

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

Final Examination, 2023
Course No: CSE 401
Time: 03 (Three) hours

2nd Year 2nd Semester
Course Title: Algorithms
Full Marks: 60

N.B. : (i) Answer any three questions from each PART
 (iii) Marks allotted are indicated in the margin

(ii) Use separate answer scripts for each PART
 (iv) Special Instruction (if any)-----N/A-----

PART-A

(Answer any three questions)

1. a) Find $O(n)$, $\Omega(n)$, $\theta(n)$ for following function. 3
 $f(x) = 3x^2 + 5x + 11$
- b) What is direct recursive function? Show the recursion of the following code segment ($n=3$). 1+3
- ```
public static int fact(int n){
 if(n==0)
 return 1;
 else
 return n*fact(n-1);}
Where n=6,
```
- c) Define Time complexity and Space Complexity of an algorithm. 3
2. a) Let the data 63, 71, 82, 64, 56, 40 are stored in  $A[1]$  to  $A[6]$ . Now show each step to sort those data using **Merge Sort** algorithm. 5
- b) Consider the following set of jobs with their respective deadlines and profits. Each job takes **1 unit of time** to complete. Apply the Greedy Algorithm for job scheduling with deadlines and profits and schedule the jobs in such a way that the total profit is maximized 5

|          |    |    |    |    |    |    |
|----------|----|----|----|----|----|----|
| Job      | A  | B  | C  | D  | E  | F  |
| Deadline | 4  | 2  | 3  | 1  | 2  | 3  |
| Profit   | 40 | 20 | 30 | 10 | 60 | 50 |

3. a) Find an optimal solution (maximum profit) to the following knapsack instance using Greedy knapsack algorithm. 6  
 Number of Objects  $n=4$ , Maximum capacity  $m=25$  and

|       |    |    |    |    |
|-------|----|----|----|----|
| $P_i$ | 40 | 30 | 50 | 10 |
| $W_i$ | 10 | 10 | 30 | 5  |

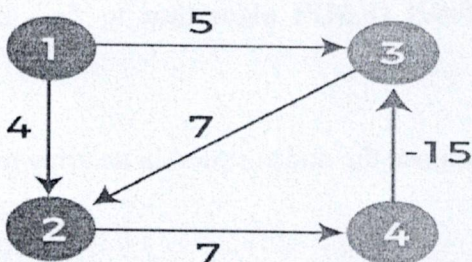
Where  $P_i$  and  $W_i$  denotes the price and weight of the  $i$ -th product respectively.

**Algorithm Greedy\_Knapsack(m, n)**

1. // Items are sorted such that  $p[i]/w[i] \geq p[i+1]/w[i+1]$
2. for  $i = 1$  to  $n$  do
3.      $x[i] \leftarrow 0.0$
4.  $u \leftarrow m$
5. for  $i = 1$  to  $n$  do

6. {
7.     if  $w[i] > u$  then
8.         break;
9.      $x[i] \leftarrow 1.0$
10.      $u \leftarrow u - w[i]$
11.     }
12. if  $i \leq n$  then
13.      $x[i] \leftarrow u / w[i]$

- b) What are the differences between the **Backtracking** and **Branch-and-Bound**? 2
- c) What is the "Principal of Optimality" in dynamic programming? 2
4. a) Find Shortest Path from vertex **A to F** using Bellman Ford's Algorithm. Show all steps. 7



b) Find the time and space complexity of the following

**PART-B**

(Answer any three questions)

