



University of Colombo, Sri Lanka

University of Colombo School of Computing

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

First Year Examination – Semester I [Sample Paper A – practice examination]

SCS 1307 – Probability and Statistics

(Two (2) Hours)

Answer ALL questions

Number of Pages = 10

Number of Questions = 4

To be completed by the candidate									
Index Number:	<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>								

Important Instructions to candidates:

- I. Students should answer in the medium of English language only using the space provided in this question paper.
- II. Note that questions appear on both sides of the paper. If a page or a part of this question paper is not printed, please inform the supervisor immediately.
- III. Write your index number CLEARLY on each and every page of this Question paper.
- IV. This paper consists of 4 questions in 10 pages (including the Cover Page).
- V. Answer ALL questions.
- VI. Programmable Calculators and any electronic device capable of storing and retrieving text including electronic dictionaries, smart watches and mobile phones are not allowed.
- VII. Non-Programmable calculators are allowed.
- VIII. Do not tear off any part of this answer book. Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.

To be completed by the examiners

1	
2	
3	
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Total	

Question 1: This question consists of 10 multiple choice questions with five options with one correct answer. Underline the most suitable answer.

1. A fair die is rolled once. What is the probability of getting an even number less than 5?
 - a) $1/6$
 - b) $1/3$
 - c) $1/2$
 - d) $2/3$
 - e) $5/6$
2. What is the probability of selecting a consonant from the word 'STATISTICS'?
 - a) $3/10$
 - b) $5/10$
 - c) $6/10$
 - d) $7/10$
 - e) $8/10$
3. A random variable X takes the values 0, 1 and 2. The probability that X takes the value 0 is 0.3 and the expected value is 1.2. What is the probability that X takes the value 2?
 - a) 0.2
 - b) 0.3
 - c) 0.35
 - d) 0.4
 - e) 0.5
4. Which of the following is true about independent events?
 - a) $P(A \cap B) = 0$
 - b) $P(A | B) = P(B)$
 - c) $P(A \cup B) = P(A) + P(B)$
 - d) $P(A \cap B) = P(A) \times P(B)$
 - e) $P(A | B) = 0$
5. A bag contains 3 red, 4 blue and 5 green balls, and one ball is drawn at random. What is the probability that it is red given that it is not green?
 - a) $1/4$
 - b) $1/3$
 - c) $3/7$
 - d) $4/7$
 - e) 1.0

6. If X is a random variable with values $\{0, 1, 2, 3\}$ and probabilities $\{0.1, 0.3, 0.4, 0.2\}$, what is $E(X)$?
- a) 1.2
 - b) 1.5
 - c) 1.7
 - d) 2.0
 - e) 2.5
7. What is the expected value of a fair eight-sided (numbered 1 to 8) die roll?
- a) 3.5
 - b) 4.0
 - c) 4.5
 - d) 5.0
 - e) 8.0
8. A workshop has two machines. Machine A produces 60% of all items and Machine B produces 40%. The probability that an item is defective is 5% for Machine A and 10% for Machine B. What is the probability that a randomly selected item is defective?
- a) 0.050
 - b) 0.070
 - c) 0.075
 - d) 0.080
 - e) 0.150
9. A continuous random variable X follows the normal distribution with a mean of 10 and a variance of 9. What is the probability that X takes the value 10?
- a) 0
 - b) 0.05
 - c) 0.10
 - d) 0.3989
 - e) 0.50
10. If $P(B) = 0.6$ and $P(A | B) = 0.4$, what is $P(A \cap B)$?
- a) 0.15
 - b) 0.24
 - c) 0.40
 - d) 0.60
 - e) 1.00

(25 Marks)

Question 2: This question consists of 10 multiple choice questions with five options with one correct answer. Underline the most suitable answer.

1. Which of the following scenarios best fits a Poisson distribution?
 - a) Counting the number of customers arriving at a bank counter in one hour
 - b) Tossing a coin 20 times and counting the number of heads
 - c) Measuring the weights of 50 students
 - d) Selecting 5 cards from a deck without replacement
 - e) Recording whether a student passes or fails an examination
2. What is the standard deviation of a binomial distribution with $n = 20$ and $p = 0.3$?
 - a) 0.21
 - b) 2.05
 - c) 4.20
 - d) 6.00
 - e) 14.00
3. A committee of three is selected at random from a group of five engineers and four accountants. The probability that the committee contains exactly two engineers is
 - a) $5/21$
 - b) $2/7$
 - c) $5/14$
 - d) $10/21$
 - e) $1/2$
4. A quality inspector checks 6 items, each of which is independently defective with probability 0.2. What is the probability that exactly 2 items are defective?
 - a) 0.033
 - b) 0.098
 - c) 0.196
 - d) 0.246
 - e) 0.311
5. The variance of a Poisson distributed random variable is 9. Then the mean of the distribution is
 - a) 3
 - b) 4.5
 - c) 9
 - d) 18
 - e) 81

