

International Islamic University Chittagong
Department of Computer Science and Engineering
B. Sc. in CSE, Final Examination, Spring 2024
Course Code: CSE 2423 Course Title: Database Management System
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

CO DL
6 2 3

- 1.a) Consider the following relational database:
Patient (pid, pname, Address, mobile, DOB, gender)
visit (pid, did, visit_date)
Doctor (did, dname, speciality)
drug (drid, d_name, d_type, manuf_year, unit_price)
prescribe (pid, did, drid, pdate, quantity)

Give an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition.

Ensure the following constraints:

Pname, dname, and d_name (not null), Mobile (unique), gender ('M', or 'F'), quantity and unit_price (not negative).

OR

Normalize the following table if it is not normalized.

sid	sname	addresses	Course_Id	cname	Department_Id	dname	D_location
S01	Forhad	ctg	C01, C02	C, C++	D01	CSE	GEC
S02	Anika	dhaka	C01, C03	C, JAVA	D01	CSE	GEC
S03	Mazed	ctg	B01	Statistics	D02	BBA	Agrabad

- 1.b) How the trigger does ensure integrity of the database? Give example.

4 2 2

OR

Write an assertion for the patient database to ensure that the patient has not visiting the two doctors at a time. (May consider the schema of Q1 (a)).

- 2.a) Let the relation schema, R(ABCDEFGH) have the following F set of functional dependencies:

2 2 4
+
3

A->B

CH->A

B->E

BD->C

EG->H

DE->F

- Can "CHDG" and "DEHC" be candidate keys for the above functional dependencies? Compute the closure and justify your answer.
- The above schema is not in BCNF but in 2NF. Decompose the relation into BCNF and explain your answer.

- 2.b) Why data normalization is important? Explain lossless decomposition and lossy decomposition with an example.

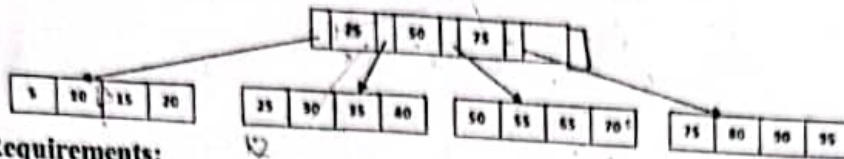
5 1 2

Group B

- 3.a) How to choose indexing or hashing technique? Justify.
OR

How can Indexes help performance? Consider employees relation, if we want to retrieve all employees, whose salary is in a given range, will it be best alternative to sort the employee records by employee id. Justify your answer.

- 3.b) Given the following B+ tree.



Requirements:

1. Insert (step by step): 13, 12, 17, 60, 45
2. Delete: 35, 60, 75, 95

4. i. For the following transaction T_i , transfers \$50 from account A to account B is shown below:

T_i : read(A);
A:=A-50;
write(A);
read(B);
B:=B+50;
write(B);

3 1 4
+
2
+
2
+
3

Considering the above example, explain each of the ACID properties.

- ii. Explain the distinction between the terms "serial schedule" and "serializable schedule".
- iii. "A given schedule can be tested for conflict serializability by constructing a precedence graph for the schedule and by searching for the absence of cycles in the graph." - State whether the statement is true or not using an example.
- iv. What is a cascadeless schedule? Why is cascadelessness of schedules desirable? Are there any circumstances under which it would be desirable to allow non-cascadeless schedules? Explain your answer.

- 5.a) Why distributed database is important? "Replication and fragmentation are the two ways of storing data in the distributed database". Distinguish between these two systems explaining the advantage of one over the other.

3 1 2

- 5.b) Explain the purpose of checkpoint mechanism. How often should checkpoints be performed give an example.

3 2 3

OR

Draw the state diagram of a transaction and elaborately discuss its state.

- 5.c) How can you resolve problem of system failure? Explain at least two techniques

4 2 2



International Islamic University Chittagong

Morality Development Program

Examination: Final

Session: 2024

Semester: Spring

Course Title: Concepts of Moral Development-I

Course Code: MDP-2404

[Other than Shariah Faculty]

Full Marks: 50

Time: 2 hour 30 minutes

[N.B: Answer the following questions]

