

International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE

Final Examination, Spring 2023

Course Code: STAT 2311

Course Title: Probability and Statistics

Time: 2 hours 30 minutes

Full Marks: 50

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

CO	DL	Mark
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Part A

[Answer the questions from the followings]

- 1 a) Define correlation coefficients and regression coefficients. CO2 U 4
Distinguish between them.

Or What is linear regression? Explain the terms regression equations and regression coefficients. State some uses of regression in engineering statistics.

- 1 b) The following data represent scores achieved by a class of 3rd semester students on a statistics (X) and a programming test (Y). CO2 C 6

Students	1	2	3	4	5	6	7
Statistics score (X)	58	72	63	75	67	54	81
Programming score (Y)	56	77	50	75	64	52	79

(i) Calculate the Karl Pearson correlation coefficient between Statistics and Programming scores and comment on your result.

(ii) Draw a scatter graph to represent the above information.

Or A study was made on the amount of converted sugar in a certain process at various temperatures. The data were coded and recoded as follows:

Temperature (in $^{\circ}\text{C}$)	8	9	10	11	12	1	14
Converted sugar (in kgs)	6.1	6.8	8.5	8.8	8.5	9.5	9.6

(i) Find the regression line of amount of converted sugar on temperatures.

(ii) Estimate the amount of converted sugar produced when the coded temperature is 15.4°C .

- 2 a) Distinguish between: (i) Experiment and Random experiment; (ii) Mutually exclusive events and Non-mutually exclusive events. CO3 U 4

- 2 b) What are the three conditions that define an independent event? If $P(A) = \frac{1}{2}$, $P(B) = \frac{3}{4}$ and $P(AB) = \frac{1}{3}$. Are A and B independent? CO3 Ap 6

$(A) = \frac{1}{2}$, $P(B) = \frac{3}{4}$ and $P(AB) = \frac{1}{3}$. Are A and B independent?

Find (i) $P(A|B)$; (ii) $P(\bar{A} | B)$ and (iii) $P(A \bar{B})$.

Part B
[Answer the questions from the followings]

3. a) Explain the terms: (i) Random variable (ii) Mathematical expectation and (iii) Probability function. CO3 U 4

Or Define random variable with example. Under what conditions is a function a probability function? Define mathematical expectation of a random variable. Write down its properties.

3. b) Suppose that in a certain region of a country the daily rainfall (in inches) is a continuous random variable X with probability density function $f(x)$ given by CO3 Ap 6

$$f(x) = P(6x - 3x^2); \quad 0 < x < 2$$

Compute (i) the value of ' P ' (ii) $E[2X + 4.5]$ and (iii) $SD[X]$

Or Suppose a random variable X has the following probability density function $f(X) = 6X(X-1); \quad 0 \leq X \leq 1$

Find

- (i) $E(X)$ (ii) $V(X)$ (iii) $SD(X)$ (iv) $P(X \geq 0.72)$ (v) $P(X \leq 0.23)$

4. a) What are the parameters of a binomial distribution? Why are they so called? Define normal probability distribution with its importance. CO3 U 4

4. b) On average, 2 out of 10 telephones is found busy. Six telephone numbers are selected at random. Find the probability that (i) four of them will be busy (ii) At most 2 will be busy and (iii) At least 8 will be busy. CO3 Ap 6

5. a) Discuss the different steps of formulation of a test of hypothesis. CO4 U 4
 Write some applications of χ^2 -test from engineering perspective.

5. b) The side effects of a new drug are being tested against a placebo. A simple random sample of 430 patients yields the results below. CO4 C 6

Result	Drug	Placebo
Nausea	32	13
No nausea	205	180

Compute the value of Chi-square for the above data and comment.



International Islamic University Chittagong (IIUC)
Department of Computer Science and Engineering (CSE)
Semester Final Examination

Program: B. Sc. in CSE
Course Code: MATH-2307
Time: 2:30 hours

Semester: Spring-2023
Course Title: Mathematics-III
Total Marks: 50

- (i) Answer all the questions. The figures in the right-hand margin indicate full marks.
- (ii) Please answer the several parts of a question sequentially.
- (iii) Separate answer script must be used for separate group.

Bloom's Taxonomy Domain Levels of the Questions

Letter Symbols	R	U	Ap	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Group - A

- | | Marks | CLO | DL |
|--|-------|------|-----|
| 1. Examine the Eigen decomposition for the matrix $A = \begin{pmatrix} 4 & 1 \\ 1 & 4 \end{pmatrix}$ | 10 | CLO2 | An |
| 2. a) Define vector and unit vector. Find a unit vector parallel to the resultant of vectors, $\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} + 3\hat{k}$ | 5 | CLO2 | R&U |

Or

Define vector product and scalar product. Find the angles which the vector, $\vec{A} = 2\hat{i} - \hat{j} + 2\hat{k}$ makes with the coordinates axes.

