><td>6</td><td>Can it be concluded that the average life span of an Indian is more than 70 years, if a random sample of 100 Indians has average life span of 71.8 years with standard deviation of 8.9 years?</td></tr>
<tr><td>7</td><td>A sample of 400 observations has mean 95 and sd 12. Can it be a random sample from a population with mean 98 ?</td></tr>
<tr><td>8</td><td>An ambulance service claims that it takes on an average 8.9 min to reach the destination in emergency calls. To check this Licensing Agency has then timed on 50 emergency calls, getting a mean of 9.3 min with a S.D. 1.6 min. Is the claim acceptable at 5% LOS?</td></tr>
<tr><td>9</td><td>The mean breaking strength of cables supplied by a manufacturer is 1800 with S.D. 100. By a new technique in the manufacturing process it is claimed that the breaking strength of the cables has increased. In order to test the claim a sample of 50 cables is tested. It is found that the mean breaking strength is 1850. Can we support the claim at 1% LOS.</td></tr>
<tr><td>10</td><td>A tyre company claims that the lives of the tyres have mean of 42000 kms with S.D. of 4000 kms. A change in production process is believed to result in a better product. A test sample of 81 new tyres has a mean life of 42500 kms. Test at 5% LOS that the new product is significantly better than the current one</td></tr>
<tr><td>11</td><td>A sample of 100 students is taken from a large population. The mean height of the student in this sample is 160 cms. Can it be reasonable that in the population, the mean height is 165cms and standard deviation is 10cms ?</td></tr>
<tr><td>12</td><td>A random sample of 50 items gives the mean 6.2 and standard deviation 10.24. Can it be regarded as drawn from a normal population with mean 5.4 at 5% LOS?</td></tr>
<tr><td>13</td><td>A machine is set to produce metal plates of thickness 1.5 cms with standard deviation 0.2 cm. A sample of 100 plates produced by the machine gave an average thickness of 1.52 cms .Is the machine fulfilling the purpose?</td></tr>
<tr><td>14</td><td>A random sample of 400 items gives the mean 4.45 & variance 4. Can it be regarded as drawn from a normal population with mean 4 at 5% level of significance?</td></tr>
<tr><td>15</td><td>A machine is claimed to produce nails of mean length 5 cms & standard of 0.45 cm. A random sample of 100 nails gave 5.1 as their average length. Does the performance of the machine justify the claim? Mention the level of significance you apply</td></tr>
<tr><td>16</td><td>A sample of 50 pieces of certain type of string was tested. The mean breaking strength turned out to be 14.5 pounds. Test whether the sample is from a batch of string having a mean breaking strength of 15.6 pounds & standard deviation of 2.2 pounds.</td></tr>
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<tr><td></td><td></td></tr>
<tr><td>17</td><td>Random sample of 900 items is found to have a mean of 65.3 cms can it be regarded as a sample from a large population whose mean is 66.2 cms & standard deviation is 5 cms at 5% level significance.</td></tr>
<tr><td></td><td>difference between the means of two large samples</td></tr>
<tr><td>18</td><td>The average of marks scored by 32 boys is 72 with standard deviation 8 while that of 36 girls is 70 with standard deviation 6.Test at 1% level of significance whether the boys perform better than the girls.</td></tr>