1.a)	What is the significance of Islamic dress code?	5
b)	Discuss the characteristics of Islamic dress and its impact to form moral society.	5
2	Define 'al ma-roof' and 'al-munkar' in light of Islam. Explain the significance of enjoining good and forbidding evil.	10
3	What is good health? According to Quran and Sunnah discuss the guidelines to maintain good health.	10
4.a)	What is gambling? What are its consequences?	4
b)	Gambling is prohibited in Islam. Explain it with necessary references.	6
	OR	
	Define brotherhood in Islam. How did the prophet Mohammad (PBUH) instilled brotherhood among Muslims?	10
5.a)	Discuss the characteristics of a Muslim leader.	4
b)	Discuss the principles of leadership of the prophet Mohammad (PBUH) and his companions.	6
	OR	
a)	Define peaceful coexistence and discuss the Islamic principles of peaceful coexistence.	6
b)	"Islam discourages racial discrimination"-explain with references.	4

15/10/2020

[illegible]

ସ-ପିତା
ମାତା: ୨୦

କ୍ର. ସଂ.	ବର୍ଣ୍ଣନା	ସମୟ	CLO	Cognitive Learning
୦୧.	"ସଫଳତା" କ୍ରିୟାତ୍ମକ ଅଭିଯୋଗ ଅନୁସାରେ ପ୍ରତିଷ୍ଠାପନା ଆମେକାମନା କର ।	୨୦	CLO3	Apply
୦୨.	"ସୂଚନା ମଧ୍ୟ ସଂକଳିତ" ଏବଂ ଅଭିଯୋଗ ପ୍ରସ୍ତୁତ ଆମେକାମନା କର । ଅଥବା, "କର" ଭାଷା ଆମେକାମନା ସାଧକ ନିଷ୍ପତ୍ତି - ଉଚ୍ଚିତ ସଂସ୍କୃତି ନିର୍ଦ୍ଧାରଣ କର ।	୨୦	CLO3	Analyze
		୨୦	CLO3	Evaluate



International Islamic University Chittagong (IIUC)

Department of Computer Science and Engineering (CSE)

Semester Final Examination

Program: B. Sc. in CSE
Course Code: MATH-2407
Time: 2:30 hours

Semester: Spring-2024
Course Title: Mathematics-IV
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:	Demonstrate the understanding of the basic principles and operations set theory, mathematical operations with complex numbers, geometrical interpretation and the related fundamental theories involving complex functions and the concept of transformation in a complex plane.
CLO2	Understanding the behavior of complex wave, periodic functions, and aperiodic functions, stable signal, unstable signal, impulse signal, unit step function, ramp function, convolution theorem.
CLO3:	Use Fourier series, Laplace's Transforms, Inverse Laplace's Transform, Fourier Transform in different scenario.
CLO4:	Analyze the harmonics & spectrum of different types of waves.
CLO5:	Demonstrate the harmonic analysis using MATLAB.

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

1. a) What is obtained by breaking down a complex wave?
b) Find the complex form of the periodic function $f(t)$ is given by:

$$f(t) = \cos \frac{1}{2}t \quad ; -\pi < t < \pi \quad [T = 2L = 2\pi]$$

Marks	CLO	DL
01	CLO2	U
09	CLO3	U

- 2 a) Evaluate the convolution sums of $y[n] = x[n] * h[n]$
Where,

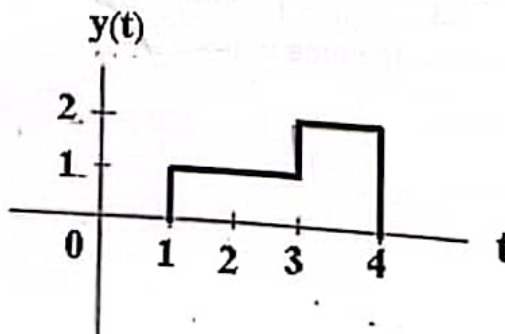
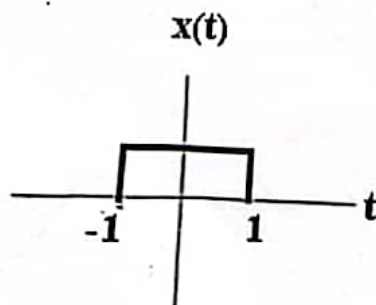
$$x[n] = \begin{cases} 1, & n = 0 \\ 3, & n = 1 \end{cases} \text{ and } h[n] = \begin{cases} 2, & n = 0 \\ 1, & n = 1 \end{cases}$$

08	CLO2	U
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Where, n represents the time index.

Or

Find convolution integral of $x_1(t) * x_2(t)$



b) If $x = \cos 3t + \frac{1}{4} \sin 4t$ then find the amplitude of the new signal and the phase shift.

