**Task Session 4**

**1) An automobile manufacturer recommends oil change intervals of 3, 000 miles. To compare actual intervals to the recommendation, the company randomly samples records of 50 oil changes at service facilities and obtains sample mean 3, 752 miles with sample standard deviation 638 miles. Determine whether the data provide sufficient evidence, at the 5% level of significance, that the population mean interval between oil changes exceeds 3, 000 miles.  
  
2) A medical laboratory claims that the mean turn-around time for performance of a battery of tests on** **blood samples is 1.88 business days. The manager of a large medical practice believes that the actual mean is larger. A random sample of 45 blood samples yielded mean 2.09 and sample standard deviation 0.13 day. Perform the relevant test at the 10% level of significance using these data.**

**3) A grocery store chain has as one standard of service that the mean time customers wait in line to begin checking out not exceed 2 minutes. To verify the performance of a store the company measures the waiting time in 30 instances, obtaining mean time 2.17 minutes with standard deviation 0.46 minute. Use these data to test the null hypothesis that the mean waiting time is 2 minutes versus the alternative that it exceeds 2 minutes, at the 10% level of significance  
  
4) A magazine publisher tells potential advertisers that the mean household income of its regular readership is $61, 500 An advertising agency wishes to test this claim against the alternative that the mean is smaller. A sample of 40 randomly selected regular readers yields mean income $59, 800 with standard deviation $5, 850 Perform the relevant test at the 1% level of significance  
  
5) Authors of a computer algebra system wish to compare the speed of a new computational algorithm to the currently implemented algorithm. They apply the new algorithm to 50 standard problems; it averages 8.16 seconds with standard deviation 0.17 second. The current algorithm averages 8.21 seconds on such problems. Test, at the 1% level of significance, the alternative hypothesis that the new algorithm has a lower average time than the current algorithm.**

**6) The mean household income in a region served by a chain of clothing stores is $48, 750 In a sample of 40 customers taken at various stores the mean income of the customers was $51, 505 with standard deviation $6, 852  
  
a. Test at the 10% level of significance the null hypothesis that the mean household income of customers of the chain is $48, 750 against that alternative that it is different from $48, 750  
  
b. The sample mean is greater than $48, 750 suggesting that the actual mean of people who patronize this store is greater than $48, 750 Perform this test, also at the 10% level of significance. (The computation of the test statistic done in part (a) still applies here.)**

**7) What are the types of statistical test and how we use each of them ?**

**8) What is COHEN `S D rule ?**

**9) What is meant by statistical power and how we use it ?**

**The Answers**

**1) x = 3,752 | S = 638 | n = 50**

**Hypothesis H0 will be that the oil changes every 3,000 miles.**

**Hypothesis H1 will say H0 is not true.**

**Z – score = = 8.335 | Yes, it’s and the there is a sufficient data to prove this.**

**2) x = 2.09 | S = 0.13 | n = 45 | 10% level of significance**

**H0 blood samples is 1.88**

**H1 will say H0 is not true**

**Z – score = 10.8363294294 | Reject H0. There is strong evidence that the actual mean turn-around time exceeds 1.88 days.**

**3) X0 = 2 min | x = 2.17 | S = 0.46 min | n = 30 | 10%**

**H0 2 min or less**

**H1 more than 2 min**

**Z – score = 2.02419206035 | Fail to reject H0. There isn't enough evidence to claim that the mean waiting time exceeds 2 minutes.**

**4) X0 = $61,500 | x = $59,800 | S = $5,850 | n = 40 | %1**

**H0 mean = X0**

**H1 mean < X0**

**Z – score = -1.83790496488 | Fail to reject H0. No evidence to suggest the mean income is lower than $61,500.**

**5) X0 = 8.21 | n = 50 | x = 8.16 | S = 0.17 | 1%**

**H0 mean = X0**

**H1 mean < X0**

**Z – score = -2.07972582702**

**We do not reject the null hypothesis.**

**6) X0 = $48,750 | n = 40 | x = $51,505 | S = $6,852**

**H0 mean = X0**

**H1 mean < X0**

**Z – score = -1.83790496488**

**we do not reject the null hypothesis.**

**The b) is also do not reject the null hypothesis.**

**7) There are several types of statistical tests**

**- Hypothesis Test: Used to compare the means of two groups. For example, comparing the average heights of men and women.**

**- Regression tests: Used to determine cause-and-effect relationships between variables.**

**- Correlation tests: Used to test the strength of association between two continuous variables.**

**8) Cohen's D is a measure of effect size used in the context of a difference between two means. It's calculated as the difference between two means divided by the pooled standard deviation of the scores in both groups. Here's how to interpret Cohen's**

**- A d of 0.2 is considered a small effect size.**

**- A d of 0.5 represents a medium effect size.**

**- A d of 0.8 represents a large effect size.**

**9) Statistical power, or sensitivity, is the likelihood of a significance test detecting an effect when there actually is one. It is the probability of avoiding a Type II error (failing to reject the null hypothesis when we actually should). High power in a study indicates a large chance of a test detecting a true effect. Power is mainly influenced by sample size, effect size, and significance level. A power analysis can be used to determine the necessary sample size for a study.**