Assignment - III

1. What do you mean by Design of Experiment? Physians depend the laboratory test results when managing the medical problems such as diabetes or epilepsy. In a uniformity test glucose tolerance, three different laboratories were each ni=5 identical blood samples from a person who had drunk 50 mg of glucose dissolved in water. The laboratory results (mg/dl) are listed here:

Lab 1	Lab 2	Lab 3
12.1	9.3	10.0
11.7	11.1	10.5
10.9	10.7	10.1
10.2	10.9	11.0
10.6	9.01	10.4

   Do the data indicate a difference in the average readings for three laboratories? Use 0.05 level of significance

2. State the mathematical model for statistical analysis of m$\times$ m LSD for one observation per experimental unit. Also prepare dummy ANOVA table for this
3. What do you mean by Latin square design? Give mathematical model with meanings. Following information represent yield on using different types of treatments

A 12	C 16	B 11	D 20
B 21	D 19	C 15	A 13
C 16	A 13	D 16	B 19
D 10	B 14	A 19	C 16

   Carry out analysis of the design

4. Give layout of Completely Randomized Design. Write down mathematical model and ANOVA table of the design.
5. For the ANOVA summary table below, fill in all the missing results. Also indicate your statistical decision for four different treatments.

Source	Degree of freedom	Sum of square	Mean sum of square	F
Treatment	?	?	70	?
Error	12	590	?	
Total	?	?		

6. Consider the partially completed ANOVA table below. Complete the ANOVA table and answer the following.

Source of variation	Sum of square	Degree of freedom	Mean sum of square	F value
Columns	72	?	?	2
Rows	?	?	36	?
Treatments	180	3	?	?
Error	?	6	12	
Total	?	?		

(i) What design was employed?

(ii) How many treatments were compared?

7. What do you mean by Randomized Block Design? Give mathematical model of the design with meaning. Following information represent yield on using different types of treatments

A 12	C 16	A 11	D 17
B 18	D 14	C 15	A 11
C 15	A 13	B 12	B 15
D 11	B 12	D 14	C 16

Carry out analysis of the design

8. Every day is generally considered as either sunny or rainy. A sunny day is followed by another sunny day with probability 0.6 whereas a rainy day is followed by a sunny day with probability 0.5 .Suppose it rains on Monday. Make forecasts for Tuesday and Wednesday.

9. Define queuing systems with suitable examples. Also explain the main components of queuing systems in brief.

10. In some town, each day is either sunny or rainy. A sunny day is followed by another sunny day with probability 0.7, whereas a rainy day is followed by a sunny day with probability 0.4. Weather conditions in this problem represent a homogeneous Markov chain with 2 states: state 1 = "sunny" and state 2 = "rainy." Transition probability matrix of sunny and rainy days is given below.

$$P = \begin{pmatrix} 0.7 & 0.3 \\ 0.4 & 0.6 \end{pmatrix}$$

Compute the probability of sunny days and rainy days using the steady-state equation for this Markov chain.

11. What are basic concepts of queuing theory? In a super market, the average arrivals rate of customers is 10 per every 30 minutes following Poisson process. The average time taken by the cashier to list and calculate the customers purchase is 2.5 minutes following exponential distribution. What is probability that queue length exceeds 6? What is expected time spent by customer in the system?

12. Laptop computers arrive at a repair shop at the rate of four per day. Assume an 8-hour working day. The expected time to complete service on a laptop is 1.25 hours. Model this process as a

single-server Bernoulli queuing process with 15-minute frames. a) Find the service rate. b) Find the arrival and service probabilities

13. In a health clinic, the average rate of arrival of patients is 12 patients per hour. On an average, a doctor can serve patients at the rate of one patient every four minutes. Assume, the arrival of patients follows a Poisson distribution and service to patients follows an exponential distribution. (i) Find the average number of patients in the waiting line and in the clinic (ii) Find the average waiting time in the waiting line or in the queue and (iii) average waiting time in the clinic.
14. Jobs are sent to mainframe computer at a rate of 4 jobs per minute. Arrivals are modeled by a binomial process;
    - (i) Choose a frame size that makes the probability of a new received during each frame equal to 0.1
    - (ii) Using the chosen frame compute the probability of more than 4 jobs received during one minute.
    - (iii) Compute mean and variance of inter arrival time.
15. Write short notes on following
    - i. Markov chain
    - ii. Stochastic process
    - iii. Principles of design
    - iv. n step transition probability
    - v. Markov process
    - vi. Experimental error
    - vii. Relative efficiency
    - viii. Assumptions of ANOVA
    - ix. Efficiency of Randomized Block Design relative to Completely Randomized Design
    - x. Efficiency of Latin square design relative to Randomized Block Design