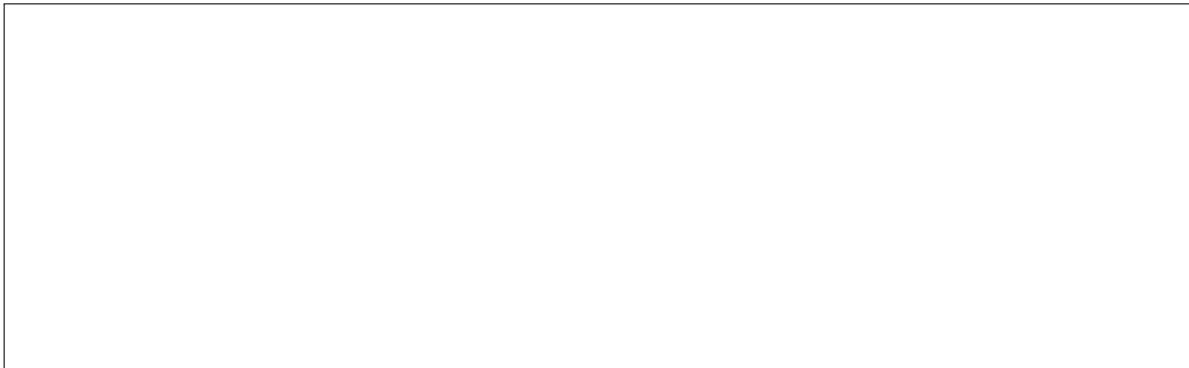
6. Which of the following statements about the standard error of the sample mean is correct?
- a) It increases as the sample size increases
 - b) It is always equal to the population standard deviation
 - c) It is always larger than the population standard deviation
 - d) It does not depend on the sample size
 - e) It decreases in proportion to $1/\sqrt{n}$
7. In a geometric distribution with probability of success $p = 0.25$, what is the probability that the first success occurs on the second trial?
- a) 0.0625
 - b) 0.1406
 - c) 0.1875
 - d) 0.2500
 - e) 0.5625
8. In a normally distributed dataset of examination marks with a mean of 500 and a standard deviation of 100, approximately what percentage of marks lie between 300 and 700?
- a) 34%
 - b) 47.5%
 - c) 68%
 - d) 95%
 - e) 99.7%
9. A population has a mean of 80 and a variance of 144. What is the standard error of the sample mean for samples of size 36?
- a) 0.33
 - b) 2
 - c) 4
 - d) 12
 - e) 24
10. A large sample is drawn from a population whose distribution is strongly skewed. According to the Central Limit Theorem, the sampling distribution of the sample mean will be
- a) skewed in the same direction as the population
 - b) approximately normal, with mean μ and variance σ^2/n
 - c) approximately normal, with mean μ and variance σ^2
 - d) exactly normal for every sample size
 - e) uniform

(25 Marks)

Question 3:

