



University of Colombo, Sri Lanka

University of Colombo School of Computing

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

First Year Examination – Semester I [Sample Paper B – 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	
4	
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 coin is tossed three times. What is the probability of getting exactly two heads?
 - a) $1/8$
 - b) $1/4$
 - c) $3/8$
 - d) $1/2$
 - e) $5/8$
2. What is the probability of selecting a vowel from the word 'MATHEMATICS'?
 - a) $3/11$
 - b) $4/11$
 - c) $5/11$
 - d) $6/11$
 - e) $7/11$
3. A random variable X takes the values 2, 4 and 6. The probability that X takes the value 2 is 0.5 and the expected value is 3.4. What is the probability that X takes the value 6?
 - a) 0.20
 - b) 0.25
 - c) 0.30
 - d) 0.40
 - e) 0.50
4. Which of the following is always true for any two events A and B ?
 - a) $P(A \cup B) = P(A) + P(B)$
 - b) $P(A \cap B) = P(A) \times P(B)$
 - c) $P(A | B) = P(A)$
 - d) $P(A \cup B) = P(A) \times P(B)$
 - e) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
5. A class has 12 boys and 8 girls. Two students are selected at random without replacement. What is the probability that both are girls?
 - a) $2/19$
 - b) $14/95$
 - c) $4/25$
 - d) $1/5$
 - e) $4/9$

6. If X is a random variable with values $\{1, 2, 3, 4\}$, each equally likely, what is $E(X)$?
- a) 2.0
 - b) 2.5
 - c) 3.0
 - d) 3.5
 - e) 4.0
7. What is the expected value of a fair ten-sided (numbered 1 to 10) die roll?
- a) 4.5
 - b) 5.0
 - c) 5.5
 - d) 6.0
 - e) 10.0
8. A factory has two production lines. Line 1 produces 40% of the output with a 3% defect rate, and Line 2 produces 60% of the output with a 7% defect rate. What is the probability that a randomly chosen item is defective?
- a) 0.030
 - b) 0.042
 - c) 0.050
 - d) 0.054
 - e) 0.100
9. A continuous random variable X follows a normal distribution with mean 20 and standard deviation 5. What is $P(X < 20)$?
- a) 0
 - b) 0.25
 - c) 0.50
 - d) 0.75
 - e) 1.00
10. If $P(A) = 0.5$ and $P(A \cap B) = 0.2$, what is $P(B | A)$?
- a) 0.10
 - b) 0.20
 - c) 0.25
 - d) 0.40
 - e) 0.50

(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 geometric distribution?
 - a) Counting the number of calls received until the first complaint
 - b) Counting the number of defective items in a batch of 50
 - c) Recording the number of accidents at a factory per month
 - d) Measuring the diameters of ball bearings
 - e) Selecting 4 cards from a deck without replacement
2. What is the standard deviation of a binomial distribution with $n = 100$ and $p = 0.2$?
 - a) 2
 - b) 4
 - c) 16
 - d) 20
 - e) 80
3. Which of the following is **NOT** a property of the probability density function $f(x)$ of a continuous random variable?
 - a) $f(x) \geq 0$ for all x
 - b) The total area under the curve of f equals 1
 - c) $P(a < X < b)$ equals the area under f between a and b
 - d) $P(X = a) = 0$ for any single value a
 - e) $f(x) \leq 1$ for all x
4. A student answers 8 true/false questions purely by guessing. What is the probability of getting exactly 5 answers correct?
 - a) 0.109
 - b) 0.219
 - c) 0.273
 - d) 0.313
 - e) 0.500
5. A salesperson makes a sale on each call independently with probability 0.3. What is the probability that the second sale occurs on the fifth call?
 - a) 0.042
 - b) 0.084
 - c) 0.123
 - d) 0.185
 - e) 0.309

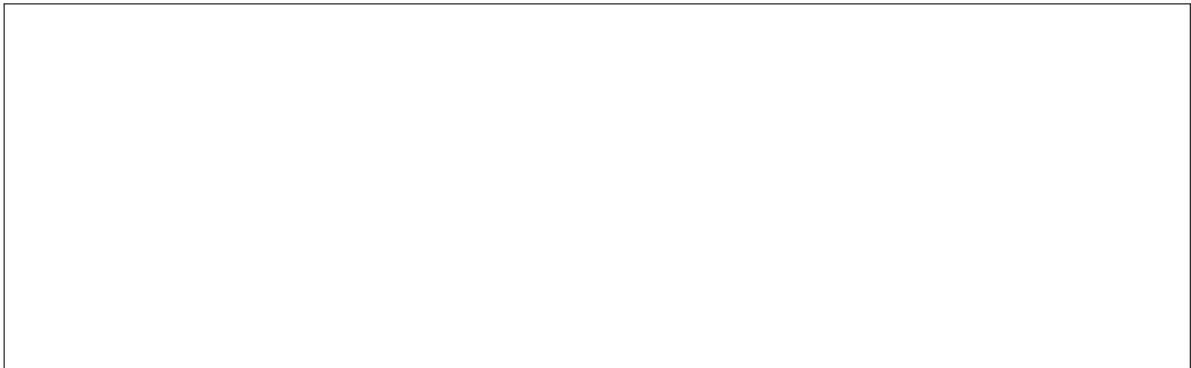
6. If $X \sim N(\mu, \sigma^2)$, which of the following transformations produces a standard normal variable?
- a) $(X - \sigma)/\mu$
 - b) $(X - \mu)/\sigma^2$
 - c) $(X + \mu)/\sigma$
 - d) $(X - \mu)/\sigma$
 - e) X/σ
7. In a Poisson distribution with $\lambda = 2$, what is $P(X = 1)$?
- a) 0.135
 - b) 0.180
 - c) 0.271
 - d) 0.323
 - e) 0.406
8. The heights of adults are normally distributed with a mean of 168 cm and a standard deviation of 6 cm. Approximately what percentage of adults are taller than 180 cm?
- a) 2.5%
 - b) 5%
 - c) 16%
 - d) 32%
 - e) 47.5%
9. Samples of size 64 are drawn from a population with a mean of 40 and a standard deviation of 16. What is the standard error of the sample mean?
- a) 0.25
 - b) 2
 - c) 4
 - d) 8
 - e) 16
10. If $X \sim N(50, 25)$ and $Y \sim N(30, 11)$ are independent, what is the distribution of $X - Y$?
- a) $N(20, 6)$
 - b) $N(20, 14)$
 - c) $N(20, 36)$
 - d) $N(80, 14)$
 - e) $N(80, 36)$

