COURSE CODE (CREDITS): 18B11MA411 (3)

MAX. MARKS: 35

COURSE NAME: Biostatistics

COURSE INSTRUCTORS: Dr. Saurabh Srivastava

MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets. Scientific calculator is allowed.

Q1. (a) Observations on the yield of a chemical reaction taken at various temperatures were recorded as follows:

$x(^0C)$	150	150	200	250	250	300
$y(\%)$	75.4	81.2	85.5	89.0	90.5	96.7

Fit a simple linear regression line and estimate the yield at 175^0C.   [3](CO1)

(b) Write normal equations for fitting a cubic regression model of the form;   [2](CO2)

$$y = b_0 + b_1 x + b_2 x^2 + b_3 x^3.$$

Q2. The following data represent the number of hours taken by certain physical process in laboratory for 16 samples:

2.4   2.3   3.1   2.2   2.3   1.2   1.0   2.4   1.7   1.1   4.2   1.9

1.7   3.6   1.6   2.3

Perform a sign test at the 0.05 level of significance to test the claim that the median time required for completing the process is 2.2 hours. [Given that:$\sum_{x=0}^{8} b\left(x; 15, \frac{1}{2}\right) = 0.6964$]

[2](CO3)

Q3.The following data represents the gain in the weights of the patients after having three types of diet programs:

Diet Programs		
Vegetarian	Non-vegetarian	Both
3.9 5.1 3.3 3.6 4.2	4.5 4.4 5.2 4.8 4.5 4.2 3.8	5.4 5.8 4.6 4.5 5.3 5.6

Use the Kruskal-Walli's test, at the 0.01 level of significance to determine if diet programs differ significantly. [Given that:$\chi^2_{0.01} = 9.210$]

[3](CO3)

Q4. Check whether the process$\{X(t)\} = \{10cos(100t + \theta)\}$, where θ is uniformly distributed over $(-\pi, \pi)$, is WSS or not?

[3](CO4)

Q5. Find the mean function for the random process$\{X(t)\} = Acost + Bsint, -\infty < t < \infty$, where A and B are independent random variables each of which has a value -2 with probability $\frac{1}{3}$ and a value 1 with probability $\frac{2}{3}$.

[2](CO4)

Q6. It has been observed via series of tosses of a particular biased coin that the outcome of the next toss depends on the outcome of the current toss. In particular, given that the current toss comes up head, the next toss will come up head with probability 0.6 and tails with probability 0.4. Similarly, given that the current toss comes up tail, the next toss will come up head with probability 0.35 and tail with probability 0.65. Construct the transition probability matrix and state diagram. Find the limiting state probabilities.

[5](CO5)

Q7. A radioactive source emits particles at a rate of 5 per minute in accordance with Poisson's process. Each particle emitted has a probability 0.6 of being recorded. Find the probability that 10 particles are recorded in 4 minutes period.

[3](CO5)

Q8. Draw a diagram for representing the following random walk:

n	0	1	2	3	4	5	6	7	8	9	10
Outcome in tossing of a coin	-	H	T	T	H	H	H	T	H	H	T

Here $x(n)$ increase by two units if a head appears and decrease by three units if a tail appears.

[4](CO5)

Q9. Explain Euclidean and Jaccard distance similarity measures in clustering.

[4](CO6)

Q10. Use agglomerative clustering algorithm for clustering the following matrix. Also construct the dendrogram and find the height.

Items	P	Q	R	S	T
P	0	-	-	-	-
Q	4	0	-	-	-
R	3	5	0	-	-
S	2	7	6	0	
T	1	3	4	3	0

[4](CO6)