Or
 $y = f(t) = 0; -\pi \leq t < 0$
 $= t; 0 \leq t < \pi$ Here, $T = 2L = 2\pi \therefore L = \pi$

Sketch the function for 3 cycles

GROUP-B

		Marks	CLO	DL
3.	a)	5	CLO3	U
	Find the Fourier transform of $f(t) = \begin{cases} 1 + \frac{t}{a}, & -a < t < 0 \\ 1 - \frac{t}{a}, & 0 < t < a \\ 0, & \text{otherwise} \end{cases}$			
	Or			
	Find the Laplace transform of the functions: $f(t) = \sin at$			
	b)	5	CLO3	U
	Express the following function in terms of unit step functions and hence find its Laplace transform $f(t) = \begin{cases} 8; & t < 2 \\ 6; & t > 2 \end{cases}$			
4.	a)	5	CLO3	U
	Evaluate $\mathcal{L}\left\{\frac{\sin 2t}{t}\right\}$ using the division theorem.			
	Or			
	Solve the Initial Value Problem (IVP) by Laplace Transformation, $Y'' - 3Y' + 2Y = 4e^{2t}$, $Y(0) = -3$, $Y'(0) = 5$			
	b)	3	CLO2	U
	Draw the graph of the following functions i. $-2u(t+3)$ ii. $x(t-2)$ iii. $3\delta(t-2)$			
	c)	2	CLO2	U
	Plot the line spectrum (at least 2) for the following Fourier series: $f(t) = \frac{\pi^2}{3} + \sum_{n=1}^{500} \frac{(-1)^{2n}}{n^2} \cos n\pi t$			
5.	a)	4	CLO5	App
	Write a user defined MATLAB function to reconstruct $f(t)$ in the time interval of $[-4, 20]$ for the following complex wave $f(t) = 2\pi + \sum_{n=1}^{500} \frac{2}{n} \cos 2n\pi t$			
	b)	4	CLO5	App
	Write MATLAB code for the following unit step function $5u(t) + 6u(t+2) - 7u(t-1)$			
	c)	2	CLO5	App
	Write MATLAB code to find the convolution sums of $y[n] = x[n] * h[n]$ Where, $x[n] = \begin{cases} 2, & n = 0 \\ 3, & n = 1 \end{cases} \text{ and } h[n] = \begin{cases} 3, & n = 0 \\ 1, & n = 1 \end{cases}$ Where, n represents the time index.			

International Islamic University Chittagong
Department of Computer Science and Engineering

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

Course Code: CSE 2421 Course Title: Computer Algorithms

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

- | | | CO | DL |
|---|---|-----|----|
| 1.a) Suppose that instead of always selecting the first activity to finish, we instead select the last activity to start that is compatible with all previously selected activities. Describe how this approach is a greedy algorithm, and prove that it yields an optimal solution.
OR
Show that activity selection problem has optimal substructure property. | 3 | CO5 | E |
| 1.b) Write a greedy algorithm for fractional knapsack problem. | 3 | CO5 | C |
| 1.c) Suppose you have the following characters with the given frequencies:
a:30 b:5 c:17 d:13 e:25 f:10
Construct Huffman tree for this set of characters showing each step and determine the optimal variable length code. | 4 | CO1 | A |
| 2.a) Consider the following graph, Fig.1. In what order will the nodes be visited using a Breadth First Search? In what order will the nodes be visited using a Depth First Search? (Assuming B is the source, show the state of queue and stack in case of BFS and DFS respectively) | 5 | CO2 | A |

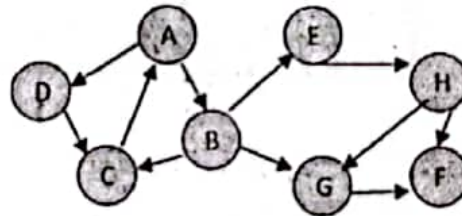


Fig.1

- | | | | |
|---|---|-----|---|
| 2b) Define spanning tree and minimum spanning tree. Construct the minimum spanning tree from the graph in Fig.2 using Prim's algorithm. | 5 | CO5 | A |
|---|---|-----|---|

OR

Find a minimum spanning tree for the graph in Fig.3 using Kruskal algorithm and show the steps.

