

Group A

1. a) Define Ackermann function. Find the value of $A(1,4)$ using the definition of Ackermann function. 3 CO4 C5
 1. b) Write the overflow conditions of array representation of circular queue. Explain the reason of the conditions. 3 CO4 C5
 1. c) Explain the Tower of Hanoi problem. Also analysis the complexity of Tower of Hanoi problem. 4 CO4 C5
- OR
1. c) Explain the two dimensional array representation of priority queue. Explain the advantages and disadvantages of priority queue over the general queue. 4 0(n)
2. a) What is *linked list*? What are the advantages and disadvantages of linked list over the linear array. 2 CO1 C1
- OR
- b) What is *circular header list*? Write the advantages of circular header list over ordinary linked list. 2 CO1 C1
 - b) Let LIST be a *sorted linked list*. Write an algorithm to *search* an element from the LIST. What is the time complexity of this algorithm? 3 CO3 C2
- OR
- c) Let LIST be a *linked list* of integers in memory. Write a procedure to find the *maximum MAX* of the values in LIST. What is the time complexity of this procedure? 2 CO1 C2
- Given is the following sorted linked list where the array INFO contains a list of integer numbers and LINK, START and AVAIL are the pointer fields-
- | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
|-------|---|---|----|-----|---|---|---|-----|----|-----|-----|----|-----|
| INFO: | | | 41 | 129 | | | 9 | 123 | 78 | 194 | 231 | 62 | 145 |
| LINK: | 2 | 5 | 11 | 12 | 0 | 3 | 4 | 7 | 10 | 0 | 8 | 9 | |
- START : 6 AVAIL : 1
- Determine the changes in the list if number XX is *added* to the list and then 145 is *deleted* from the list. [Here XX is the last two digits of your ID]
- d) What is *two way linked list*? Form a *two way linked list* from the one way list in Q 2(c). 3 CO1 C3

Group B

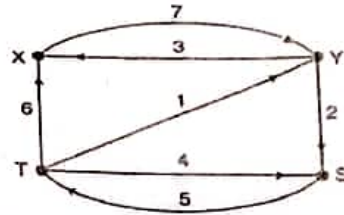
3. a) Suppose the following characters are stored in an array A:
D, A, T, A, S, T, R, U, C, T, U, R, E, S
Apply *selection sort* algorithm to sort the array A and show each pass separately. 3 CO3 C2
- OR
- Suppose the following numbers are stored in an array A:
44, 33, 11, 50, 90, 70, 45, 98, 22, 65, 78
- Apply *merge sort* algorithm to sort the array A and show each pass separately.
- b) Consider a situation where *swap* operation is very costly. Which of the following sorting algorithms should be preferred so that the number of swap operations are minimized in general? Why? 1 CO4 C4
- i) Heap Sort ii) Selection Sort ii) Insertion Sort iv) Merge Sort
- c) Write an algorithm to sort an array A of n elements using *insertion sort*. What is the time complexity of this algorithm? 3 CO1 C2
 - d) The following values are to be stored in a hash table:
35, 58, 102, 79, 131, 46, 112, 177, 2XX
Describe how the values are hashed by using *division method* of hashing with a *table size* of 11. Use *linear probing* as the method of *collision resolution*.
[Here XX is the last two digits of your ID. For example, if ID is C191085, 2XX will be 285]. 3 CO1 C2

4. a) Analyze the differences between complete binary tree and heap tree with figure. Build a max heap from the following list of numbers: **33, 29, 49, 21, 57, 62, 73, 54** 5 CO5 C2
- b) Write the difference between binary search tree and m-way search tree. How do you delete a node from the binary search tree? Explain the deletion with example. 5

OR

- c) Suppose the following sequences list the nodes of a binary tree T in preorder and inorder, respectively:
 Preorder: G, B, Q, A, C, K, F, P, D, E, R, H
 Inorder: Q, B, K, C, F, A, G, P, E, D, H, R
 Draw the tree. 5 CO3 C2

