TXL 382: Applied Statistics for Textile Engineers

Major Test

Full Marks: 40

Date: November 21, 2017 **Time: 3:30 pm - 5:30 pm** **Venue: LH108**

1) State, by giving reasons, whether the following statements are TRUE or FALSE. 6×1

a) A large sample gives more precise estimate of population mean than does by a small sample.

b) $S^2 = \sum_{i=1}^{n}\frac{(x_i-\bar{x})^2}{n-1}$, is a biased estimator of population variance.

c) The coefficient of determination (R^2) ranges from 0 to 1.

d) In ANOVA, if all population means are equal then the value of F-ratio is very high.

e) An acceptance sampling plan with a higher value of n offers less discriminatory power than that with a ~~higher~~ lower value of n.

f) If $C_p = 1.0$ then the associated process fallout (in defective parts per million) for a normally distributed process with one-sided specification is 1350.

2) A textile engineer performs an experiment to determine the effect of four different types of chemicals on the strength of a fabric. Each chemical type is applied on five different types of fabrics and the experimental data are shown in Table 1. Perform a two-way analysis of variance to conclude whether the chemical types are different so far as their effect on fabric strength is concerned. Use level of significance as 0.01. **12**

Table 1

Chemical type	Fabric sample				
	1	2	3	4	5
1	1.3	1.6	0.5	1.2	1.1
2	2.2	2.4	0.4	2.0	1.8
3	1.8	1.7	0.6	1.5	1.3
4	3.9	4.4	2.0	4.1	3.4

3) A garment retailer receives batches of garments and decides to accept or reject a batch according to an acceptance sampling plan for which AQL is 4%, RQL is 16%, producer's risk is 5% and consumer's risk is 10%. (a) Determine sample size and acceptance number. (b) Determine the probability of acceptance of a batch produced by a process that manufactures 10% defective garments. 7+3

4) A yarn-manufacturing company receives an order for a large quantity of yarns with a mean breaking strength of 15 $cN.tex^{-1}$ and a standard deviation of breaking strength of 1 $cN.tex^{-1}$. The company wishes to set up a control chart with samples of size 100 such that the probability of rejecting good yarns produced by a statistically-controlled process is 0.01. (a) Calculate the upper and lower control limits for the mean chart of yarn strength. (b) Determine the probability of accepting bad yarns produced by a statistically-uncontrolled process when the mean breaking strength is shifted to 14.5 $cN.tex^{-1}$. Assume that the standard deviation of breaking strength is remained at 1 $cN.tex^{-1}$. 3+3

5) Consider two yarn-manufacturing processes and the mean and standard deviation of the breaking strength of the yarns resulting from these processes are given in Table 2.

Table 2

Process	Characteristics	
	Mean (cN)	Standard deviation (cN)
A	100	3
B	105	1

The specifications on the yarn breaking strength are given as 100 ± 10 cN. (a) Compute C_p, C_{pk}, and C_{pm} for both the processes and interpret them. (b) Which of the two processes would you prefer to use and why? 4+2

[End of Question Paper]