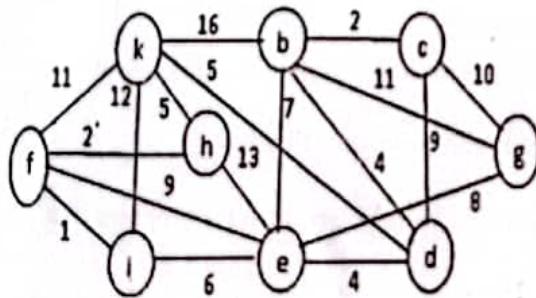


Fig.2

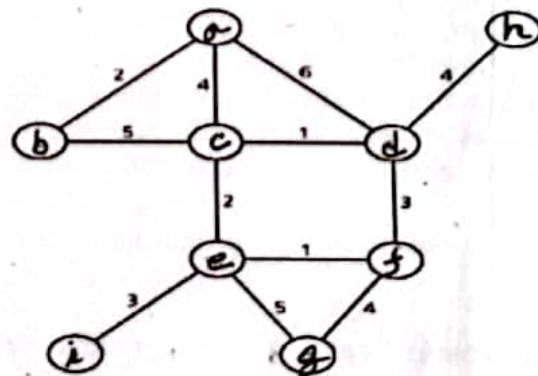


Fig.3

Group B

- 3.a) What is the difference between the Floyd-Warshall algorithm and Dijkstra's algorithm for finding the shortest path between two vertices in a weighted graph? 2 CO3 U
- 3.b) Consider the directed weighted graph in Fig.4. Apply Dijkstra's algorithm to find single source shortest path. Show intermediate results of shortest path estimate and predecessor. 4 CO2 U

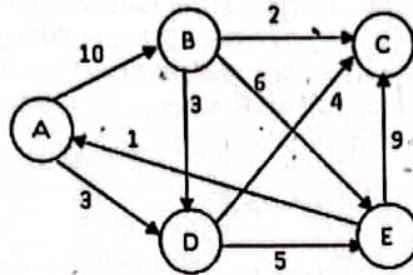


Fig.4

- 3.c) Consider the graph in Fig.5 for finding all pair shortest path using Floyd-Warshall algorithm. 4 CO2 U

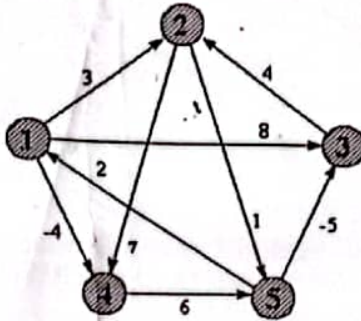


Fig.5

$D(4) =$

0	3	-1	-4	-4
3	0	-4	1	-1
7	4	0	5	3
2	-1	-5	0	-2
8	5	1	6	0

Fig.6

What is the value of matrix $D(5)$ calculated from matrix $D(4)$ given in Fig.6.

OR

Define relaxation technique and negative-weight cycle. How the presence of negative-weight cycle in a graph can be identified?

- 4.a) Let a bee is travelling from point A to point B in a straight line and then turned left and go towards point C in a straight line. Show with necessary calculations that if she returns using the same path then she will make a right turn at point B. 3 CO1 C
- OR
- Show how the sign of the cross-product of two vectors can be used to determine whether one vector resides in clockwise or anti-clockwise direction with respect to another vector. Show using suitable figure.
- 4.b) i) Plot the following points on a Cartesian coordinate plane. 3 CO3 A
 $[(4,3), (7,4), (12,5), (6,9), (3,8), (17,8), (2,2), (6,5), (1,8), (7,8), (12,3), (3,6)]$
- ii) Sort the above points according to polar angle with respect to the point which is the lowermost and in case of a tie the leftmost.
- 4.c) How can you determine if two line segments intersect? Explain with necessary figures. 4 CO1 A
- 5.a) What is the implication of having a polynomial time algorithm for a problem in NP-complete class? 2 CO4 U
- OR
- How can you determine if a problem belongs to NP-complete class?
- 5.b) Consider a weighted undirected simple graph with 5 vertices. Add exactly 15 edges in the graph. Then assign all the following weights randomly to the edges. Solve the Travelling Salesman problem for the graph and find the optimal trip applying branch and bound technique. 4 CO2 A
 Weights: 5, 7, 3, 2, 12, 8, 14, 6, 3, 4, 14, 7, 4, 4, 7
- 5.c) Why Branch and Bound algorithm is capable of solving optimization problems efficiently? 4 CO1 R
 [Hint: Think about the logic behind not expanding a certain node.]

International Islamic University Chittagong
Department of Computer Science and Engineering
B. Sc. in CSE Final Term Examination, Spring 2024
Course Code: CSE 2425 Course Title: Theory of Computing

Total marks: 50

Time: 2 hour 30 minutes

[Answer all the questions. Figures in the right-hand margin indicate full marks. The questions must be answered in order.]

