

BE INFO TECH 2nd YEAR 2nd SEMESTER EXAMINATION 2023

Mathematics for IT - II

Time: 3 Hours

Full Marks: 100

Answer All Questions

1.a) State The Law of Total Probability. With a Relevant Numerical Example, explain this Law.

b) Create A random experiment and define the events accordingly; so that, we have a case of both Dependent Events and Mutually Exclusive Events at the same time. ((2+3)+5) [CO1]

2.a) If a disease is fairly rare and the antibody test is fairly expensive, then one way to cut down time and money is to do pool testing. In this method, all the incoming patient's (No of patients N) test sample is divided into two halves. One half is used to do pool testing; the other half is kept aside, in case it is required later for individual testing. For pool testing, it is better to group about n test samples together; n being 5, 10, 20 or more. If the test result is negative, then none of the patients (participating in the pool) got the disease; thus saving n-1 tests. However if the result of the pool test is positive; one has to proceed for individual testing, thus requiring n+1 tests all together.

If the infection rate, N and n are 5%, 500 and 5 respectively; then what will be the Expected number of Tests? Justify your answers.

b) Study the following story of a Biased Random Number Generator.

The Random Number Generator generates any integer X whose value is anywhere from 1 to 10. Since this Generator is biased, it gives out even numbers more frequently than the odd numbers. In fact, after a careful study it was noticed that, the probability of generating an odd integer by the generator is just thrice the probability of generating an even integer.

What is the Expected Value and Standard Deviation of X? Justify your answers. (5+5) [CO1]

3.a) A continuous random variable X is having a Uniform distribution with parameters α and β .

What is the Expected Value and Variance of X? Justify your answer.

b) Prove that the Binomial Mean and Variance are np and npq respectively (where the parameters n, p, q are having their usual significance). ((2+2)+(3+3) [CO2]

[Turn over

4. Find the Measures of location, Measures of Spread, third and fourth orders of moments of the following: [Show all the Intermediate Steps] (3+3+2+2) [CO2]

x	1	3	5	6	8	10
f	4	3	6	7	3	2

5.a) Using relevant numerical examples, explain the various characteristic parameters of Sampling Distribution of the Proportion.

b) In a certain test (Full Marks 150) taken by 800 students; the μ and σ came out to be 75 and 15. Approximately, how many students scored less than 45? [Show all the Intermediate Steps] (5+5) [CO3]

6.a) Using Proper Numerical Examples, explain your understanding about Maximum Likelihood Estimation (MLE).

b) Using Proper Numerical Examples, explain your understanding about Point Estimation.

c) List down and explain the characteristics of good estimators. (4+3+3) [CO4]

7.a) List down 8 different OR Tools and Techniques.

b) Using relevant Payoff Matrix, explain Zero-Sum-Game, Pure Strategy, Minimax Criterion, Value of the Game, Equilibrium and Saddle Point.

c) Using relevant Payoff Matrix, explain Mixed-Strategy-Game. Also, calculate expected outcomes for both the parties. (2+4+4) [CO5]

8.a) Using a proper table, explain ABC/VED type of Inventory Classification.

b) List down and explain different costs associated with Inventory.

c) A manufacturer uses Rs.20, 000 worth of an item during the year. Manufacturer estimated the ordering cost as Rs.50 per order and holding costs as 12.5% of average inventory value. Find the optimal order size, number of orders per year, time period per order and total cost. (3+3+4) [CO5]

9.a) Explain Kendall's Notation for Queuing Models.

b) For M/M/1 Queue, draw the state-transition diagram which is also called Markov Chain Model.

c) For the Markov Chain Model, prove:

$P_k = (1 - \rho)\rho^k$, where the symbol ρ has its usual significance related to Queuing Theory.
(2+2+6) [CO6]

10.a) Study the below Activity List for a certain Project. Develop an AON for this Project. Identify the Critical Path and Compute the Project Completion Time.

Activity Name	Immediate Predecessor	Duration (in Weeks)
T1		8
T2	T1	3
T3	T1	6
T4	T1, T3	3
T5	T2	6
T6	T5	7
T7	T3, T6	7

b) Now, modify the above Diagram by adding the ES, EF, LS, LF information.

c) Now, Calculate the Slack and add this information as another column to the Table mentioned above.
(4+3+3) [CO6]

Z-Table

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
+0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
+0.1	.53983	.54380	.54776	.55172	.55567	.55966	.56360	.56749	.57142	.57535
+0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
+0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
+0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
+0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
+0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
+0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
+0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
+0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
+1	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
+1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
+1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
+1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91308	.91466	.91621	.91774
+1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
+1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
+1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
+1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
+1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
+1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
+2	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
+2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
+2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
+2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
+2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
+2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
+2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
+2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
+2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
+2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
+3	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
+3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
+3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
+3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
+3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
+3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
+3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
+3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
+3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
+3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997
+4	.99997	.99997	.99997	.99997	.99997	.99997	.99998	.99998	.99998	.99998