


Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science & Engineering

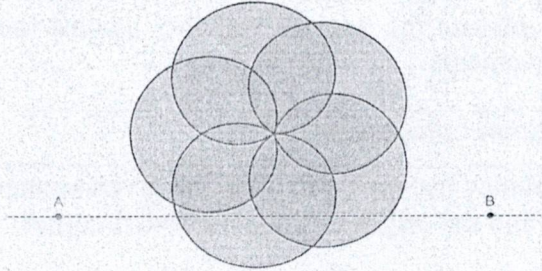
Final Examination, 2023
Course No: CSE 715
Time: 03 (Three) hours

4th Year 1st Semester
Course Title: Digital Image Processing
Full Marks: 60

N.B. : (i) Answer any three question from each PART (ii) Use separate answer scripts for each PART
 (iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-----N/A-----

PART-A
 (Answer any three questions)

1.	(a)	What is Image digitization? Why do we need to digitize an image?	03									
	(b)	Explain the difference between 72 dpi and 150 dpi and what the dpi unit is used to measure.	03									
	(c)	A doctor struggles to see a tumor in a CT scan due to obscuring surrounding tissues. What technique can enhance the tumor's visibility against these tissues? Describe the steps and expected improvements.	04									
2.	(a)	What is digital image processing?	02									
	(b)	Measure the distance between pixels for the given arrangements where pixel coordinates are $P(0,0)$, $Q(2,2)$ and the origin is in the upper-left corner. <table border="1" style="margin-left: 40px;"> <tbody> <tr><td>1</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>1</td></tr> </tbody> </table> – $D_4(P, Q)$ – $D_8(P, Q)$ – $m_distance(P, Q)$	1	0	0	1	1	0	0	1	1	04
	1	0	0									
1	1	0										
0	1	1										
(c)	Why is padding necessary while filtering images? You have given a grayscale image of a chest X-ray for medical diagnosis. Which type of padding would you use to pre-process the image and why?	04										
3.	(a)	The following figure shows an image that has been corrupted by either salt noise or pepper noise. Is it salt noise or pepper noise? Given a choice of (1) arithmetic mean filter; (2) harmonic mean filter; and (3) contraharmonic mean filter, which one is most appropriate for this task. Explain. 	03									
	(b)	You have given RGB values (29, 98, 128) and convert into its equivalent CMY values.	02									

	(c)	You are given an image of $f(x,y)$ and filter mask $w(x,y)$. Find both correlation and convolution of the image with the filter mask and show the full correlation and convolution result and cropped correlation and convolution result.	05																																		
		<table border="1" style="display: inline-table; margin-right: 20px;"> <tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr> </table> $f(x,y)$ <table border="1" style="display: inline-table; margin-left: 20px;"> <tr><td>7</td><td>8</td><td>9</td></tr> <tr><td>4</td><td>5</td><td>6</td></tr> <tr><td>1</td><td>2</td><td>3</td></tr> </table> $w(x,y)$ <div style="margin-left: 100px;">Fig.2</div>	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	7	8	9	4	5	6	1	2	3	
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7	8	9																																			
4	5	6																																			
1	2	3																																			
4.	(a)	What is histogram equalization?	02																																		
	(b)	Describe the following types of noise: Salt and pepper, Impulse, and Gaussian.	03																																		
	(c)	Explain the steps involved in converting the line AB of the sample analog image into a digital image.	05																																		
																																					

PART-B

(Answer any three questions)

