Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: Statistical Modelling for Computer Sciences **Semester: I**
Program: M.Tech. (CSE) **Time : 03 hrs.**
Course Code: CSEG7003 **Max. Marks: 100**
No. of printed pages: 3
Instructions: Attempt all the questions. Refer appendix for required distribution tables.

SECTION A

S. No.		Marks	CO
Q1	What is central limit theorem? Suppose the age a student graduates from UPES is Normally distributed. If the mean age is 23.1 years and the standard deviation is 3.1 years, what is the probability that 6 randomly selected students had a mean age at graduation that was greater than 27?	**[4]**	**CO1**
Q2	Suppose some data for two variables x and y is as shown in the table. Use that data to predict the Y value for X = 5 and state how confident you are in your prediction: X: 1, 2, 3 Y: 3, 5, 6	**[4]**	**CO3**
Q3	How do Markov Chains work and what is memorylessness?	**[4]**	**CO4**
Q4	What is queuing network? Differentiate the open queuing and closed queuing networks.	**[4]**	**CO5**
Q5	What is queueing theory? Explain Kendall's notation for representing queueing models?	**[4]**	**CO5**

SECTION B

Q6	What is Naïve Bayes classifier? A test for a disease gives a correct positive result with a probability of 0.95 when the disease is present, but gives an incorrect positive result (false positive) with a probability of 0.15 when the disease is not present. If 5% of the population has the disease, and Jean tests positive to the test, what is the probability Jean really has the disease?	**[10]**	**CO1**
Q7	A used car dealer says that the mean price of used cars sold in the last 12 months is at least $21,000. You suspect this claim is incorrect and find that a random sample of 14 used cars sold in the last 12 months has a mean price of $19,189 and a standard deviation of $2950. Is there enough evidence to reject the dealer's claim at α=0.05? Assume the population is normally distributed.	**[10]**	**CO3**

<table>
<tr><td>Q8</td><td>Discuss the characteristics of Bernoulli trial. You are a telemarketer with a 10% chance of persuading a randomly selected person to switch to your long-distance company. You make 8 calls. What is the probability that exactly one is successful?
or
A manager of a fast food restaurant observes that, an average of 9 customers is served by a waiter in a one-hour time period. Assuming that the service time has an exponential distribution, what is the probability that
a) A customer shall be free within 12 minutes.
b) A customer shall be serviced in more than 25 minutes.
c) A customer shall be serviced in between 10 and 20 minutes.</td><td>[10]</td><td>CO3</td></tr>
<tr><td>Q9</td><td>What is meant by Poisson process? Let X equal the number of typos on a printed page with a mean of 3 typos per page.
a) What is the probability that a randomly selected page has at least one typo on it?
b) What is the probability that a randomly selected page has at most one typo on it?</td><td>[10]</td><td>CO4</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q10</td><td>Suppose that we have a 6-sided die. We assume that the die is unbiased (upon rolling the die, each outcome is equally likely). An experiment is conducted in which the die is rolled 240 times. The outcomes are in the table below. At a significance level of α = 0.05, is there enough evidence to support the hypothesis that the die is unbiased?
<table>
<tr><td>Outcome</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Frequency</td><td>34</td><td>44</td><td>30</td><td>46</td><td>51</td><td>35</td></tr>
</table>
</td><td>[20]</td><td>CO2</td></tr>
<tr><td>Q11</td><td>Discuss M/M/1 queuing system. New Delhi Railway Station has a single ticket counter. During the rush hours, customers arrive at the rate of 10 per hour. The average number of customers that can be served is 12 per hour. Find out the following:
a) Probability that the ticket counter is free.
b) Average number of customers in the queue.
or
At Bharat petrol pump, customers arrive according to a Poisson process with an average time of 5 minutes between arrivals. The service time is exponentially distributed with mean time = 2 minutes. On the basis of this information, find out
a) What would be the average queue length?
b) What would be the average number of customers in the queuing system?
c) What is the average time spent by a car in the petrol pump?
d) What is the average waiting time of a car before receiving petrol?</td><td>[20]</td><td>CO5</td></tr>
</table>

Appendix 1

TABLE D

t distribution critical values

	Upper-tail probability *p*											
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073

Appendix 2

Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of x^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09
6	0.872	1.635	2.204	3.455	5.348	7.84	10.64	12.59	16.81
7	1.239	2.167	2.833	4.255	6.346	9.04	12.02	14.07	18.48
8	1.647	2.733	3.490	5.071	7.344	10.22	13.36	15.51	20.09
9	2.088	3.325	4.168	5.899	8.343	11.39	14.68	16.92	21.67
10	2.558	3.940	4.865	6.737	9.342	12.55	15.99	18.31	23.21
11	3.053	4.575	5.578	7.584	10.341	13.70	17.28	19.68	24.72
12	3.571	5.226	6.304	8.438	11.340	14.85	18.55	21.03	26.22
13	4.107	5.892	7.042	9.299	12.340	15.98	19.81	22.36	27.69
14	4.660	6.571	7.790	10.165	13.339	17.12	21.06	23.68	29.14
15	5.229	7.261	8.547	11.037	14.339	18.25	22.31	25.00	30.58
16	5.812	7.962	9.312	11.912	15.338	19.37	23.54	26.30	32.00
17	6.408	8.672	10.085	12.792	16.338	20.49	24.77	27.59	33.41
18	7.015	9.390	10.865	13.675	17.338	21.60	25.99	28.87	34.80
19	7.633	10.117	11.651	14.562	18.338	22.72	27.20	30.14	36.19
20	8.260	10.851	12.443	15.452	19.337	23.83	28.41	31.41	37.57