- | | | | |
|---|---|------|---|
| b) If $\phi(x, y, z) = xy^2z$ and $\vec{A} = xz\hat{i} - xy^2\hat{j} + yz^2\hat{k}$, then find $\frac{\partial^3}{\partial x^2 \partial z} (\phi \vec{A})$ at the point $(2, -1, 1)$ | 5 | CLO2 | U |
|---|---|------|---|

Or

A particle moves along a curve whose parametric equations are, $x = 2t^2$, $y = t^2 - 4t$ & $z = 3t - 5$, where t is the time. Find the components of its velocity and acceleration at time $t = 1$ in the direction $\vec{A} = \hat{i} - 3\hat{j} + 2\hat{k}$

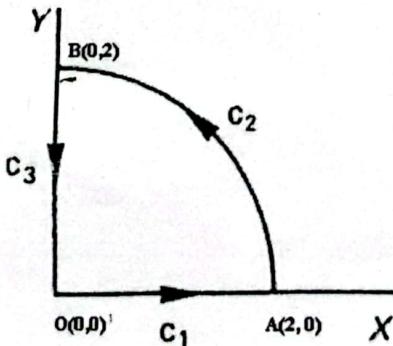
Group - B

- | | | Marks | CLO | DL |
|----|--|-------|------|-----|
| 3. | a) Find the directional derivative of the function $\phi = x^2y + y^2z + z^2x$ at the point of $(1, -1, 2)$ in the direction of the vector $\vec{A} = 4\hat{i} + 2\hat{j} - 5\hat{k}$. | 4 | CLO2 | U |
| b) | What do you mean by \vec{dr} and $\vec{\nabla}\phi$? Present your answer graphically. | 2 | CLO2 | U |
| c) | Sketch the level curve for the function $f(x, y) = x^2 + y^2$ through the point $(3, 4)$ and draw the gradient vector at this point. | 2 | CLO3 | U |
| d) | Show that, $\vec{\nabla} = \frac{\vec{r}}{r} \frac{\partial}{\partial r}$ | 2 | CLO3 | U |
| 4. | Show that $\iint \vec{F} \cdot \hat{n} ds = \frac{3}{2}$; Where $\vec{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$ and S is the surface of the cube bounded by the planes $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$ | 10 | CLO4 | App |

Or

- Verify Green's theorem for the integral $\oint \{(x^2 + y^2)dx + (x + 2y)dy\}$ taken round the boundary curve c defined by

$$\begin{aligned} y &= 0; 0 \leq x \leq 2 \\ x^2 + y^2 &= 4; 0 \leq x \leq 2 \\ x &= 0; 0 \leq y \leq 2 \end{aligned}$$



5. State Divergence's theorem. Verify the divergence theorem for the vector field $\vec{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$ taken over the region bounded by the planes, $x = 0, x = 1; y = 0, y = 1; z = 0, z = 1$

10 CLO4 U&Ap

(Answer all questions; the columns on the right-side indicate the marks, CLOs and Bloom's taxonomy-domain for each question):

#	Questions	Marks	CLOs	Bloom's taxonomy domain
1	<p>a) Define <i>Makki</i> and <i>Madani</i> revelation. Summarize some extraordinary features of <i>Makki</i> and <i>Madani</i> revelations from the viewpoint of sciences of the Qur'an.</p> <p style="text-align: center;"><i>Or,</i></p> <p>b) "<i>AsbabunNuzul</i> (the causes of revelation) is the best way to understand the messages of the holy Qur'an properly"- evaluate this statement mentioning various types of <i>AsbabunNuzul</i> with examples.</p>	10	3	Remember & Evaluate
				Evaluate & Analyse
2	How was the holy Qur'an preserved during the time of Prophet Muhammad (SAAS)? Why did the Prophet (SAAS) not compile the holy Qur'an in a single volume? Explain elaborately.	10	3	Evaluate & Create
3	Prove the scientific miracle of the holy Qur'an with some examples.	10	3	Remember, Analyze & Evaluate
4	Define Hadith literally and terminologically. Identify the position and importance of Hadith in Islamic <i>Shari'ah</i> .	10	3	Remember, Analyze & Evaluate
5.	<p>a) The speeches, works and approvals of the Prophet (SAAS) are termed Hadith"- justify this statement explaining some types of Hadith according to the reference to a particular authority with some examples.</p> <p style="text-align: center;"><i>Or,</i></p> <p>b) Write short notes: <i>Sahih Hadith;</i> <i>Mutwatin Hadith;</i> <i>Sanad;</i> <i>Matan;</i> <i>Mawdu' Hadith.</i></p>	10	3	Remember & Create
				Evaluate & Create

