KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS & STATISTICS
DHAHRAN, SAUDI ARABIA

STAT 302: Statistical Inference
Semester 151
Third Major Exam
Saturday December 05, 2015
6:00 − 8:00 pm

Name: ID #:

Question No	Full Marks	Marks Obtained
1	**08**	
2	**10**	
3	**04**	
4	**07**	
5	**07**	
6	**10**	
Total	**46**	

Q.No.1:- (5+3 = 8 points)

a)   For a random sample of size n drawn from the probability density function

$$f(x) = (1 + \alpha)x^{\alpha}; \quad 0 < x < 1$$

Find the Maximum Liklihood Estimator (MLE) for the unknown parameter α. Also check (using the second derivative) whether the likelihood function has been maximized or minimized.

b)   Estimate the parameter β of the distribution $f(x; \beta) = \beta e^{-\beta x}$ for $0 \leq x \leq \infty$, by the method of moments.

Q.No.2:- (5+5 = 10 points) Let X represents a random variable following $N(\mu, \sigma^2 = 9)$. The hypotheses are $H_0: \mu = 4$ against $H_1: \mu = 11/4$. A sample of size 25 is selected randomly and H_0 is rejected if sample mean is less than $7/4$. Find the probability of type I error and the power of the test.

Q.No.3:- (4 points) Define simple and composite hypotheses. Give an example of both.

Q.No.4:- (5+2 = 7 points) Two suppliers manufacture a plastic gear used in a laser printer. The impact strength of these gears measured in foot-pounds is an important characteristic. A random sample of 16 gears from supplier 1 results in $\bar{x}_1 = 321$ and $s_1 = 21$, while another random sample of 10 gears from the second supplier results in $\bar{x}_2 = 290$ and $s_2 = 18$.

a)   Construct a 98% confidence interval estimate for the difference in mean impact strength and interpret this interval.

b) Based on the interval in part (a), can we conclude that the impact strength of gears for both suppliers is same? (Clearly state your hypotheses and then give the answer).

Q.No.5:- (5+2 = 7 points) An automobile insurance company selected random samples of 300 single male policyholders and 300 married male policyholders. The resulting sample data were that 19% of the single policyholders and 12% of the married ones had reported an accident at some time within the past 3 years.

a)   Estimate the true difference between the two population proportions in these two types of policyholders using 99.5% confidence interval.

b)   Using the interval from part (a), would you agree with the claim that there is a difference in these two types of policyholders? (Clearly state your hypotheses and then give the answer).

Q.No.6:- (10 points) A cold drink company claims that the average liquid filled in their cold drink tins is 250 ml. To test this claim, we took a sample of 16 cans and measured the exact amount of liquid in each can, which is given as follows:

252.6	251.4	246.3	255.6	249.5	252.1	253.6	252.6	250.8	247.8	254.6	253.4	253.7	249.8	246.6	254.2

For testing the claim of company, develop a critical region using likelihood ratio test and then give your decision (Clearly state your hypotheses and then give the answer). Use $\alpha = 0.05$ and assume that the data is approximately normal.

With Best Wishes