504105

January 2023
M.Tech. (CSE) 1st SEMESTER
Mathematical Foundations of Computer Science
(MCS-18-101)

Time : 3 Hours]   [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Normal distribution table has been provided.*

PART–A

1. (a) An unbiased coin is tossed 10 times, what is expected number of heads.   (1.5)

    (b) Write the equation for Markov's inequality.   (1.5)

    (c) What is the purpose of pooling in CNN?   (1.5)

    (d) Name the basic fields which combine to form the basis for bioinformatics.   (1.5)

    (e) State the principal of "Inertia of large numbers". (1.5)

    (f) Write the status (high/low) of bias and variance in Goodfit, underfit and overfit model.   (1.5)

(g) Differentiate between regression and classification. (1.5)

(h) What is a Hamiltonian circuit? (1.5)

(i) Make a fully connected graph of five vertices and write its chromatic polynomial. (1.5)

(j) Name the various components of soft computing. (1.5)

PART-B

2. (a) Suppose half of the population in a town is consumer of rice. 100 investigators are appointed to check the truth. Each investigators talks to 10 people. How many investigators will report 4 or less people as consumer of rice? (5)

(b) A workshop produces 2000 items per day. The average weight of the item is 130 kg with standard deviation as 10 kg. Assuming the normal distribution, find out how many items will have (i) more than 140 kg weight (ii) less than 1.15 weight on each day. (5)

(c) What is multivariate analysis? How Principal Component Analysis helps in multivariate analysis. (5)

3. (a) Consider the island problem. A person landing on the main land of Thailand has the probabilities of moving to Samui Island, Phangan Island or staying at the main land 0.7, 0.2 and 0.1 respectively. The transition probability for moving to other places is shown in the

figure, below. Find out the probability of being found on a particular island after 3 moves. (5)
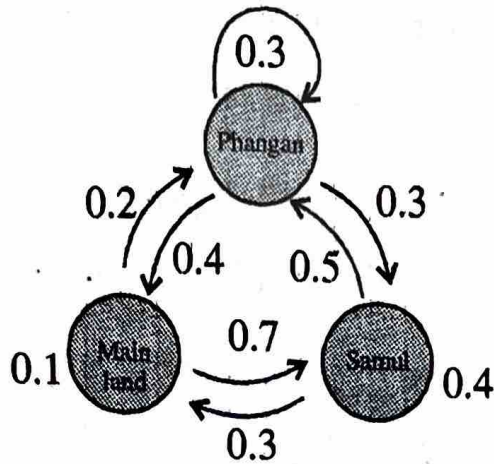
(b) Write a short note on Markov's and Chebyshev's Inequalities. (5)

(c) What is correlation coefficient? How it is calculated? What is its range? How it is interpreted? (5)

4. (a) What is overfitting? How it can be avoided? (5)

(b) What are the characteristics of a good estimator? (4)

(c) Describe the following types of sampling : Multistage sampling, Systematic sampling, Convenience Sampling. (6)

5. (a) In a class, there are 27 boys and 14 girls. The teacher wants to select 1 boy and 1 girl to represent the class for a function. In how many ways can the teacher make this selection? (3)

(b) Three married couples are to be seated in a row having six seats in a cinema hall. If spouses are to be seated next to each other, in how many ways can they be seated? Find also the number of ways of their seating if all the ladies sit together. (5)

(c) Explain how you can enumerate all the subsets of a set. (4)

(d) What are the necessary and sufficient conditions for two graphs to be isomorphic ? (3)

6. (a) What is a planar graph? Use Euler's Formula to prove that the following graph is planar. (4)
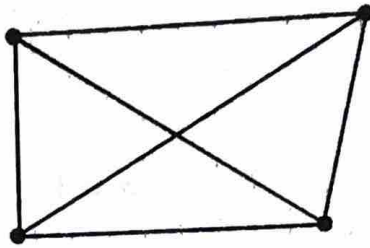
(b) What is the purpose of sequence matching in bioinformacics? Match the following two sequences using dynamic programming: ATTTGC and ATTGCC (Match Score = +1 Mismatch Score = –1 Gap penalty = –2) (8)

(c) Differentiate between a normal set and a fuzzy set. (3)

7. (a) Explain how Convolution Neural Network (CNN) is used for identifying different features in an image. (9)

(b) What is machine learning? Differentiate between supervised learning, unsupervised learning and reinforcement learning. (6)

VII. AREAS UNDER THE STANDARD NORMAL DISTRIBUTION

The entries in this table are the probabilities that a standard normal variate is between 0 and Z (the shaded area).
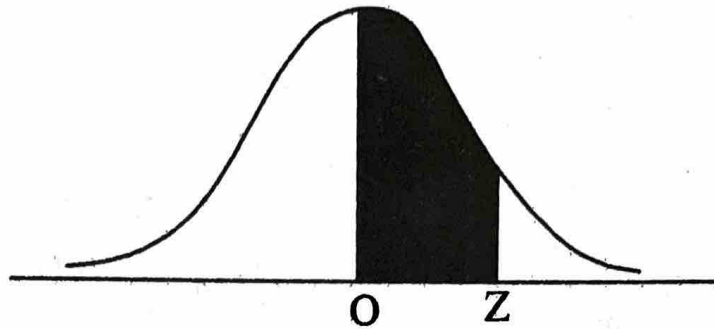
z	.00	.01	02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1519	.1628	1664	.1700	.1736	.1772	1808	.1844	.1879
0.5	.1915	.1950	.1985	2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	2389	2422	.2454	.2480	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	,2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	,3133
09	3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	3X10	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3981	.3997	.4015
1.3	.4032	.4049	4066	.4082	.4099	4115	.4131	.4141	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382.	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545

1.7	.4554	.4564	.4573	4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	4783	.4788	4793	4798	4803	.4808	4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	,4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4908	4969	.4T0	.4971	.4972	4973	.4974
2.8	.4974	.4975	.497b	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	4984	.49.84	.4985	.4985	4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990