<tr><td>19</td><td>Two groups A & B of patients each consisting of 200 people are used to test effectiveness of a new serum. Group A is given serum while group B not. It is found that mean of two groups of A & B are 140 & 120 respectively and standard deviation of 14 & 12 respectively . Test at 1% LOS wether the new serum helps to cure the disease.</td></tr>
<tr><td>20</td><td>A sample of 200 fish of a particular kind taken as random from one end of a lake had mean weight of 20 lbs & standard deviation of 2 lbs. At the other end of the lake, a sample of 80 fish of the same kind had mean weight of 20.51lbs & standard deviation of 2 lbs. Is the difference between the mean weights significant at 1% level of significance ?</td></tr>
<tr><td>21</td><td>A man buys 100 electric bulbs of each of two well-known makes taken at random from stock for testing purpose. He finds that ‘make B’ has a mean life of 1248 hrs with S.D of 93 hrs. Discuss the significance of these results.</td></tr>
<tr><td>22</td><td>Two samples drawn from two different populations gave the following results . Test the hypothesis at 5% level of significance that the difference of the means of the populations is 45
<table>
<tr><td></td><td>Size</td><td>Mean</td><td>S.D</td></tr>
<tr><td>Sample I</td><td>125</td><td>340</td><td>25</td></tr>
<tr><td>Sample II</td><td>150</td><td>380</td><td>30</td></tr>
</table></td></tr>
<tr><td>23</td><td>A potential buyer of light bulbs bought 50 bulbs each of 2 brands. Upon testing the bulbs, he found that brand A had a mean life of 1282 hrs with a S.D of 80 hrs, brand B had a mean life of 1377 hrs with S.D of 94 hrs. Can the buyer be quite certain that the means of the two brands differ by 95 hrs.</td></tr>
<tr><td>24</td><td>A random sample of size 36 has mean 53and sum of squares of deviations from mean is 150. Can this sample be regarded as drawn from the population having 54 as mean?</td></tr>
<tr><td>25</td><td>Average height of a sample of 6400 persons from one population was found to be 67.85 inches with a S.D of 2.56 inches. Average height of a sample of 1600 persons from another population was found to be 68 inches with a S.D of 2.52 inches. Is the difference between the mean heights of two samples significant?</td></tr>
<tr><td>26</td><td>
<table>
<tr><td></td><td>Mean</td><td>S.D</td><td>No</td></tr>
<tr><td>Girls</td><td>84</td><td>10</td><td>121</td></tr>
<tr><td>Boys</td><td>81</td><td>12</td><td>81</td></tr>
</table>
Intelligence tests of two groups of boys & girls obtained from two normal populations having the same standard deviations gave the following results. Is the difference between the means significant?</td></tr>
<tr><td>27</td><td>The mean of two simple samples of 1000 and 2000 items are 170 and 169 respectively. Can the samples be regarded as drawn from the same populationwith sd 10 at 5% LOS.</td></tr>
<tr><td></td><td>Difference between sample mean and population means for small samples</td></tr>
<tr><td>28</td><td>The mean life time of a sample of 25 bulbs is found as 1550 hours with standard deviation of 120 hours. The company manufacturing the bulbs claim that the average life of their bulbs is 1600 hours. Is the claim acceptable at 5% LOS ?</td></tr>
<tr><td>29</td><td>A random sample of size 16 from a normal population showed a mean of 103.75 cm & sum of squares of deviations from the mean 843.75 $cm^{2.}$ Can we say that the population has a mean of 108.75?</td></tr>
<tr><td>30</td><td>A machinist is expected to make engine parts with axle diameter of 1.75 cm. A random sample of 10</td></tr>
</table>