(25 Marks)

Question 3:

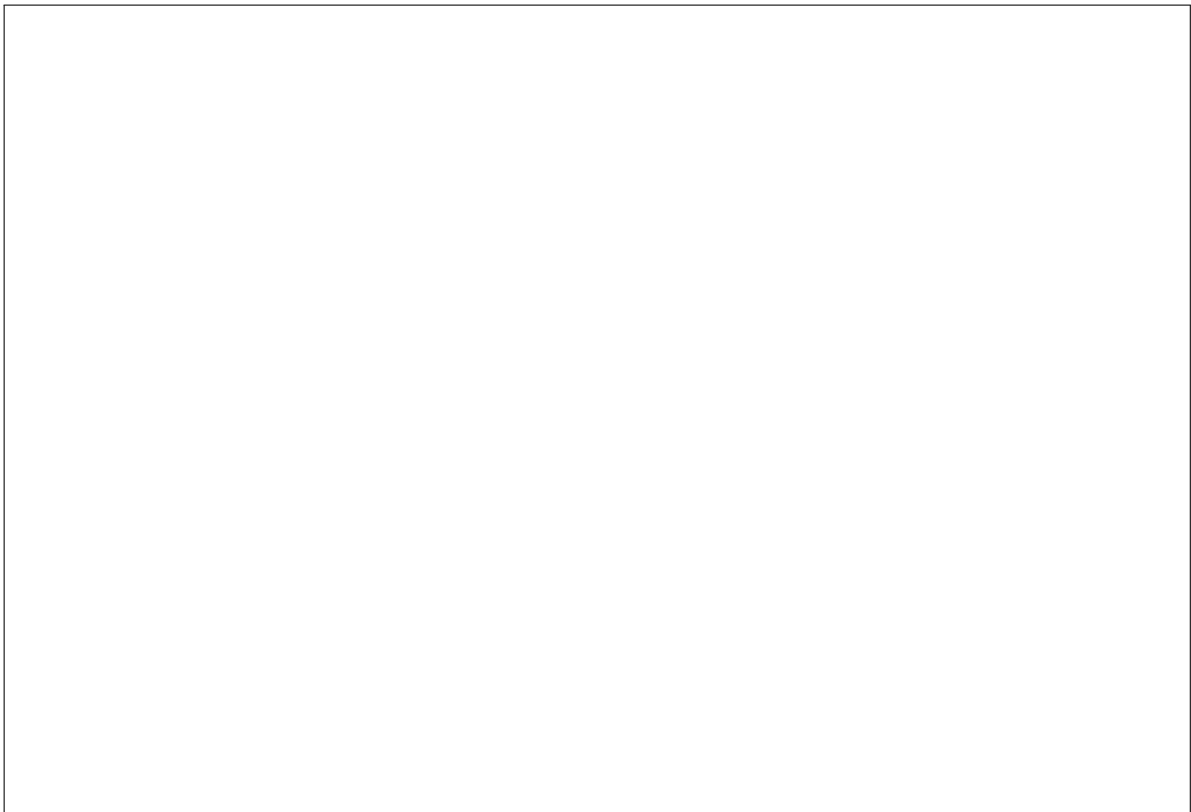
At a software company, each code module is tested and the number of critical bugs found per module is known to follow a Poisson distribution with a mean of 1.2.

- (a) What is the probability that a randomly selected module contains at most one critical bug?



(5 Marks)

- (b) A random sample of 8 modules is taken from each of 12 releases. If fewer than 5 modules in a release contain at most one critical bug, that release is sent back for review. What is the probability that exactly 2 of the 12 releases are sent back?



(10 Marks)

(c) At a charity fair, a player pays an amount (Rs. Y) and draws one card at random from an ordinary pack of 52 playing cards. The payout rules are:

If the card is an Ace, the player wins Rs 30.00

If the card is a picture card (Jack, Queen or King), the player wins Rs 10.00

If the card is a 10 of any suit, the player wins Rs 5.00

For any other card 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(4.5) distribution, approximately 2.5% of the sample means are less than 3.84. Estimate n .

(9 Marks)

(b) The masses of packets of biscuits are normally distributed with mean 200 g and standard deviation 8 g. In a batch of 500 packets, estimate how many will have a mass less than 190 g.

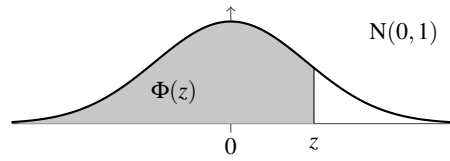
(8 Marks)

(c) The times taken by employees to complete a particular task are normally distributed with mean μ and variance σ^2 . 8% of employees take more than 52 minutes and 15% of employees take less than 38 minutes. 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