5. a) Find **Longest Common Subsequence** from the following two sequences: 6

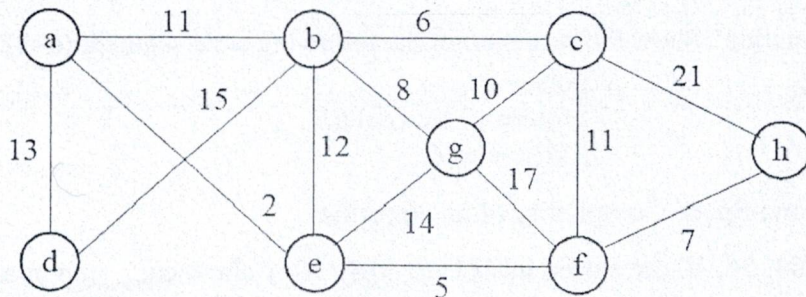
**Sequence A: ABCDGH**

**Sequence B: AEDFHR**

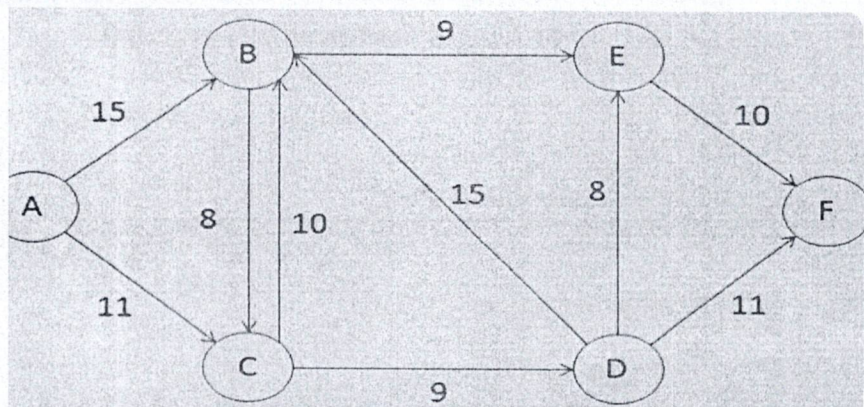
b) Demonstrate how divide and conquer technique is used in this algorithm to find the key element  $k = -7$  for the following entries: 4

-123, -5, 0, 9, 14, 23, 46, 54, 83, 114, 130, 141, 144, 151

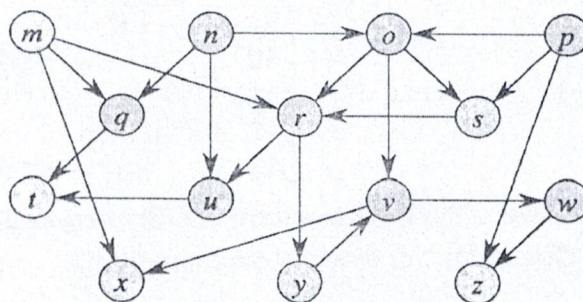
6. a) Consider the weighted graph in the following figure. Apply Kruskal's algorithm to find out the minimum-cost spanning tree. Show the steps. 7



b) **Apply the Ford-Fulkerson method** continue until no more augmenting paths exist. **Report the total maximum flow from S to T.** 3



7. a) Traverse the following graph in **Depth First Search & Breadth First Search** order starting from M. Show all the steps. 5



b) Given a **text** and a **pattern**, use the **Knuth-Morris-Pratt (KMP) algorithm** to find all occurrences of the pattern in the text. 5

Text: ABABDABACDABABCABAB

Pattern: ABABCABAB

8. a) Consider the **directed graph G** in the following figure. Suppose the nodes stored in an array as follows: P, Q, R, S. 5



b) Use Huffman coding to encode the following symbols with the frequencies listed: **M: 5, N: 9, O: 12, P: 13, Q: 16, F: 45**. What is the average number of bits used to encode a character? 5

i) **Construct the Huffman Tree** for the symbols.

ii) Determine the **Huffman codes** for each symbol.

ii) Calculate the **average number of bits per symbol** in the encoded message.

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

**Final Examination, 2023**  
**Course No: CSE 405**  
**Time: 02 (Two) hours**

**2<sup>nd</sup> Year 2<sup>nd</sup> Semester**  
**Course Title: Computer Architecture**  
**Full Marks: 40**

N.B.: (i) Answer any two questions from each PART  
(iii) Marks allotted are indicated in the margin

(ii) Use separate answer scripts for each PART  
(iv) Special Instruction (if any)-----N/A-----

**PART-A**

(Answer any two questions)