**International Islamic University Chittagong
Morality Development Program (MDP)**

Semester End Examination, Spring 2023

3rd Semester (other than *Shari'ah* faculty)

Course Code: MDP- 2303

Course Title: *Tajweedul Qur'an-III*

Time: 2.5 Hours

Full Marks: 50

[Answer any five of the following. All questions are of equal value]

Q.1. Write the meaning of the following Surah (any two):

a) *Surah Al-Inshirah* (سورة الانشراح)

b) *Surah At-Teen* (سورة التين)

c) *Surah Wad-Dhuha* (سورة الضحى)

Q.2. Define *At-Tafkhim* and *At-Tarqiq* (Valorization & Attenuation). Identify *At-Tafkhim* and *At-Tarqiq* in the following Arabic Letters mentioning the reasons.

A	B	C	D	E	F	G	H	I	J
ج	خ	ذ	ص	ر	ط	س	ع	غ	ق

Q.3. Explain the rule of *Tafkheem* (Valorization) and *Tarqeeque* (Attenuation) in the letter *Alif* of *Madd*, letter *Laam* of the name of the Majesty (Allah), and letter *Raa* in Arabic Alphabet with examples.

Q.4. Define *Al-Waqf*. What is the importance of *Waqf* in *Tajweed*? Explain different types of *Al-Waqf* with examples.

Q.5. How many types of voluntary prayers are there in Islam? Explain any five types among them.

Q.6. How to perform *Salatul Janazah* (Funeral Prayer)? Describe it with some details.

Q.7. What are the special method for performing *Salatul 'Eid* (Eid Prayer)? Explain in brief.

International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE

Final Examination-Spring 2023

Course Code: CSE 2223

Course Title: Digital Logic Design

Time: 2 hours 30 minutes

Full Marks: 50

(i) The figures in the right-hand margin indicate full marks

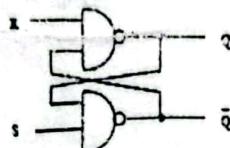
[Answer the questions from the followings. Parts of the same question must be answered serially]

Part A

CO	DL	Marks
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The figure below shows an RS latch made out of NAND gates (rather than

1. a) NOR gates). How do Q and Q' (Prime) depend on the RS inputs? i.e. verify that CO2 A 5
the circuit can indeed be used as a RS latch.



Or, Design a SR Flip Flop using NAND gate.

1. b) What is flip-flop triggering problem? Describe the master-slave D flip. CO1 U 5
2. a) Differentiate between combinational logic and sequential logic. List some CO1 U 5
applications of sequential logic. What are the major differences between latch
and flip?
2. b) Design a bus system that would take 4-bits input from two input devices namely CO3 A 5
keyboard and mouse using multiplexer.

Or, How does JK flip-flop remove the indeterminate states of S-R flip-flop? Design a JK
flip-flop and show its characteristic equation, characteristic table, logic diagram and
timing diagram.

Part B

- Design the sequential circuit described by the following state equations using JK flip-flops. CO2 A 5
 $A(t+1) = xAB + yA'C + xy$
 $B(t+1) = xAC + y'BC'$
 $C(t+1) = x'B + yAB'$
3. b) Design BCD counter with proper timing diagram. CO3 A 5
4. a) Design a 4-bit Up counter with T flip-flop. CO2 A 5
4. b) What are the basic difference between ring counter and Johnson counter?
Explain with Block diagram. CO3 R 5
5. a) Using sequence generator generates sequence of 11010 and also draw proper
circuit diagram. CO2 A 5

Or, Design a multiplexer using the following Boolean Equation.

$$F(A, B, C) = \sum(1, 3, 4, 5, 6, 7)$$

5. b) If counter is having 10FF. It is initially 0. What count will it hold after 2060
pulses? Design D latch with truth table and proper circuit diagram. CO2 A 5

Or, What is a memory cell? Design a 4x4 RAM and describe its operation with example.