5. a) Use *Warshall's algorithm* to find the *path matrix* for the graph G in following figure. Show each step. 5 CO1 C2



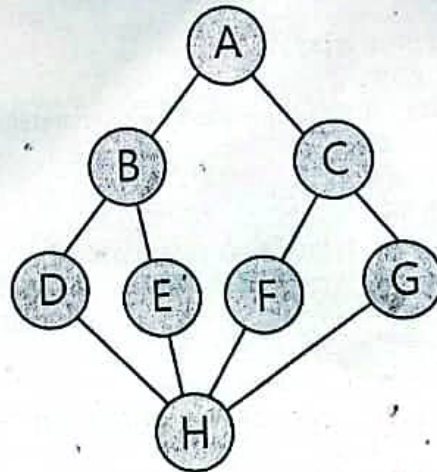
- b) Define *graph*? Draw a picture of the directed graph specified below: 5 CO4 C2
- $G = (V, E)$
 $V(G) = \{1, 2, 3, 4, 5, 6\}$
 $E(G) = \{(1,2), (2,3), (3,4), (5,1), (5,6), (2,6), (1,6), (4,6), (2,4)\}$

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

- b) Traverse the graph G shown below in **breadth first order**, **depth first order** and construct the **breadth first** and **depth first spanning trees**. Start from node D [if last digit of your ID is *odd*] / G [if last digit of your ID is *even*]. 5



International Islamic University Chittagong
Department of Computer Science and Engineering
B. Sc. in CSE

Final Exam, Spring 2024

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

Part A

[Answer the questions from the followings]

- 1 a) What is linear regression? Distinguish between correlation coefficient and regression coefficient. CO2 U 4

- 1 b) An experiment was carried out to investigate variation of solubility of chemical X in water. The quantities in kg that dissolved in 1 liter at various temperatures are shown in the table. CO2 C 6

Temp. $^{\circ}\text{C}$ (y)	17	20	25	30	35	50	70
Mass of X (x)	2.1	2.6	2.9	3.3	4.0	5.1	7.0

Calculate the equation of the regression line of y on x and x on y. What quantity might be expected to dissolve at 32°C ?

Or,

Explain the terms correlation coefficients and regression coefficients. State some uses of regression in engineering statistics.

Suppose temperature and volume be represented by t and v respectively. From 10 pairs of observations if you get $\sum t = 476$;

$$\sum t^2 = 32396; \quad \sum v = 483 \quad \sum v^2 = 33359 \text{ and } \sum tv = 32864.$$

- (i) Fit a regression line of v on t and t on v respectively. Estimate the volume if temperature is 70°C
- (ii) Estimate the temperature if volume is 65ml.

(iii) Verify that $r_{tv} = \sqrt{b_{vt} \times b_{tv}}$

- 2 a) Present illustrative examples to distinguish between (i) mutually exclusive and non-mutually exclusive events; (ii) sample Space and event; (iii) Independent event and dependent event. CO3 R 4

- 2 b) In a software engineering firm, bolts are manufactured by three machines: A, B, and C. Machine A produces twice as many bolts as machine B, while machines B and C produce an equal number of bolts. However, 2% of the bolts produced by machines A and B are defective, while 4% of the bolts produced by machine C are defective. All bolts are stored in a single stockpile, and one bolt is randomly chosen from this stockpile. What is the probability that the chosen bolt is defective? CO3 Ap 6

Part B
[Answer the questions from the followings]

3. a) What does the expected value of a random variable measure? Can the expected value be negative? State four important properties of the variance of a random variable. CO3 U 4

Or Under what conditions can a function be a probability function? What are the key properties of mathematical expectation of a random variable?

