COMSATS University Islamabad
Department of Computer Sciences
Final Examination Fall 2023
Subject: Statistics and Probability Theory

Program: BSDS, BSAI
Semester: 3rd and 4th
Date: 11th January 2024.
Instructions:
All questions carry equal marks. Calculators are allowed but sharing is strictly prohibited.

Total Marks: 50
Time Allowed: 8:30 - 11:30
Instructor: Dr. Amna Nazeer

Question No. 01: An environmentalist wants to determine the relationships between the numbers (in thousands) of forest fires (X) over the year and the number (in hundred thousand) of acres burned (Y). The data for 8 recent years are shown.

y	62	42	19	26	51	15	30	15
x	72	69	58	47	84	62	57	45

a. Estimate correlation coefficient and interpret.
b. Estimate the slope and intercept in a simple linear regression model.
c. If there are 40 forest fires (X) in a year, predict the number (in hundred thousand) of acres burned for that year.

Question No. 02: According to recent surveys, 60% of households have personal computers. If a random sample of 1800 households is selected, what is the probability that more than 1375 but fewer than 1400 have a personal computer?

Question No. 03: Consider the following joint probability density function of the variables X and Y:

$$f(x,y) = \begin{cases} \frac{3(x^2+y^2)}{2}, & 0 < x < 1, 0 < y < 1 \\ 0 & elsewhere \end{cases}$$

a. Find the marginal density functions of X and Y.
b. Are X and Y independent?
c. Find $P(x > 0.5 | y = 0.75)$.

Question No. 04: A shipment of 12 television sets contains 3 defective sets. If a hotel purchase 5 of these sets what is the probability that it will receive at least 2 of the defective sets?

Question No. 05: The average price of a personal computer (PC) is $949. If the computer prices are approximately normally distributed and standard deviation is $100, what is the probability that a randomly selected PC costs more than $1200? The least expensive 10% of personal computers cost less than what amount?

Question No. 06: According to a survey by the Administrative Management Society, one-half of U.S. companies give employees 4 weeks of vacation after they have been with the company for 15 years. Find the probability that among 6 companies surveyed at random, the number that give employees 4 weeks of vacation after 15 years of employment is anywhere from 2 to 5.

Question No. 07: On average, a textbook author makes three words processing errors per page on the first draft of her textbook. What is the probability that on the next page she will make 5 or more errors?

$\lambda t = 3$.

$$P(x \geq 5) = 1 - P(x \leq 5)$$

$$= 1 - \sum_{x=0}^{5} \frac{e^{-\lambda t}(\lambda t)^x}{x!}$$

$E(XY) - E(X)E(Y)$

$\sum x,y \; f(x,y)$

Question No. 08: Two students are selected at random from group that contains 3 computer science students, 2 engineering students, and 3 management students. If X is the number of computer science students selected and Y is the number of engineering students selected, find the covariance of X and Y.

Question No. 09: Interest centers around the nature of an oven purchased at a particular department store. It can be either a gas or an electric oven. Consider the decisions made by six distinct customers.

a. Suppose that the probability is 0.40 that at most two of these individuals purchase an electric oven. What is the probability that at least three purchase the electric oven?
b. Suppose it is known that the probability that all six purchase the electric oven is 0.007 while 0.104 is the probability that all six purchase the gas oven. What is the probability that at least one of each type is purchased?

Question No. 10: During a quiz competition it is known that the participant that wins four sessions out of seven is the winner. Suppose that two participants A and B face each other and have very tough competition. It is known that participant A has probability 0.52 of winning a session over participant B. What is the probability that participant B will win the competition?

4 out of seven

≥ 4

$A = 0.52$

$P(B) = 1 - P(A)$

$(0.52) \quad = 1 - 0.52$

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Normal Distribution Area Table

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0190	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2969	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3513	0.3554	0.3577	0.3529	0.3821
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998

≥ 3

0.5

$0.52 \times 0.$

$1 - P(U)$

k = no of success

x = no of trails

$x-1 \; C_{k-1} \; p^k \; q^x$

$(0.48)(0.48)(0.48)(0.48)(\quad)$

$(0.48)^4 (0.52)^3$