5.	(a)	The table below shows different symbols with their corresponding occurring probabilities.	05														
		<table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Symbol</th> <th>m1</th> <th>m2</th> <th>m3</th> <th>m4</th> <th>m5</th> <th>m6</th> </tr> </thead> <tbody> <tr> <td>Probability</td> <td>0.30</td> <td>0.25</td> <td>0.15</td> <td>0.12</td> <td>0.10</td> <td>0.08</td> </tr> </tbody> </table> <p>i) Create a Huffman tree and Huffman table for table above and also calculate the respective Huffman codes for each symbol. ii) What is the compression ratio achieved by employing Huffman coding instead of 8-bit fixed length coding. iii) Calculate the relative data redundancy and comment on the type of redundancy used by the Huffman coding.</p>	Symbol	m1	m2	m3	m4	m5	m6	Probability	0.30	0.25	0.15	0.12	0.10	0.08	
Symbol	m1	m2	m3	m4	m5	m6											
Probability	0.30	0.25	0.15	0.12	0.10	0.08											
	(b)	Covert HSI value to RGB value where $H = 120$ (degrees), $S = 0.5$, $I = 0.8$.	05														
6.	(a)	Explain the given statement: "Intensity transformations is a point processing technique."	02														
	(b)	Can you briefly explain what image segmentation is? Write down the masks for point detection, vertical line detection, and edge detection.	03														
	(c)	What is discrete unit impulse? Show the correlation and convolution outcome when a 1×5 kernel is used on a discrete unit impulse of size 1×7 . Given kernel: $[2 \ 1 \ 8 \ 4 \ 3]$	05														
7.	(a)	What will happen if the gamma value is too low for the Gamma transformations?	02														
	(b)	What are the effects of reducing the spatial resolution of a digital image?	02														

	<p>(c) Consider the following 3X4 grayscale image below with intensity level, $L = 16$. The image has Salt and pepper noise.</p> $\begin{bmatrix} 4 & 8 & 14 & 3 \\ 0 & 7 & 1 & 13 \\ 9 & 15 & 1 & 6 \end{bmatrix}$ <p>Apply the appropriate 3X3 filter with zero padding to remove the noise and what will be the resulting image? Illustrate each of the steps.</p>	06
8.	<p>Consider the following 5X5 grayscale image matrix with gray level, $L = 8$:</p> $\begin{bmatrix} 7 & 0 & 6 & 0 & 7 \\ 4 & 1 & 7 & 0 & 4 \\ 5 & 0 & 0 & 0 & 5 \\ 2 & 4 & 6 & 1 & 5 \\ 0 & 1 & 4 & 0 & 4 \end{bmatrix}$	
(a)	What does filtering refer to in terms of image enhancement?	02
(b)	What is thresholding? When and why is thresholding required in the segmentation problem?	03
(c)	Apply the basic global thresholding algorithm to recognize the digit on the given image and provide a demonstration of each step with calculation.	05

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Final Examination, 2023
Course No: CSE 703
Time: 03 (Three) hours

4th year 1st semester
Course Title: Artificial Intelligence
Full Marks: 60

N.B. : (i) Answer any three question from each PART (ii) Use separate answer scripts for each PART
 (iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-----N/A-----

PART-A
 (Answer any three questions)

1. (a) What do you understand by the Complete Turing Test? 01
- (b) Differentiate between thinking humanly and thinking rationally. 03
- (c) What is the relation between Artificial Intelligence, Machine Learning and Deep Learning? 02
- (d) Explain the importance of the following foundational fields of AI: 04
 Computer Engineering, Neuroscience, Economics and Linguistics

2. (a) What is an agent program? How does an agent program shape the behavior and performance of an agent? 03
- (b) What is Learning Agent? Why learning is important in Artificial Intelligent? 02
- (c) Let's assume, you have a 3*3 chess board and a knight at the upper left corner denoted by (*). [Knight's move: either it goes horizontally (left or right) 2 steps and vertically (up or down) 1 step or goes vertically (up or down) 2 steps and horizontally (left or right) 1 steps, if it is not out of the board. It actually jumps off from the initial position and lands at the destination rather than visiting every place in its path.] 05

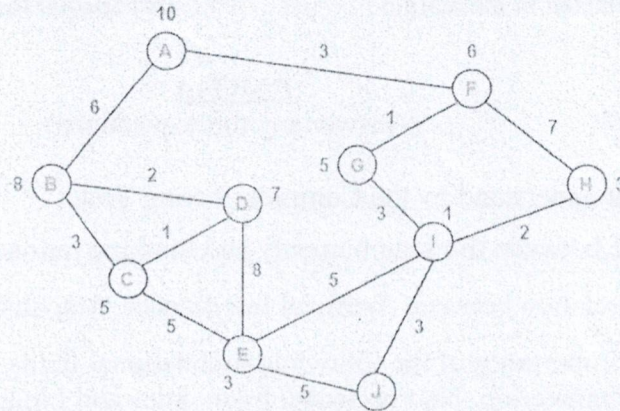
*		

Which places are possible to be visited by the knight, find using state space diagram. [You may give some name to specific moves, like 2U1L = Vertically up 2 steps and horizontally left 1 step].

