	Tutorial: Testing of Hypothesis
Q.1	Some dice was thrown 400 times and six resulted 80 times. Do the data justify the hypothesis of an unbiased dice?
Q.2	A sample of 100 tyers is taken from a lot. The mean life of tyers is found to be 39350 kms with a S.D. of 3260. Could the sample come from a population with mean life of 40000 kms? Establish 99% confidence limits within which mean life of tyers is expected to lie?
Q.3	The monthly salaries of women professionals' average to Rs. 66030. Do men in similar professions have average monthly salaries that are higher than those for women? A random sample of $n = 36$ men in professional positions shows Rs. 67,053 and S.D. Rs. 1800. Test the hypothesis using LOS as 5%.
Q.4	It has been claimed that the resistance of electric wire can be reduced by more than 0.050 ohm by alloying. To test this claim, 32 values obtained for standard wire yielded mean 0.316 ohm and S.D. 0.004 ohm and other 32 values obtained for alloyed wire yielded mean 0.083 ohm and S.D. 0.005 ohm. At the 5% ohm LOS does this support the claim?
Q.5	Twenty people were attacked by a disease and only 18 survived. Will you reject the hypothesis that the survival rate if attacked by this disease is 85 % in favour of the hypothesis that it is more at 5 % level.
Q.6	The mean life of a random sample of 10 light bulbs was found to be 1456 hours with a standard deviation of 423 hours. A second sample of 17 bulbs chosen at random from a different batch showed a mean life of 1280 hours with a standard deviation of 398 hours. Is the difference between the mean life of the two batches significant at 5 % level of significance?
Q.7	The manager of a theatre complex with four theaters wanted to see whether there was difference in popularity of the four movies currently showing for Saturday afternoon with the following results: 86,77,84,81 custormers viewed movies 1,2,3, and 4 respectively. Complete the test to see whether there is a difference at the 5 % level of significance.
Q.8	Ten objects are chosen at random from a large population and their weights are found to be in grams:61,63,64,65,68,69,69,70,71,71. Discuss the suggestion that the mean is 65 g. [Use $t_{0.05}=2.262$ at $v=9$]
Q.9	The means of simple samples of sizes 1000 and 2000 are 67.5 cm and 68 cm respectively. Can the samples be regarded as drawn from the same population of standard deviation 2 cm. [use $Z_{0.05}=1.96$]
Q.10	A sample of 20 items has mean 42 units and standard deviation 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units. [t at 5% level for 19 d.f. is 2.09.]
Q.11	Samples of sizes 10 and 14 were taken from two normal populations with standard deviation 3.5 and 5.2. The sample means were found to be 20.3 and 18.6. Test whether the means of the two populations are the same at 5% level. [$t_{0.05}=2.0739$].
Q.12	Two independent samples of 8 and 7 items respectively had the following values of thevariable (weight in kg): Sample I : 9 11 13 11 15 9 12 14 Sample II: 10 12 10 14 9 8 10

	Do the two estimates of population variance differ significantly? Given that for (7,6) d.f. the value of F at 5% level of significance is 4.20 nearly.
Q.13	Two samples of size 9 and 8 give the sum of squares of deviations from their respective means equal 160 inches and 91 inches square respectively. Can they be regarded as drawn from two normal populations with the same variance? (F for 8 and 7 d.f. = 3.73).
Q.14	The following figures refer to observations in live independent samples: Sample I: 25 30 28 34 24 20 13 32 22 38 Sample II: 40 34 22 20 31 40 30 23 36 17 Analyse whether the samples have been drawn from the population of equal means. [t at 5% level of significance for 18 d.f is 2.1] Test whether the means of two population are same at 5% level (t at 0.05=2.0739)
Q.15	500 units from a factory are inspected and 12 are found to be defective, 800 units from another factory are inspected and 12 are found to be defective. Can it be concluded at 5% level of significance that production at second factory is better that in first factory. ($Z_{0.05}$ = ±1.96)
Q.16	Two salesmen A and B are working in a certain district. From a sample survey conducted by the head office, the following results were obtained. Whether is there any significant difference in the average sales between two salesmen's? A B Number of sales 20 18 Average sales in Rs. 170 205 Standard deviation in Rs. 20 25 The critical value of t at 5% level of significance and 36 degree of freedom is more than 36.
Q.17	A random sample of size 15 from a bivariate normal population gave correlation coefficient $r=0.5$. Is this indicate the correlation in the population? Choose $\alpha = 0.05$ as level of significance, $(\tau_{\alpha/2, 13}) = 2.160$
Q.18	The mean of 35 sample of the thermal conductivity of a certain kind of cement brick is 0.343 with standard deviation of 0.010. Test the hypothesis that the population mean is 0.340 at 5% level of significance.
Q.19	A tire company is suspicious to claim that the average lifetime of certain tires is at least 28000 km. To check the claim, the company takes the sample of 40 tires and gets a mean life time of 27463 km with standard deviation of 1348 km. Test the hypothesis at 1% level of significance.
Q.20	A manufacturer of fuses claims that with a 20% overload, the fuses will blow in 12.40 minutes on the average. To test the claim, a sample of 20 of the fuses was subjected to a 20% overload, and the times it took them to blow had a mean of 10.63 minutes and a s.d. of 2.48 minutes. If it can be assumed that the data constitute a random sample from a normal population, do they tend to support or refute the manufacturer's claim?
Q.21	If two independent random samples of size $n_1 = 13$ and $n_2 = 7$ are taken from a normal population. What is the probability that the variance of the first sample will be atleast four times as that of the second sample?

