Assignment I

1. Suppose a population of 4 computers with their lifetimes 3, 5, 7 & 9 years. Comment on the population distribution. Assuming that you sample with replacement, select all possible samples of n = 2, and construct sampling distribution of mean and compare the population distribution and sampling distribution of mean. Compare population mean versus mean of all sample means, and population variance versus variance of sample means and comment on them with the support of theoretical consideration if any.
2. Describe the concept of sampling distribution of mean with reference to the population data (20, 21, 22 & 23) of size 4. In order to explain this, perform simple random sampling with replacement taking all possible samples with sample size n = 2. While describing the sampling distribution following issues will be covered.
   population mean & population variance, and its distribution
   Sample mean & sample variance, and its distribution
   Comparison of population mean and sample mean; population variance and sample variance; population distribution and sampling distribution based on the given data.
   Standard error of mean
   Final comments based on your result
3. Explain sampling distribution of mean with some reference to numerical example. Illustrate the practical implication of central limit theorem in inferential statistics
4. A study of 1000 computer engineers conducted by their professional organization reported that 300 stated that their firms' greatest concern was to uplift the professional quality of work. In order to conduct a follow up study to estimate the population proportion of computer engineers to fulfill their greatest concern within ±0.01 with 99% confidence interval, how many computer engineers would be required to be surveyed?
5. What do you understand by estimation? If we want to determine average mechanical aptitude of a large group of workers, how large a random sample is need to be able to assert with probability 0.95 that the sample mean will not differ from the true mean by more than 2.0 points? Assume that population standard deviation is 30.
6. The average time taken by server to execute an algorithm varies from time to time. From the past experience it is known that the time taken is normally distributed with standard deviation of 6.7 minutes. The IT manager wishes to estimate the average by drawing a random sample such that the probability is 0.95 that the mean of the sample will not deviate by more than 1 minute from the population mean. What should be sample size?
7. An effort to estimate the mean amount per customer for dinner at a major Atlanta restaurant , data were collected for a sample of 49 customers and a sample mean is found as $ 24.8. Assume population standard deviation is $ 5 .
   a. Compute standard error of mean
   b. Find 95% confidence interval estimate for the population mean
8. A survey was conducted among 70 students studying B.Sc. CSIT in some colleges randomly. Among them 50 students secured more than 80% marks in Statistics. Compute 99% and 95%

confidence interval for population proportion of students who secured more than 80% marks in the subject statistics and comment on the results

9. A manufacturer of computer paper has a production process that operates continuously throughout an entire production shift. The paper is expected to have an average length of 11 inches and standard deviation is known to be 0.01 inch. Suppose random sample of 100 sheets selected and the average paper length is found to be 10.68 inches. Set up 95% and 99% confidence interval estimate of the population average paper length.
10. A machine produce metal rods used in an automobile suspension system. A random sample of 6 rods is selected and diameter is measured. The measuring data (in millimeters) are as follows. Assuming that the sample drawn from the normally distributed population.

8.24	8.26	8.20	8.28	8.21	8.23

Find 95% two sided confidence interval on the mean rod diameter, and interpret the result with reference to the given problem.