parts shows a mean diameter of 1.85 cm with an sd of 0.1 cm. On the basis of this sample would you say that the work of the machinist is superior.

31 Nine items of a sample had the following values 45,47,50,52,48,7,49,53,51. Does the mean of 9 items differ significantly from the assumed population mean 47.5?

32 Sandal powder is packed into packets by a machine. A random sample of 12 packets is drawn & their weights are found to be 0.49, 0.48, 0.47, 0.48, 0.49, 0.50, 0.51, 0.49, 0.48, 0.50, 0.51, 0.48 kg. Test if the average packing can be taken as 0.5 kg

33 Ten individual are chosen at random from a population & heights are found to be 63, 63, 64, 65, 66, 69, 69, 70, 70, 71.inches. Discuss the suggestion that the height of universe is 65 inches.

34 Tests made on breaking strength of 10 pieces of metal wire gave the following results 578,572,570,568,572,570,570,572,596 & 584 in kgs. Test if the breaking strength of the metal wire can be assumed to be 577 kg?

35 Vanaspati oil is marketed in tins of 10 kgs .A sample of 20 tins showed the mean weight as 9.5 kg with standard deviation of 3 kgs. Dose the sample justify the claim that the mean weight is 10 kg. Mention the level of significance, you use.

36 The average breaking strength of steel rods is specified to be 17.5 (in units of 1000 kg) to test this sample of 14 rods tested & gave the following results: 15, 18, 16, 21, 19, 21, 17, 17, 15, 17, 20, 19, 17, 18. Is the result of the experiment significant? Also obtain the 95% confidence interval for the average breaking strength.

37 A machine is designed to produce insulating washers for electrical devices of average thickness of 0.025 cms. A random sample of 10 washers was found to have average thickness of 0.024 cms, with standard deviation of 0.002 cms. Test the significance of the deviation

Test for significance of the difference between the means of two Samples (SAMPLES ARE INDEPENDENT)

38

	No. of samples	Mean	Standard deviation
Type I	8	1134	35
Type II	7	1024	40

Samples of two types of electric bulbs were tested for length of life and the following data were obtained. Show that at 5% LOS the difference in the sample means is significant. Also Test at 1% LOS whether type I is better than type II.

39

Sample	Size	Mean	S.D
1	16	23.4	2.5
2	12	24.9	2.8

Two independent samples from normal population with equal variance. Is the difference between the mean significant?

40

DietA:	5	6	8	1	12	4	3	9	6	10
DietB	2	3	6	8	10	1	2	8		

A group of 10 rats fed on diet A & another group of 8 rats fed on diet B recorded the following increase in weight (gms). Does it show superiority of diet A over diet B ?

41 The following table gives the values of protein from cow's milk & buffalo's milk. Examine if these difference are significant.

Cows milk:	1.90	1.95	2.00	2.02	1.85	1.80
Buffalos milk	2.12	2.00	2.20	2.45	2.20	2.10

42 A group of five patients treated with medicine A weight 42,39,48,60, & 41 kg a second group of 7 patients from the same hospital treated with medicine B weight 38,42,56,64,68,69, & 62 kg. Do you agree with the claim that medicine B increases the weight significantly?

43 The means of two random samples of size 9 & 7 are 196.42 & 198.82 respectively. The sum of the squares of the division from the mean is 26.94 &18.73 respectively. Can the samples be considered to have been drawn from the same population?

44 Six guinea pigs injected with 0.5 mg of a medication took on an average 15.4 secs to fall asleep with an unbiased standard deviation 2.2 sec while six other guinea pigs injected with 1.5 mg of the medication took on an average 11.2 sec to fall asleep with an unbiased standard deviation 2.6 sec.

Use 5% level of significance to test the null hypothesis that the difference in dosage has no effects.

45 Let X= the group of seven chickens on high protein diet with weights (ounce) 13, 16, 12, 17, 15, 15, 17 and Y= the group of five chickens on low protein diet with weights (ounce) 9, 11, 15, 11, 14. Test whether chickens on high protein diet show increased in weight

46

Sample 1	21	24	25	26	27	--
Sample 2	22	27	28	30	31	36

The nicotine contrasts in two random samples of tobacco are given below:
Can you say that the two samples came from the same population?

47 The mean height and SD height of 8 randomly chosen soldiers are 166.9 & 8.29 cms respectively. The corresponding values of 6 randomly chosen sailors are 170.3 & 8.5 cms respectively. Based on this data, can we conclude that soldiers are in general shorter than sailors?

paired t-test (**SAMPLES ARE NOT INDEPENDENT)**

48 Ten boys were given a test in statistics & their scores were recorded. They were given a month's special coaching & a second test was given to them in the same subject at the end of the coaching period. Test if the marks given below give evidence to the fact that coaching benefits the students

Marks in test I	70	68	56	75	80	90	68	75	56	58
Marks in testII	68	70	52	73	75	78	80	92	54	55

49 In a certain experiment to compare two types of pig foods A &B the following results of increasing weights were obtained

Pig no	1	2	3	4	5	6	7	8
Increase in weight X by A	49	53	51	52	47	50	52	53
Increase in weight Y by B	52	55	52	53	50	54	54	53

a) Assuming that the two samples of pigs are independent can we conclude that food B is better than food A? b) Examine the case if the same set of pigs were used in both cases.