3. (a) What do you understand by the optimal solution of a searching problem? 01
- (b) What is Heuristic Function? What do you understand by Informed search and Uninformed search? 1+3
- (c) You're given an initial state and a final state of 8-Puzzles game. You have to use BFS to reach the goal state. Draw the full search tree and show the solution path. 05

<p>Initial State</p> <table border="1" style="margin-left: auto; margin-right: auto; text-align: center;"> <tr><td>1</td><td>4</td><td>2</td></tr> <tr><td>3</td><td>5</td><td>8</td></tr> <tr><td>6</td><td></td><td>7</td></tr> </table>	1	4	2	3	5	8	6		7	<p>Goal State</p> <table border="1" style="margin-left: auto; margin-right: auto; text-align: center;"> <tr><td></td><td>1</td><td>2</td></tr> <tr><td>3</td><td>4</td><td>5</td></tr> <tr><td>6</td><td>7</td><td>8</td></tr> </table>		1	2	3	4	5	6	7	8
1	4	2																	
3	5	8																	
6		7																	
	1	2																	
3	4	5																	
6	7	8																	

4. (a) What is the time and memory complexity of depth-first-search where the branching factor is b ? 01
- (b) Explain the importance of an optimal admissible heuristic on the performance of the heuristic search. Explain one way to generate admissible heuristic value. 04
- (c) Consider the following graph where A is the starting state and J is the goal state. Find the solution path using A* Search algorithm. (The paths are both way connected and the cost on the path denotes the commuting cost between those two nodes. The estimated cost to reach the goal from a node is denoted beside each node). 05



PART-B

(Answer any three questions)

5. (a) How local search is different from uninformed search? Where we can use local searches? 03
- (b) Explain how does Simulated Annealing Search remove the shortcomings of the Hill Climb Search? 02
- (c) Let's consider the following 4-Queens board 05

Q1			
	Q2		
		Q3	
			Q4

Here, we assume the heuristic cost function is the number of pairs of queens that are attacking each other, either directly or indirectly.

Perform the hill-climb search to find the goal state that has no attacking queen pair. [You may assume the rows from A to D and the columns from 1 to 4. Show the heuristic values for each possible neighboring move from this initial state till the goal state. Don't need to draw the board repetitively, just mention the queen number and its position for going to a new state when you are calculating to find the best neighbor. You may draw the best neighbor.]

6. (a) Why do we prune in any game tree? 02
- (b) How does heuristic search perform better than uninformed search? 03
- (c) Let's say you (X) are going to play tic-tac-toe against one opponent (O). This tic-tac-toe is slightly different from the traditional one and contains weighted slots to move. Your main target is to win with the maximum possible collected utility and the opponent wants the opposite. 05

The board is like below, shown along with the weights:

4	2	4
2	8	2
4	2	4

The utility function is given as

$$U(n) = \text{your sum of elements} - \text{opponent's sum of elements}$$

Let a state is as below:

O		X
O	X	

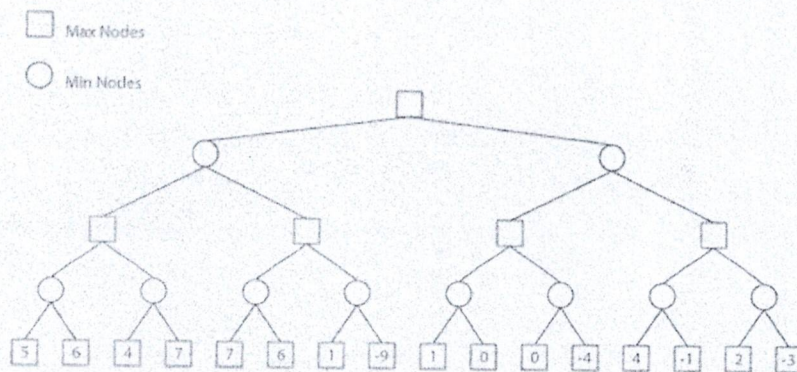
We calculate the $U(n) = (8+4)-(2+4) = 6$

