Indian Statistical Institute, Bangalore
M.S. (QMS) First Year
Second Semester – Statistics for Decision Making II

Final Exam Duration: 3 Hrs Date: May 04, 2017 Max Marks: 50

Answer as many questions as you can, but the maximum score you can get is 50 only.

1. For the One Way ANOVA, consider the fixed effect model $y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$, (for all i=1,2,....,a & j=1,2,.....,n), where ,
   μ = Overall Population mean,
   α_i = Effect of the ith class of attribute A,(i=1,2,.....,a) and
   ε_{ij} = Error for the jth observation in the ith class(j=1,2,.....,n), and
   ε_{ij}'s (for each i=1,2,....,a & j=1,2,.....,n) are independently normally distributed with zero mean and constant variance = σ^2.

   Show that E(MSA)= $\sigma^2 + n\left(\frac{\sum_{i=1}^{a} {\alpha_i}^2}{a-1}\right)$ [10]

2. Show that -1≤ $r \leq 1$, where 'r' is the correlation coefficient between two variables x and y . [10]

3. It is known that a sample consisting of the values 11.5, 11.2, 13.5, 12.3, 13.8, and11.9 comes
   from a population with the density function

   $f(x; \theta) = \frac{\theta}{x^{\theta+1}}$

   =0, elsewhere,

   where $\theta > 0$. Find the maximum likelihood estimate of θ. [8]

   or

   Ten engineering colleges in India were surveyed. The sample contained 250 electrical engineers, 80 being women; 175 chemical engineers, 40 being women.
   (a) Compute a 90% confidence interval for the difference between the proportions of women in these two fields of engineering.
   (b) Is there a significant difference between the two proportions? [6+2=8]

4. Engineers at a large automobile manufacturing company are trying to decide whether to purchase brand *A* or brand *B* tyres for the company's new models. To help the arrive at a decision, an experiment is conducted using 12 of each brand. The tyres are run until they wear out. The results are as follows:

   Brand *A*: x1bar = 37,900 kilometers, s1 = 5100 kilometers.
   Brand *B*: x1 bar = 39,800 kilometers, s2 = 5900 kilometers.

Test the hypothesis that there is no difference in the average wear of the two brands of tyres. Assume the populations to be approximately normally distributed with equal variances. [10]

5. The grades of a class of 9 students on a midterm report (x) and on the final examination (y) are as follows:

x: 77 50 71 72 81 94 96 99 67
y: 82 66 78 34 47 85 99 99 68

(a) Estimate the linear regression line.
(b) Estimate the final examination grade of a student who received a grade of 85 on the midterm report. [8+2=10]

6. An experiment was conducted to study the effects of temperature and type of oven on the life of a particular component. Two types of ovens and 3 temperature levels were used in the experiment. Twelve pieces were assigned randomly, two to each combination of treatments, and the following results recorded.

Temperature	OVEN	
	1	2
500	227, 221	214, 259
550	187, 208	181, 179
600	174, 202	198, 194

Analyze the data and draw conclusions (use α =0.05).

[12]