51 In a certain experiment to compare two types of pig foods A &B the following results of increasing weights were obtained . Assuming that the two samples of pigs are independent

Pig no	1	2	3	4	5	6	7	8
Increase in weight X by A	49	53	51	52	47	50	52	53
Increase in weight Y by B	52	55	52	53	50	54	54	53

can we conclude that food B is better than food A? b) Examine the case if the same set of pigs e were used in both cases.

52 Memory capacity of 9 students was tested before & after a course of mediation for a month. State whether the course was effective or not from the data below

Before	10	15	9	3	7	12	16	17	4
After	12	17	8	5	6	11	18	20	3

53 The following data represent the mark obtained by 11 students in two tests one held at the beginning of the year and the other at the end of the year after giving intensive coaching.

TestI	19	23	16	24	17	18	20	18	21	19	20
TestII	17	24	20	24	20	22	20	20	18	22	18

Do the data indicate that the students are benefited by coaching?

54 A certain injection administered to 12 patients resulted in the following change of blood pressure 5,2,8, -1,3,0,6, -2,1,5,0,4. Can be concluded that the injection will be in general accompanied by an increase in blood pressure?

55 The sales-data of an item in six shops before & after a special promotional campaign are as under

Shops	A	B	C	D	E	F
Before campaign	53	28	31	48	50	42
After campaign	58	29	30	55	56	45

Can the campaign be judged to be a success 5% level of significance?

56 A drug was administered to 5 persons and the systolic blood pressure before and after was measured. The results are given below: Test whether the drug is effective in lowering the systolic blood pressure at 5% LOS. Test whether the drug is effective in lowering the systolic blood pressure at 5% LOS.

Candidates	I	II	III	IV	V
B.P. Before	140	130	132	150	140
B.P. After	132	126	133	144	133

57 Two independent random samples of size 8 and 10 have means 950 and 1000. The standard deviations of two populations are 80 and 100. Test the hypothesis that the two populations have same mean

58 An I.Q. test was administered to 5 persons and after they were trained. The results are given below. Test whether there is any change in I.Q. after the training programme, use 1% LOS.

	I	II	III	IV	V
I.Q. Before training	110	120	123	132	125
I.Q. after training	120	118	125	136	121

Chi-square distribution

59 The following table gives the number of accidents in a city during a week. Find whether the accidents are uniformly distributed over a week

Day	SUN	MON	TUE	WED	THUR	FRI	SAT	TOTAL
no of accident	13	15	9	11	12	10	14	84

60 A total number of 3759 individuals were interviewed in a public opinion survey on a political proposal of them 1872 were men and the rest were women. A total of 2257 individuals were in favor of the proposal and 917 were opposed to it. A total of 243 men were undecided and 442 women were opposed to the proposal. Do you justify on contradict the hypothesis that there is no association between sex and attitude, at 5% LOS

61 The number of car accidents in a metropolitan city was found to be 20,17,12,6,7,15,8,5,16, &14 per month respectively. Use χ^2-test to check whether these frequencies are in an agreement with the belief that occurrence of accident was the same during 10 months period. Test at 5%level of significance.

62 A die was thrown 132 times & the following frequencies were observed Test the hypothesis that the die is unbiased.

No obtained	1	2	3	4	5	6	Total
Frequency	15	20	25	15	29	28	132

63 Theory predicts that the proportion of beans in four groups A, B, C, D should be 9:3:3:1. In an experiment among 1600 beans the in four groups were 882,313,287, &118.Does the experimental results support the theory?