3. b) A continuous random variable X has the following probability density function: CO3 Ap 6
 $f(x) = K(x+1); 2 \leq x \leq 5$
 Compute (i) the value of 'K'; (ii) $P(X \leq 3)$; (iii) $P(X \geq 3)$; (iv) $V(X)$; (v) $SD(X)$.

Or,

A random variable X has the following probability function:

Values of X :	0	1	2	3	4	5
x						
$f(x)$	a	3a	5a	7a	9a	11a

Determine the value of a . Find $P[x < 4]$ and $P[0 < x < 3]$

4. a) Introduce the binomial distribution along with its assumptions. Under what conditions does the binomial distribution reduce to the Poisson distribution? CO3 U 4

4. b) In the manufacturing process of glassware, bubbles can occur in the glass which reduces the status of the glassware to that of a 'second'. If, on average, 1 in every 1000 items produced has a bubble, calculate for a batch of 2000 items: CO3 E 6

- (i) The probability that exactly six items are seconds.
 (ii) The probability that more than two items are seconds.
 (iii) The probability that at least one item is a second.

5. a) Explain Level of significance and P-Value. Write some applications of CO4 U 4

χ^2 -test?

5. b) In a software development company, a project manager is interested in investigating whether there is a correlation between the type of programming language used (Python or Java) and the time of day when coding errors occur (morning or evening). The project manager collects data on coding errors over a month and constructs a 2x2 contingency table as follows: CO4 C 6

	Python	Java
Morning	40	15
Evening	25	30

Conduct a chi-square test at a significance level of 5% to determine whether there is an association between the programming language used and the time of day when coding errors occur.

(Note: At 5% level of significance tabulated value of Chi-square @ 1df=3.84)

THE END

International Islamic University Chittagong

Department of Computer Science and Engineering

Final Examination, Spring 2024

Course Code: CSE 2323

Course Title: Digital Logic Design

Total Marks: 50

Time: 2 hours 30 minutes

- i) The figures in the right-hand margin indicate full marks.
ii) Course Outcomes and Bloom's Levels are mentioned in additional columns.

Group-A

- a) Construct a 4-to-16 decoder by joining 2-to-4 decoders with enable input. CO2 A 5
Or
a) Design a multiplexer using the following Boolean Equation. CO2 A 5
$$F(A, B, C) = \sum (1, 3, 4, 5, 6, 7)$$

b) What is the carry propagation problem of parallel Adder? What could be the solution of carry propagation problem of parallel adder? CO1 U 5
2. a) Explain the working principle of a JK flip-flop and how it differs from an SR flip-flop. CO1 U 5
Provide a detailed description of the characteristic table and the excitation table for the JK flip-flop. What is the basic building block of sequential logic circuits?
b) Write down the differences between latch and flip flop. Write down the steps associated for SR to JK Flip Flop conversion with proper circuit diagram. CO1 U 5

Group-B

3. a) Design a ring counter with proper timing diagram. CO3 A 5
Or
Which combinational circuit is renowned for selecting a single input from multiple inputs & directing the binary information to an output line? What is the major functioning responsibility of the multiplexing combinational circuit? 5
b) Can you explain how to design an 8-to-1 multiplexer using smaller ones? How many inputs does a 4-to-1 multiplexer comprise of? CO2 A 5
4. a) Design the sequential circuit described by the following state equations using JK flip-flops. CO3 A 5
$$A(t+1) = xAB + yA'C + xy$$
$$B(t+1) = xAC + y'BC'$$
$$C(t+1) = x'B + yAB'$$

b) Differentiate between sequential circuit and combinational circuit. CO3 10
a) Define coincidence logic with example. Differentiate between PAL and PLA. A
combinational circuit is defined by the functions:
$$F1(A, B, C) = \sum (3, 5, 6, 7)$$
$$F2(A, B, C) = \sum (0, 2, 4, 7)$$
 - Implement the circuit with a PLA having three inputs, four product terms, and two outputs.
 - What is the main difference between Register and counter?
Or
5. a) Design a universal shift register and explain its operation. CO3 U 5
b) Design a 3 bit magnitude comparator circuit with proper explanation. E 5



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-2024
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.
(iv) Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.