Bismillahir Rahmaniir Rahim
International Islamic University Chittagong
Department of Computer Science & Engineering
B. Sc. in CSE Final Examination, Spring 2023
Course Code: CSE 2321 Course Title: Data Structures
 Total marks: 50 Time: 2 hours 30 minutes

[Answer all the following questions. Figures in the right hand margin indicate full marks. Use a Separate answer script for Group-A and Group-B.]

Group A

CO DL

1. What is *circular queue*? Write a procedure to *insert* an element into a circular queue and *delete* an 4 CO1 C1
 a) element from a circular queue.

OR

What is *priority queue*? Discuss the *one way list* representation of a priority queue. Compare the *one way list* and *array* representation of priority queues.

- Consider the following queue of characters where QUEUE is a circular array which is allocated six 2 CO1 C2
 b) memory cells:

FRONT = 2, REAR = 5, QUEUE: _, D, C, R, K, _

Describe the queue, including FRONT and REAR, as the following operations take place –

- i) S is added to the queue. iii) B, R, D are added to the queue.
 ii) Two letters are deleted. iv) Three letters are deleted.

- c) Consider the code fragment written in C below: 2 CO1 C2

```
void rec(int n)
{
    if (n == 0)
        return;
```

```
    printf("%d", n%2);
    rec(n/2);
}
```

What does *rec* (2X) print? Explain.

[Here X is the last digit of your ID. For example, if ID is C191085, 2X will be 25].

- d) Let A and B be non-negative integers. Suppose a function GCD is recursively defined as follows- 2 CO1 C2

$$\begin{aligned} \text{GCD (B,A)} &\quad \text{if } A < B \\ \text{GCD (A,B)} = &\quad A \quad \text{if } B=0 \\ &\quad \text{GCD (B, MOD(A,B))} \quad \text{Otherwise} \end{aligned}$$

Here MOD (A, B) denotes the remainder when A is divided by B.

- i) Find GCD (6, 15), GCD (20, 28) and GCD (540, 279).
 ii) What does this function do?

OR

Let B be an integer array with N elements. Suppose Y is an integer function defined by

$$Y(K) = Y(B, N, K) = \begin{cases} 0 & \text{IF } K = 0 \\ Y(K - 1) + B(K) & \text{IF } 0 < K \leq N \\ Y(K - 1) & \text{IF } K > N \end{cases}$$

and Y(5) for each of the following array:

- i) N = 8, B: 3, 7, -2, 5, X, -4, 2, 7
- ii) N = 3, B: X, 7, -4

[Here X is the last digit of your ID. For example, if ID is C191085, X will be 5].

2. Suppose LIST is a linked list in memory consisting of numerical values. Write a procedure for each of the 5 CO1 C2
- a) following:

- i) Finding the maximum even number of the values in LIST
- ii) Finding the sum of even numbers that are less than or equal to N of the LIST (Note: N is the last two digits of your ID. i.e. if your ID is C151216, then N=16).

OR

Write a procedure which adds a given ITEM of information at the end of a list.

5 CO1 C2

- b) The following figure is a list of five hospital patients and their room numbers. 5 CO1 C2
- i. Fill the values for NSTART and NLINK so that they form an alphabetical listing of the names.
 - ii. Fill the values for RSTART and RLINK so that they form an ordering of the room numbers.

NSTART	<input type="text"/>
RSTART	<input type="text"/>

	NAME	ROOM	NLINK	RLINK
1	X	650		
2	Smit	422		
3	Adams	704		
4	Jones	N		
5	Burns	632		

(Note: Your last name is X of your ID. i.e. if your ID is

and N is the last three digits C151216, then N=216).

3. Suppose the following characters are stored in an array A: 3 CO3 C2

- a) D, A, T, A, S, T, R, U, C, T, U, R, E, S

Apply insertion sort algorithm to sort the array A and show each pass separately.

OR

Suppose the following numbers are stored in an array A:

32, 22, 49, 68, 92, 45, 54, 105, 12, 88, 64, 39

Apply merge sort algorithm to sort the array A and show each pass separately.

Explain which of the following is not a stable sorting algorithm in its typical implementation- 1 CO4 C4

- b) i) Insertion Sort ii) Merge Sort iii) Quick Sort iv) Bubble Sort

- c) Write an algorithm to sort an array A of n elements using selection sort.

- d) What is hashing? Briefly discuss about any two techniques for collision resolution in hashing. 3 CO1 C2

4. Construct an expression tree T for the arithmetic expression: 3 CO1 C2

$$a) (A + B * C) - ((D / E + F) - G)$$

Traverse the tree T in pre, post and inorder.