64 The following mistakes per page were observed in a book

No of mistake per pages	0	1	2	3	4
No. of pages	211	90	19	5	0

Fit a Poisson distribution & test the goodness of fit.

65

No of defects	0	1	2	3
Observed freq	32	15	9	4

The number of defects in printed circuit board is hypothesized to follow Poisson distribution. A random sample of 60 printed boards showed the following data Does the hypothesis of Poisson distribution seem appropriate?

66 5 dice were thrown 192 times & the number of times 4,5or 6 were obtained are as follows . Calculate χ^2

No of dice showing 4,5 or 6	5	4	3	2	1	0
frequency	6	46	70	48	20	2

67 Test for goodness of fit of a Poisson distribution at 0.05 LOS to the following frequency distributions.

No of patients arriving/hour(x)	0	1	2	3	4	5	6	7	8
Frequency	52	151	130	102	45	12	5	1	2

68 The figures given below are a)the observed frequencies of a distribution b)the frequencies of the normal distribution ,having the same mean ,standard deviation & the total frequencies as in a)1,12,66,220,495,792,924,792,495,220,66,12,1 b)2,15,66,210,484,799,943,799,484,210,66,15,2. Apply χ^2 test of goodness of fit.

69 Investigate the association between the darkness eye color in father & son from the following data

Color of sons eye	Color of fathers eye		
	Dark	Not dark	Total
Dark	48	90	138
Not dark	80	782	862
Total	128	872	1000

70 Two batches of 12 animals each are given test of inoculation. One batch was inoculated & the other was not. The number of dead & surviving animals is given in the following table for both cases. Can the inoculation be regarded as effective against the disease at 5% level of significance?

	Dead	Surviving	Total
Inoculated	2	10	12
Not inoculated	8	4	12
Total	10	14	24

71 In an industry 200 workers employed for a specific job were classified according to their performance & training received to test independence of training received & performance. The data are summarized as follows. Use χ^2-test for independence at 5% level of significance & write your conclusion.

Performance	Good	Not good	Total
Trained	100	50	150
Untrained	20	30	50
Total	120	80	200

72 Random samples of 220 students in a college were asked to give opinion in terms of yes or no about the winning of their college cricket team in a tournament. The following data are collected.

	Class in college		
	Ist year	IInd year	IIIrd year
Yes	43	20	37
No	23	57	40

Test whether there is any association between opinion and class in college (use 5% LOS)

73 Justify, if there is any relationship between sex and color for the following data.

Color	Male	female
Red	10	40
White	70	30
Green	30	20

74 Based on the data below determine if there is relation between literacy and smoking:

	Smokers	Non-smokers
Literates	83	57
Illiterates	45	68

75 A certain drug is claimed to be effective in curing cold in an experiment on 500 persons with cold. Half of them were given drug and half of them were given the sugar pills. The patients reaction to the treatment are recorded in the following table.

	Helped	Harmed	No Effect	Total
Drug	150	30	70	250
Sugar pills	130	40	80	250
Total	280	70	150	500

On the basis of this data, can it be concluded that the drug and sugar pills differ significantly in curing cold.

76 To test two methods of instruction, 50 students are selected at random from each of the two groups. At the end of the instruction period, each student is assigned a grade (A, B, C, D or F) by an evaluating team. The data is recorded as follows:

	Grade					
	A	B	C	D	F	Total
Group I	8	13	16	10	3	50
Group II	4	9	14	16	7	50

Does the data indicate that there is relation between grades and the methods of instruction?

77 Table shows the performances of students in mathematics and Physics. Test the hypothesis that the performance in Mathematics is independent of performance in Physics.

Grades in Physics		Grades in Maths		
		High	Medium	low
	High	56	71	12
	Medium	47	163	38
	Low	14	42	81