Now start playing from the initial state (blank board). You(X) have the first turn. Follow the minimax algorithm. Just show your and opponents move until the game is over (win, lose or tie) using the utility function and the algorithm. [Don't need to draw the full tree]

7. (a) Define Constraint Satisfaction Problem (CSP). 01
- (b) Why do we need constraint propagation in CSP? Briefly explain three constraint propagation techniques. 04
- (c) Solve the Sudoku using the CSP, mentioning variables, domains, and constraints: 05
[Sudoku is a game that has unique number in each row, column and subgrid in its solution]

1			2
		1	4
	1	2	
2	3		

8. (a) Take an example of a tree of 3 layers. There should be at least 3 children of each node in the first two layers. You can assign random weights to the leaf node. Apply **Minimax** Algorithm and **Alpha-Beta Pruning on the tree separately**. 04
- (b) Consider the following game tree assuming first player as maximizing. [Square denotes the max node and the circle is the min node] 06



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Final Examination, 2023

Course No: CSE 705

Time: 03 (Three) hours

4rd Year 1st Semester

Course Title: Peripheral and Interfacing

Full Marks: 60

N.B. : (i) Answer any three questions from each PART

(ii) Use separate answer scripts for each PART

(iii) Marks allotted are indicated in the margin

(iv) Special Instruction (if any)-----N/A-----

PART-A

(Answer any three questions)

- | | | | |
|----|-----|---|----|
| 1. | (a) | Define a peripheral device and give two examples. | 03 |
| | (b) | Explain why peripheral devices are important in computing systems. | 04 |
| | (c) | Draw a block diagram showing the connection between a CPU and two peripherals through an I/O interface. | 03 |
| 2. | (a) | What is a Programmable Peripheral Interface (PPI)? | 02 |
| | (b) | Draw the block diagram of the Intel 8255A PPI architecture. | 04 |
| | (c) | Explain the roles of the Data Bus Buffer, Control Logic, Registers, and Internal Data Bus in interrupt handling. How do D7-D0 and A0, A1 pins facilitate data transfer between the microprocessor and the ports/control register? | 04 |
| 3. | (a) | Define an interrupt and explain its significance in a computer system. | 03 |
| | (b) | Draw the internal block diagram of the Intel 8259A priority interrupt controller. | 04 |
| | (c) | Describe the 8259A cascading with figure. | 03 |
| 4. | (a) | Define synchronous and asynchronous data transfer. | 02 |
| | (b) | How RS 232C interfaced with telephone line? | 04 |
| | (c) | Compare the two modes of data transfer in terms of speed and reliability. | 04 |

PART-B

(Answer any three questions)

- | | | | |
|----|-----|---|----|
| 5. | (a) | What is a control word in the 8255 PPI? | 02 |
| | (b) | Explain the difference between Mode 0 and Mode 1 of the 8255A. | 03 |
| | (c) | Draw the Bit Definitions of Control Words and determine the control word configuration for the Intel 8255A chip operating in Mode 0 with Port A and Port C (Upper) set as inputs, and Port B and Port C (Lower) set as outputs. | 05 |
| 6. | (a) | What is the handshaking principle in peripheral interfacing? | 02 |
| | (b) | Draw the figure and describe the mode-1 input configuration and status word. | 05 |
| | (c) | Describe the role of the interrupt request (INTR) signal in Mode 2 bidirectional I/O. | 03 |
| 7. | (a) | What is Direct Memory Access (DMA) and how does it work? | 03 |
| | (b) | Draw the block diagram of the DMA controller 8237 and explain its main components. | 07 |
| 8. | (a) | What is Isolated I/O and memory mapped I/O method? Describe with figure. | 03 |
| | (b) | What is Handshaking? Discuss with an example. | 04 |
| | (c) | Describe 3 to 8 line decoder with figure and also show function table. | 03 |