Q.22	If two independent random samples of size $n_1 = 26$ and $n_2 = 8$ are taken from a normal population. What is the probability that the variance of the second sample will be atleast 2.4 times as that of the first sample?
Q.23	If S_1^2 and S_2^2 are the variances of independent random samples of size $n_1 = 10$ and $n_2 = 15$ from normal population with equal variances find $P(S_1^2/ S_2^2 < 4.03)$?
Q.24	A courier service advertises that its average delivery time is less than 5 hours for local deliveries. A random sample of 10 for the amount of time this courier service takes to deliver packages to an addressee across town produced the following times: 8,3,4,7,10,5,6,4,5,8. Is this evidence support the claim of the courier service at 5 % level of significance?
Q.25	If 57 out of 150 patients suffering from certain disease are cured by allopathy and 33 out of 100 patients with the same disease are cured by homeopathy, is there reason to believe that allopathy is better than homeopathy at 0.05 level of significance?
Q.26	A process for making certain bearings is under control if the diameters of the bearings have a mean of 0.5000 cm. What can we say about this process if a sample of 10 of these bearings has a mean diameter of 0.5060 cm and a standard deviation of 0.0040 cm?
Q.27	An auto company claims that the mean petrol consumption of its new six-cylinder car is 9.5 km per liter which is lower than the existing auto engine. It was found that the mean petrol consumption of a sample of 50 of these cars was 10 km per liter with a standard deviation of 3.5 km per liter. Test the claim at 5 % level of significance.
Q.28	A stenographer claims that she can type at the rate of 120 words per minute. She demonstrated, based on 100 trials, an average speed of 116 words with a standard deviation of 15 words. Does this enable us to reject the null hypothesis $\mu=120$ against the alternative hypothesis $\mu<120$ at the 0.05 level of significance?
Q.29	A random sample from a company's very extensive files shows that orders for a certain piece of machinery were filled, respectively, in 10,12,19,14,15,18,11 and 13 days. Use the level of significance $\alpha=0.01$ to test the claim that on average such orders are filled in 10.5 days. Choose the alternative hypothesis so that rejection of the null hypothesis $\mu=10.5$ implies that it takes longer than indicated. Assume normality.
Q.30	The dean of a college wants to use the mean of a random sample to estimate the average amount of time students take to get from one class to the next, and she wants to be able to assert with 99 % confidence that the error is at most 0.25 minute. If it can be presumed from experience that $\sigma=1.40$ minutes, how large a sample will she have to take?
Q.31	Ten bearings made by a certain process have a mean diameter of $0.506\ cm$ and a standard deviation of $0.004\ cm$. Assuming that the data may be looked upon as a random variable from a normal population, construct a 95 % confidence interval for the actual average diameter of bearings made by this process.
Q.32	A consumer protection agency wants to test a paint manufacturer's claim that the average drying time of his new paint is 20 minutes. It instructs a member of its research staff to paint each of 36 boards using a different 1−gallon can of the paint, with the intention of rejecting the claim if the mean of the drying times exceeds 20.75 minutes. Otherwise, it will accept

	the claim. Find the probability of a Type I error. Also, find the probability of a Type II error when $\mu=21$ minutes. Assume that $\sigma=2.4$ minutes.
Q.33	In a study of automobile collision insurance costs, a random sample of 80 body repair costs for a particular kind of damage had a mean of 33065 $Rs.$ and a standard deviation of 4364 $Rs.$ If $\bar{x}=33065$ $Rs.$ is used as a point estimate of the true average repair cost of this kind of damage, with what confidence can one assert that the error does not exceed 700 $Rs.$?
Q.34	Two random samples are drawn from two populations and the following results were obtained: Sample I: 21 24 25 26 27 Sample II: 22 27 28 30 31 36 Find the variances of the two samples and test whether the two populations have the same variances.[Use $F0.05(5,4)=6.26$.]
Q.35	The manager at Costello Drug Store assumes the company's employees are honest. However, there have been many shortages from the cash register lately. There is only one employee who could have taken money from the register during these periods. Realizing that the shortages might have resulted from the employee inadvertently giving incorrect change to customers, the employer does not know whether to forget the situation or accuse the employee of theft. In words, what are the null and alternative hypotheses? Explain your choices. (a) What constitutes a Type I error in this problem? (b) What is a Type II error? Which do you think is more serious? Explain.