Course Learning Outcomes (CLOs) of the Questions

CLO1:	Understand the fundamentals of Matrix, Linear system of equations & Vector analysis.
CLO2:	Implement the fundamental knowledge of Matrix, linear system of equations, vector functions, vector field, scalar field, gradient, divergence, curl, differentiation and integration of vector valued functions, partial derivatives in different problems.
CLO3:	Solve line integrals, surface area, surface integrals, volume integrals, and the work done in different problems.
CLO4:	Apply Green's theorem, Stoke's theorem, and Gauss' theorem in solving mathematical problems.

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. a)	Using LU decomposition solve the following linear system of equation, $x + 2y + 3z = 5, 2x - 4y + 6z = 18, 3x - 9y - 3z = 6$	09	CLO1	R&U
b)	What is singular value of a matrix?	01	CLO1	R&U
2. a)	Find all vectors \vec{v} such that $(\hat{i} + 2\hat{j} + \hat{k}) \times \vec{v} = 3\hat{i} + \hat{j} - 5\hat{k}$	5	CLO2	R&U
Or)	Find the angles which the vector $\vec{A} = 2\hat{i} - \hat{j} + 2\hat{k}$ makes with the coordinates axes.	5	CLO2	U
b)	If A and B are constant vectors and K is a constant scalar, then show that $H = e^{-Kx}(A \sin Ky + B \cos Ky)$ satisfies the Laplace equation $\frac{\partial^2 H}{\partial x^2} + \frac{\partial^2 H}{\partial y^2} = 0$.	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 $\vec{A} = \hat{i} - 3\hat{j} + 2\hat{k}$.	5	CLO2	U

GROUP - B

Marks 5 CLO CLO2 DL U

- 3 a) Suppose that over a certain region of space the electrical potential V is given by $\phi(x, y, z) = 5x^2 - 3xy + xyz$. Find the rate of change (derivative) of the potential at $P(3, 4, 3)$

in the direction of the vector $\vec{v} = \hat{i} + \hat{j} - \hat{k}$

- b) Prove that the angle between the surfaces at the point is equal to the angle between the normals to the surfaces at the point

5 CLO2 U

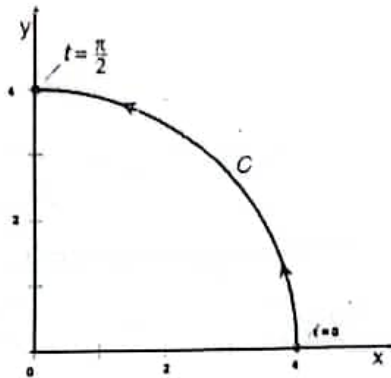
- 4 a) Determine the constant a so that the vector $V = (x + 2y)\hat{i} + (y - 2z)\hat{j} + (x + az)\hat{k}$ is solenoidal.

3 CLO2 U

- b) Evaluate the line integral $\int_C xy^2 dx$ on the quarter circle C

3 CLO3 U

defined by $x = 4 \cos t, y = 4 \sin t, 0 \leq t \leq \frac{\pi}{2}$



c)

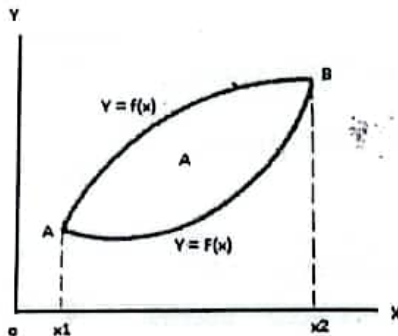


Figure 1

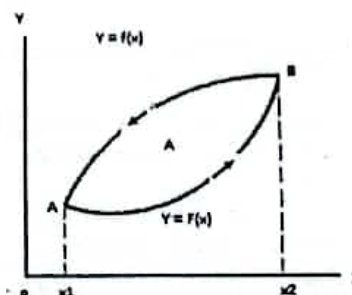


Figure 2

What is the area A from figure 1 and figure 2

- d) How much work is accomplished by the force

2 CLO3 U

$\vec{F}(x, y) = xy\hat{i} + y\hat{j}$ in pushing a particle from $(0, 0)$ to $(3, 9)$ along the parabola $y = x^2$?