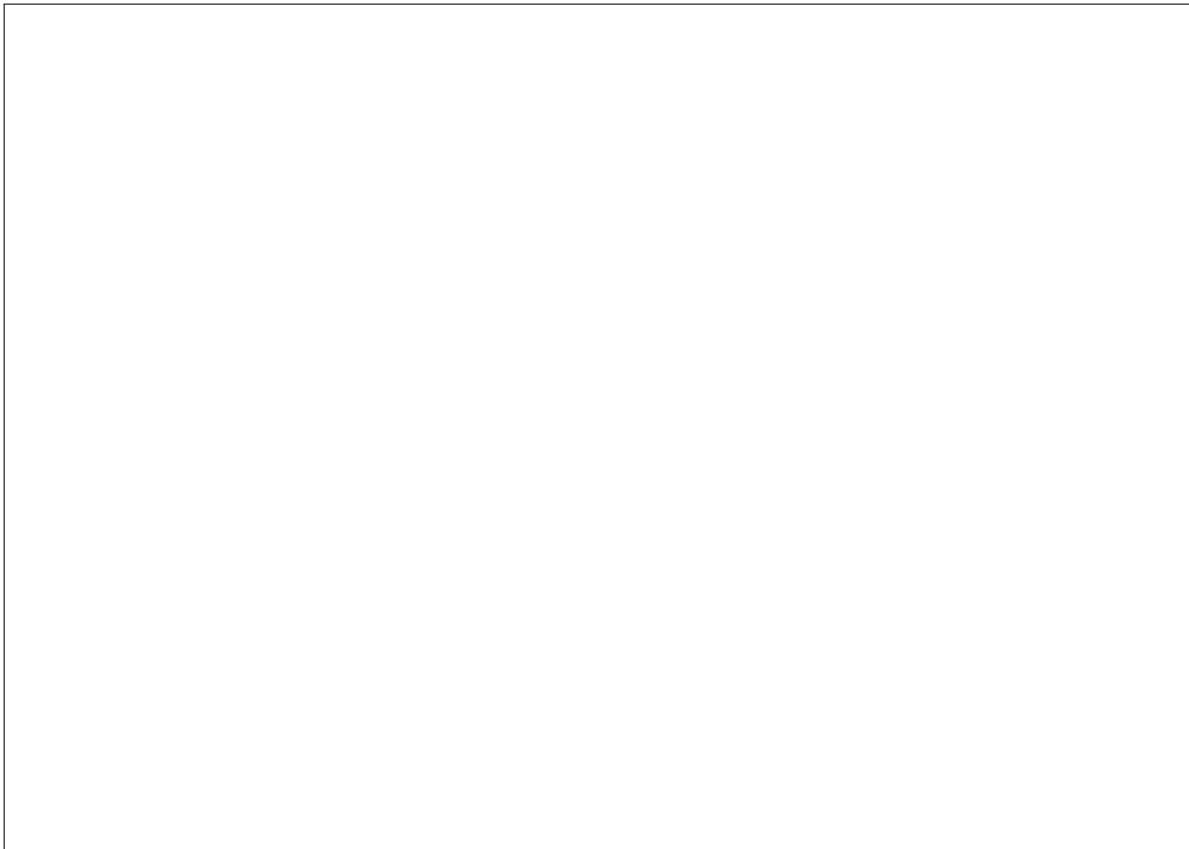
At GreenLeaf Tea Factory, packets of tea are inspected for the presence of foreign particles that affect quality. The number of foreign particles per packet is known to follow a Poisson distribution with a mean of 0.6.

- (a) What is the probability that a randomly selected packet contains at least one foreign particle?



(5 Marks)

- (b) A random sample of 12 packets is taken from each of 15 crates. If more than 6 packets in any crate contain at least one foreign particle, the entire crate is rejected. What is the probability that exactly 3 of the 15 crates are rejected?



(10 Marks)

(c) At StarSpin Arcade, a player pays an amount (Rs. Y) and rolls two fair six-sided dice. The payout rules are:

If the total is 7, the player wins Rs 9.00

If the total is 11, the player wins Rs 15.00

If the total is 3, the player wins Rs 12.00

For any other value the player does not get anything.

To make the game fair, what amount should be paid by the player to start the game?



(10 Marks)

Question 4:

(a) If a large number of samples of size n are taken from a Poisson(3.2) distribution, approximately 1% of the sample means are greater than 3.79. Estimate n .

(9 Marks)

(b) A certain variety of mango has a mass which is normally distributed with mean 250 g and standard deviation 20 g. In a consignment of 600 of these mangoes, estimate how many will have a mass greater than 283 g.

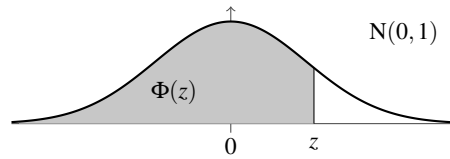
(8 Marks)

(c) The lifetimes of a certain type of bulb are normally distributed with mean μ and variance σ^2 . 10% of the bulbs last more than 1200 hours and 20% of the bulbs last less than 950 hours. Find the values of μ and σ .

(8 Marks)

***** End of the Question Paper *****

THE DISTRIBUTION FUNCTION $\Phi(z)$ OF THE NORMAL DISTRIBUTION $N(0, 1)$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

For negative values of z use $\Phi(z) = 1 - \Phi(-z)$

Selected percentage points of the standard normal distribution

$\Phi(z)$	0.900	0.920	0.950	0.975	0.980	0.990	0.995
z	1.2816	1.4051	1.6449	1.9600	2.0537	2.3263	2.5758