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Final Examination, 2023

Course No: CSE 707

Time: 03 (Three) hours

4th year 1st semester

Course Title: Information System Design

Full Marks: 60

N.B. : (i) Answer any three questions from each PART

(ii) Use separate answer scripts for each PART

(iii) Marks allotted are indicated in the margin

(iv) Special Instruction (if any)-----N/A---

PART-A

(Answer any three questions)

- | | | | |
|----|-----|---|----|
| 1. | (a) | What are the characteristics of valuable information? | 02 |
| | (b) | How can an organization use valuable information derived from an information system to gain a competitive advantage? Provide an example. | 04 |
| | (c) | Identify potential challenges an organization might face when transitioning from a traditional system to an information system | 04 |
| 2. | (a) | What are the skills a System Analyst should have? | 02 |
| | (b) | What is the prototyping method in system development, and why is it important to get user feedback on the prototype? | 03 |
| | (c) | Describe the Spiral method with a diagram. How does the emphasis on risk assessment in this approach enhance the overall quality and flexibility of the development process compared to traditional linear methods? | 05 |
| 3. | (a) | i) What is data modeling, and why is it important in database design?
ii) Explain the process of normalization, including the first three normal forms (1NF, 2NF, and 3NF). | 04 |
| | (b) | Suppose you are tasked with creating a system proposal for a new online learning platform. Describe the key components that should be included in the proposal, focusing on the feasibility analysis section. How would you assess the technical, economic, and operational feasibility of this project, and what methods or tools would you use to support your analysis? | 06 |
| 4. | (a) | Briefly describe Data Gathering and Data Dictionary. | 02 |
| | (b) | What is the importance of ensuring accurate data gathering? What are the consequences if we collect improper data? | 03 |
| | (c) | To determine your eligibility for a job application in a tech company, you need to meet four conditions: Relevant work experience > 2 years, Proficient in at least one programming language, Complete a technical assessment, and Submit a professional portfolio.
If any of these conditions are not fulfilled, your application will be rejected.
Create an activity diagram illustrating the entire scenario, including fork, join, and merge conditions. | 05 |

PART-B

(Answer any three question)

- | | | | |
|----|-----|--|----|
| 5. | (a) | What is Information System? | 01 |
| | (b) | Design a Use Case Diagram for a library management system. The system should include roles like librarian, member, and admin. | 04 |
| | (c) | A company is looking to implement a new Customer Relationship Management (CRM) system. Conduct a feasibility analysis based on technical, operational, and economic criteria. | 05 |
| 6. | (a) | What is the SCRUM framework, and how does it differ from traditional models? | 03 |

- (b) What are the main types of system testing? How does quality assurance (QA) help in testing? 03
- (c) Suppose a company undertakes a complex system. Which framework would be most suitable for managing and completing it, and what are the key events and major roles guiding this framework? 04
7. (a) Differentiate between reactive and proactive risk management strategies by providing suitable examples. 02
- (b) Explain the types of risks that can affect a system. How can the risks be controlled? 03
- (c) Design a class diagram for a student result processing system. The system should include classes for Students (with attributes like name, student ID, and enrolled courses), Courses (attributes like course name, course code, and credits), Results (attributes like result ID, marks obtained, and grade), and Instructors (attributes like name, instructor ID, and assigned courses). Show the relationships and interactions between these classes, indicating functionalities such as result calculation, course registration, and instructor management. 05
8. (a) Mention the components of DFD with a diagram. 02
- (b) What is the main goal of quality control measures in data collection, and how can a well-written procedures manual help prevent problems? 03
- (c) Suppose you are tasked with designing Data Flow Diagrams (DFDs) for a library management system. 05
- (i) Create a Level 0 DFD summarizing the major processes: "Search Catalog," "Borrow Book," "Return Book," and "Manage User Accounts."
- (ii) Create a Level 1 DFD detailing the "Borrow Book" process, including data flows and databases.