5. Verify Green's theorem for the line integral $\int_C (x^2 + xy)dx + (x^2 + y^2)dy$ where C is the square formed ABCD by the lines $y = \pm 2, x = \pm 2$

10 CLO4 Ap

Or

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, $x = 0, x = 2; y = 0, y = 2; z = 0, z = 2$

10 CLO4 Ap

International Islamic University Chittagong
Morality Development Program
Semester End Examination, Spring-2024
3rd Semester (Other than Shari'ah faculty)

Course code: MDP-2303

Course Title: *Tajweedul Qur'an-III* (Arts of correct recitation of the Qur'an)
Full Marks: 50 Time: 2 hours & 30 minutes

Answer the following questions:

1. Write the meaning of the following Surah: (Any two): 5×2=10
 - a) *Surah Al-Inshirah* (سورة الانشراح)
 - b) *Surah At-Teen* (سورة التين)
 - c) *Surah Ad-Dhuha* (سورة الضحى)
 2. Define *Tafkheem* (Velarization) and *Tarqeeq* (Attenuation). How many letters of *Tafkheem* are there in *Tajweed*? When the letter of *Raa* (ر) will be recited with *Tafkheem* and when it will be recited with *Tarqeeq*? Explain. 2+3+5=10
 3. Define *Al-Waqf* (الوقف). What is the importance of *Waqf* in *Tajweed*? Explain different types of *Waqf* with examples. 2+2+6=10
 4. (a) Explain briefly ten types of voluntary prayers mentioning their importance in Islamic *Shari'ah*.

Or, 10

(b) How to perform *Salatul Janazah* (Funeral prayer)? Describe it in some detail.
 5. (a) Explain biographies of five Muslim heroes who have extraordinary contributions to the history of Islam.

Or, 5×2=10

(b) Explain five significant scientific indications of the holy Qur'an with some examples.
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International Islamic University Chittagong
Center for General Education (CGED)
 Semester End Examination, Spring-2024

Course Code: URED-2302 (URED-2101 for LLB)
 Course Title: Sciences of Qur'an and Hadith

Full Marks: 50

Time: 2 Hours 30 Minutes

(Answer all questions. The right side columns contain marks, CLOs, and Bloom's taxonomy domain for each question):

#	Questions	Marks	CLOs	Bloom's taxonomy domain
1	Define Makki and Madani Surah. Summarize some extraordinary characteristics of Makki and Madani Surah. Why was the holy Qur'an divided into Makki and Madani Surah? Explain.	10	3	Remember & Create
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? When was the holy Qur'an compiled in a single volume? Explain elaborately.	10	3	Remember & Create
3	Summarize some scientific indications of the holy Qur'an proving it as the best miracle of prophet Muhammad (SAAS) with evidence.	10	3	Evaluate & Create
4	Identify the position of Hadith in Islamic Shari'ah. Prove the importance of Hadith from the viewpoint of Islam.	10	3	Analyze & Evaluate
5	<p>a) Define Hadith literally and terminologically. Explain some types of Hadith according to the reference to a particular authority with some examples.</p> <p style="text-align: center;">Or,</p> <p>b) Explain with examples:</p> <ul style="list-style-type: none"> • Sanad & Matan • Al-Hadith As-Sahih • Al-Hadith Al-Qudsi • Al-Hadith Al-Mawdu' • Six books of Hadith. 	10	3	<p>Remember & Create</p> <p>Create</p>

International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE, Final Examination, Spring 2024

Course Code: CSE 2301 Course Title: Chemistry

Total marks: 50

Time: 2 hours 30 minutes

[The figures in the right hand margin indicate full marks. Course Outcomes and Bloom's Taxonomy Levels are mentioned in additional columns. The questions must be answered in order.]