- b) A *binary tree* T has 9 nodes. The *inorder* and *preorder* traversals of T yields the following sequences 3 CO1 C
of nodes:

Inorder : E A C K F H D B G

Preorder : F A E K C D H G B

Draw the tree T.

- c) What is a *binary search tree*? Suppose the following characters are inserted in order into an empty 4 CO1 C
binary search tree.

B, A, N, G, L, A, D, E, S, H

i) Draw the tree T.

ii) Find the inorder traversal of T.

OR

Illustrate the operation of *Heap sort* on the array $A = \{5, 13, 2, 25, N, 7, 17, 20, 8, 4\}$. (Note: N is the sum of last two digits of your ID. i.e. if your ID is C151216, then $N=1+6=7$)

5. Describe the adjacency list and linked representation of graph with necessary figure. 5 CO3 C

a)

- b) Define *graph*? Draw a picture of the directed graph specified below: 5 CO4 C

$$G = (V, E)$$

$$V(G) = \{1, 2, 3, 4, 5, 6\}$$

$$E(G) = \{(1,2), (2,3), (3,4), (5,1), (5,6), (2,6), (1,6), (4,6), (2,4)\}$$

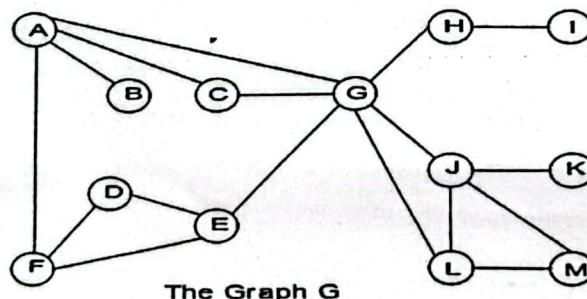
Obtain the following for the above graph:

- Find the *adjacency matrix* A of the graph G.
- Find the *adjacency list* of the graph G.

OR

Traverse the graph G shown below in **breadth first search** and **depth first search** starting from node C.

5 CO4 C



International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE, Course Code: CHEM-2301, Course Title: Chemistry

Time: 2 hours 30 minutes

Full Marks: 50

Answer all the questions. The figures in the right-hand margin indicate full marks.

Course Outcomes (COs) of the Questions

CO1	Develop chemical engineering knowledge and understanding of the chemical behavior, and physical properties of the common substances.
CO2	Demonstrate basic proficiency to solve chemical problems and discussing the interactions between matter and energy at the atomic and molecular levels.

Part A

- | | | | |
|--|------------|------|---|
| 1) a) Define the following terms:
i) Transport Number, ii) Molar Conductance, and iii) Ionic Mobility | CO1 | R/Un | 5 |
| b) If 1-ampere current passing for 1 second, how many amounts of a substance are deposited in the Electrolytic dissociation process? | CO2 | An | 5 |
| 2) a) What is a dilute solution? Explain Raoult's law of lowering vapor pressure. | CO1 | R/Un | 5 |
| b) What happened when a solute is mixed or shaken up with two liquids which are immiscible with each other? | CO2 | An | 5 |
| OR | | | |
| 2) a) Exhibit the electrolysis process in a cell with an example. | CO2 | An | 4 |
| b) When are the laws on colligative properties valid? | CO1 | Un | 2 |
| c) State and explain Henry's law with limitations and applications. | CO2 | Un | 4 |

Part B

- | | | | |
|---|------------|------|---|
| 3) a) Define Chemical kinetics. | CO1 | R | 2 |
| b) Define zero-order reaction and Pseudo-unimolecular reaction with examples. | CO1 | Un | 4 |
| c) Derive the integrated rate equation for a first-order reaction. Mention some properties of a first-order reaction. | CO2 | Un | 4 |
| 4) a) What do you mean by 'Reaction rate', 'Rate law', and Order of reaction? | CO1 | R/Un | 5 |
| b) State and explain Nernst distribution law with limitations and applications. | CO2 | Un | 5 |
| 5) a) Write the lyophilic, lyophobic and emulsion solution. | CO1 | R/Un | 5 |
| b) Prove that $K = \frac{1}{t} \frac{x}{a(x-a)}$ Where symbols have usual meanings. | CO2 | Ev | 5 |

OR

- | | | | |
|--|------------|------|---|
| 5) a) What is physical and chemical adsorption? Give example. | CO1 | R/Un | 5 |
| b) What is the equilibrium constant? Derive the equilibrium constant of the following reaction and find the relation between K_p and K_c : | CO2 | Ev | 5 |
- $pP + qQ + rR = xX + yY + zZ$

Collected by: Istahadul Hoque Tasin