Group A

- 1.a) Construct a Context-Free Grammar (CFG) that generates the following language over the alphabet $\Sigma = \{0,1\}$ 3 CO1 Ap
 $L = \{w \mid \text{the length of } w \text{ is odd and its middle symbol is a '0'}\}$
 Or,
 Construct a Context-Free Grammar (CFG) corresponding to the regular expression $(0 + 1)^*011^*$ over the alphabet $\Sigma = \{0,1\}$. That is, any string described as "any combination of '0' and '1' followed by '01' ending with any number of '1's" belongs to the associated language.
- 1.b) Give the formal definition of Context-Free Grammar (CFG) and Chomsky Normal Form (CNF). 2 CO2 R
- 1.c) When is a grammar called *ambiguous*? Consider the following grammar 5 CO2 An
 $S \rightarrow SAB \mid \epsilon, A \rightarrow AaB \mid a, B \rightarrow AS \mid b$
 This grammar is *ambiguous*. Show in particular that the string $aaaabaabbabab$ has two:
 i. Parse trees ii. Leftmost derivations iii. Rightmost derivations
- 2.a) Using the pumping lemma show that the following languages are not context free (any one): 3 CO1 U
 $L = \{a^n b^n c^l \mid l \leq n, l \geq 0, n \geq 0\}, L = \{x^n y^n z^n \mid n \geq 1\}$
 or,
 Can you give a context-free grammar (CFG) for the following language over the alphabet $\Sigma = \{a, b\}$ –
 All strings in the language $\{a^n b^{2n} c^{4n} \mid n \geq 0\}$
 If you cannot, justify the reason.
- 2.b) How can Context-Free Grammar (CFG) be simplified? Write down the procedure for eliminating unit productions from a CFG. Remove the unit productions from the following grammar – 3 CO2 Ap
 $S \rightarrow AC, A \rightarrow a, C \rightarrow B \mid d, D \rightarrow E, E \rightarrow b$
- 2.c) Convert the following CFG into an equivalent CFG in CNF: 4 CO2 Ap
 $S \rightarrow TX$
 $T \rightarrow 0T0 \mid 1T1 \mid \#X$
 $X \rightarrow 0X \mid 1X \mid \epsilon$
 Or,
 Convert the following CFG into an equivalent CNF form.
 $S \rightarrow ASB$
 $A \rightarrow aAS \mid a \mid \epsilon$
 $B \rightarrow SbS \mid A \mid bb$

Group B

- 3.a) Formally define the pushdown automata. Illustrate the component of PDA with figure. 2 CO2 R
 Or,
 Why do you think pushdown automata are more powerful than finite automata?
- 3.b) Construct a pushdown automaton that recognizes the following language 4 CO3 An
 $L = \{t^i s^j a^k \mid i, j, k \geq 0 \text{ and } i = j \text{ or } j = k\}$

Or,
 Suppose the PDA $P = (\{q, p\}, \{0, 1\}, \{Z_0, X\}, \delta, q, Z_0, \{p\})$ has the following transition functions:

$$\begin{array}{lll} \delta(q, 0, Z_0) = \{(q, XZ_0)\} & \delta(q, 1, X) = \{(q, X)\} & \delta(p, \epsilon, X) = \{(p, \epsilon)\} \\ \delta(q, 0, X) = \{(q, XX)\} & \delta(q, \epsilon, X) = \{(p, \epsilon)\} & \delta(p, 1, X) = \{(p, XX)\} \\ & & \delta(p, 1, Z_0) = \{(p, \epsilon)\} \end{array}$$

Starting from the initial instantaneous description (q, w, Z_0) , show all the reachable instantaneous descriptions when the input w is:

- i. 0011 ii. 010

Prove that, Every non-deterministic finite automata has an equivalent deterministic finite automata.

3 CO1 C

c) Convert The following Regular Expression to NFA: (Any two)

- i) a^*bc^*
- ii) $a^*U b^*$
- iii) $a^*b(aUb)^*$
- iv) $(a + ba)^*ba$

3

a) Using Pumping Lemma, Prove that the language $L = \{0^i1^i, i > 0\}$ is not Regular.

4 CO2 An

Or

Prove that the class of Regular Language is closed under Union operation and build a NFA from the regular expression $(ab U a)$.

4 CO2 An

b) What are the language describe by the following regular expressions. Write a one sentence description for each language: (Any two)

- i) $0^*(0U11)^*$
- ii) $((1(11)^*00)U(11)^*0)^*$
- iii) $1^*(01^+)^*$
- iv) $[(0 + 1)^*0(0 + 1)^*1(0 + 1)^*] + [(0 + 1)^*1(0 + 1)^*0(0 + 1)^*]$

2 CO2 U

c) Convert the following DFA into regular expression:

4 CO1 Ap