Group A

- | | | | | |
|------|---|-----------|-----|----------|
| 1.a) | What are ideal and non-ideal solutions? What are the thermodynamic criteria of such solutions? | 2 | CO1 | DL
C1 |
| 1.b) | What are positive and negative deviations from Raoult's law? Point out the reasons for positive and negative deviations of non-ideal solutions from ideal one with the help of V.P. (vapour pressure) composition plots. | 4 | CO2 | C2 |
| 1.c) | State and explain Nernst distribution law with limitations and applications. | 4 | CO2 | C2 |
| 2.a) | How would you differentiate between electrolytes and nonelectrolytes? | 2 | CO1 | C2 |
| 2.b) | Identify the strong electrolytes and weak electrolytes from the following-
HCl, H ₂ SO ₄ , H ₃ PO ₄ , CH ₃ COOH, NaOH, Ca (CH ₃) ₂ , NH ₄ OH | 3 | CO1 | C2 |
| 2.c) | Define transport number. In an electrolysis of copper sulphate between copper electrodes the total mass of copper deposited at the cathode was 0.153g and the masses of copper per unit volume of the anode liquid before and after electrolysis were 0.79 and 0.91g respectively. Calculate the transport number of the Cu ²⁺ and SO ₄ ²⁻ ions. | 1 + 4 = 5 | CO2 | C5 |

OR

- | | | | | |
|------|---|---|-----|----|
| 2.a) | What are the colligative properties of dilute solutions? When are the laws on colligative properties valid? | 2 | CO1 | C2 |
| 2.b) | Differentiate between ionization and dissociation. Deduce Arrhenius dissociation constant for AB. | 4 | CO2 | C4 |
| 2.c) | State and explain Henry's law with limitations and applications. | 4 | CO2 | C4 |

Group B

- | | | | | |
|------|--|---|-----|----|
| 3.a) | What are the difference between order and molecularity of a reaction? | 2 | CO1 | C2 |
| 3.b) | Define zero order reaction and Pseudo-unimolecular reaction with examples. | 4 | CO1 | C2 |
| 3.c) | Define second order reaction. Derive the integrated rate equation for second order reaction. | 4 | CO3 | C4 |
| 4.a) | Introduce, with example, different types of chemical equilibrium. | 2 | CO1 | C1 |
| 4.b) | What is Le- Chatelier principle? What are the optimum temperature and pressures for maximum production of Ammonia in industry using Le- Chatelier Principle? | 3 | CO1 | C2 |
| 4.c) | Using Law of mass action derives an expression for the equilibrium constant K _c and K _p of the following reaction and also finds the relationship between K _p & K _c .
$a A + b B + c C = d D + e E + f F$ | 5 | CO3 | C4 |
| 5.a) | Write the differences between lyophilic and lyophobic sols and Oil in water and water in oil emulsions. | 3 | CO2 | C2 |
| 5.b) | Explain activation energy and activated complex in terms of Transition State Theory. | 4 | CO1 | C4 |
| 5.c) | Explain collision theory along with Arrhenius equation. | 3 | CO1 | C1 |
| OR | | | | |
| 5.a) | Mention some applications of colloids. | 2 | CO1 | C2 |
| 5.b) | Prove that $K = \frac{1}{t} \frac{x}{a(a-x)}$ Where the symbols have their usual meanings. | 4 | CO2 | C5 |
| 5.c) | Classify colloidal solutions based on dispersed medium and dispersed phase. | 4 | CO1 | C3 |