11. A random sample of 10 bulbs has the following life in months; 24, 26, 32, 28, 20, 20, 23, 34, 30 and 43. Obtain the 95% confidence limit for the population mean life of bulbs.
12. In order to ensure efficient usage of a server, it is necessary to estimate the mean number of concurrent users. According to records, the average number of concurrent users at 100 randomly selected times is 37.7, with a sample standard deviation of 9.2. At the 1% level of significance, do these data provide considerable evidence that the mean number of concurrent users is greater than 35? Draw your conclusion based on your result.
13. A dealer of a DELL company located at New Road claimed that the average lifetime of a multimedia projector produced by Dell Company is greater than 60,000 hours with standard deviation of 6000 hours. In order to test his claim, sample of 100 DELL projectors are taken and the average life time was monitored and it was found to be 55,000 hours. Test the claim of the dealer at 5% level of significance.
14. It is claimed that Samsung and Redmi mobiles are equally popular in Kathmandu. A random sample of 500 people from Kathmandu showed 300 have Samsung mobile. Test the claim at 5% level of significance.
15. A sample of 250 items from lot A contains 10 defective items, and a sample of 300 items from lot B is found to contain 18 defective items. At a significance level $\alpha = 0.05$, is there a significant difference between the quality of the two lots?
16. In location I there are 250 corona positive cases out of 460 persons and in location 2 , 250 positive cases reported out of 650 persons. Can it be concluded that proportion of corona positive cases is higher in location 1 compared to location 2? Test at 10% level of significance.
17. What do you mean by hypothesis? Describe null and alternative hypothesis. A company claims that its light bulbs are superior to those of the competitor on the basis of study which showed that a sample of 40 of its bulbs had an average life time 628 hours of continuous use with a standard deviation of 27 hours. While sample of 30 bulbs made by the competitor had an average life time 619 hours of continuous use with a standard deviation of 25 hours. Test at 5% level of significance, whether this claim is justified?
18. Based on the following information, performed the following:
    (i)Test whether two mean are significance different ($\alpha = 5\%$) using independent t-test.
    (ii)Compute 95% confidence interval estimation for the difference of mean.
    (iii)Show the linkage between testing of hypothesis and confidence interval estimation in this problem.

	Group A	Group B
Sample mean	10	15
Sample Standard Deviation	3	5
Sample Size	49	64

19. Two random sample of Nepalese people taken from rural and urban region gave the following data of income;

Sample from	size	Average daily income	sd
Rural region	15	800	50
Urban region	10	1250	30

Test whether the average daily income of rural people is significantly less than that of urban people.

20. Previous literature has reported that the average age of B.Sc CSIT enrolling students in Tribhuvan University is 22 years. A researcher has doubts on this information and he feels that the average age to be less than 22 years. In order to examine this following sample data were collected randomly from the enrolling students of CSIT

Age in years : 20 19 22 23 19 20 21 20 19 20

Set up null and alternative hypothesis and test whether the researcher doubt will be justified. Use 5% level of significance. Assume that the parent population from which samples are drawn is normally distributed

21. Two kinds of manure were applied to sixteen one hector plot, other condition remaining the same. The yield in quintals are given below;

Manure I	51	18	20	36	50	49	36	34	49
Manure II	29	28	26	35	30	44	46		

Is there any significant difference between the mean yields? Use 5% level of significance.

22. Define type I and type II error in testing of hypothesis. A psychologist wishes to verify that a certain drug increases the reaction time to given stimulus. The following reaction times (in tenth of seconds) were recorded before and after injection of the drug for each of four subjects

	Subject	1	2	3	4
Reaction time	Before	7	2	12	12
	After	13	3	18	13

Test at 5% level of significance to determine whether the drug significantly increases reaction time.

23. Following are the scores obtained by 10 university staffs on the computer proficiency skills before training and after training. It was assumed that the proficiency of computer skills is expected to be increased after training.

	Score	
Staff	Before training	After training
1	50	55
2	30	40
3	15	30
4	22	30
5	34	36

6	45	45
7	40	41
8	10	30
9	26	40

Test at 5% level of significance whether the training is effective to improve the computer proficiency skills applying appropriate statistical test. Assume that the given score follows normal distribution.

24. A drug was given to 10 patients. The change in blood pressure of patients were recorded as 8, 10, -2, 0, 5, -1, 9, 12, 6 and 5. Is it reasonable to believe that drug has increase blood pressure? Use 5% level of significance.
25. Define central limit theorem. The life of a certain brand of an electric bulb may be considered a random variable with mean 1350 hours and standard deviation 550 hours. Using central limit theorem, find the probability that the average life time of 100 bulbs exceeds 1440 hrs.
26. Write short notes on
    (i) Properties of good estimator
    (ii) Estimation of minimum sample size for given proportion
    (iii) Test of equality of two variances
    (iv) level of significance and Critical value