1. (a) What is Computer Architecture? Briefly describe its three key areas. 3  
(b) Show the structure of Von Neumann Machine and explain its operation. 5  
(c) Compare Static RAM with Dynamic RAM. 2
2. (a) What is an instruction format in computer architecture? 2  
(b) Explain the different types of instruction formats based on the number of operands. Give one example for each. 3  
(c) Consider the following equation,  $Y = \frac{A+B}{C*(D-E)}$  5  
Now, write the instructions with comments for:  
i) 3 Address Instructions  
ii) 2 Address Instructions
3. (a) Using paper-pencil method multiply 1011\*1101 2  
(b) What are addressing modes in computer architecture? Explain the addressing mode used in each of the following instructions with their meaning: 6  
i) Move R1, #10  
ii) Move R1, (R2)  
iii) Move R1, @(R3)  
iv) Move R1, (R4)+  
v) Move R1, -(R5)  
(c) Briefly describe any three types of computers based on their use and size. 2

**PART-B**

(Answer any two questions)

4. (a) What are Bits, Bytes and other units of measure for digital information? 2  
(b) Perform multiplication of signed integers using Booth's Algorithm. 4  
Given:  
Multiplicand = -7 and Multiplier = +3  
(c) Perform Non - Division Algorithm where, 4  
Dividend: 11 and Divisor: 5
5. (a) What are the techniques to improve cache performance? 2  
(b) How Does Error Detection Take Place? 2  
(c) Explain the concept of a critical section in a multiprocessor system and describe the three 2

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

**Final Examination, 2023**

**2<sup>nd</sup> Year 2<sup>nd</sup> Semester**

**Course No: CSE 403**

**Course Title: Web Engineering & E-Commerce**

**Time: 03 (Three) hours**

**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) Define the term E-commerce. What are the advantages of E-commerce? 3  
(b) What are the key limitations and challenges faced by e-commerce businesses? 3  
(c) What is the primary distinction between conventional business models and e-commerce? 4
2. (a) What do you understand by Search Engine Optimization? 2  
(b) Explain the following payment systems: Credit Card, EFT, E-cash. 4  
(c) Compare and contrast the B2B and B2C models of E-Commerce in terms of transaction complexity, payment systems, and customer relationship management. Use real-world platforms as examples. 4
3. (a) Elaborate on the planning stages involved in E-Commerce website development. 5  
(b) Explain what carousel adverts are. What is the significance of Facebook marketing for businesses in today's digital landscape? 5
4. (a) How do business ethics influence decision-making in a competitive environment, and what guidelines can organizations follow to ensure they are acting responsibly and ethically? 5  
(b) What is serverless architecture? What are the key technologies used in web engineering, and how do they contribute to the development, functionality, and performance of modern web applications? 5

**PART-B**

(Answer any three questions)

5. (a) Define Pay-Per-Click Advertising. Give an overview of the many kinds of data collection techniques. 4  
(b) What is Navigation Aid? Write some web hosting requirements. 3  
(c) Why is it essential for your e-commerce store to have a privacy policy in place? 3
6. (a) Explain the effectiveness of LATTE and SMART theory for business organizations. 3  
(b) What are the key differences between server-side development and client-side development in web applications? 4  
(c) What is Apache Spark? Write about the advantages of m-commerce. 3
7. (a) What is difference between security & privacy? 2  
(b) Suppose, you are part of a team developing a secure e-commerce platform. Discuss how you would employ cryptographic algorithms to safeguard online transactions and customer data. 3  
(c) What are the different types of threats that organizations (e-commerce) face in the context of cybersecurity, and what effective strategies can be employed to mitigate or eliminate these threats? 5
8. (a) What is web engineering? A development team has implemented a new feature: users can reset their passwords through a "Forgot Password?" link. As a tester, how would you apply black box and white box testing techniques to validate this feature? 5  
(b) A retailer is considering launching a mobile commerce platform in addition to their existing desktop website. 5

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

**Final Examination, 2023**

**Course No: CSE 407**

**Time: 03 (Three) hours**

**2<sup>nd</sup> Year 2<sup>nd</sup> Semester**

**Course Title: Operating System**

**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 the difference between logical address space and physical address space? How does an OS manage this translation? 04
- (b) In what ways do device drivers and interrupts support interaction between hardware components and the operating system? 03
- (c) Explain how multiprogramming improves CPU utilization. 03
2. (a) What are the responsibilities of the operating system in process management? 02
- (b) Draw and explain the structure of a Process Control Block (PCB). 04
- (c) Draw and explain a detailed diagram of process state transitions. 04
3. (a) Explain different types of Scheduling. 02
- (b) Explain multilevel queue scheduling and feedback queue scheduling. 02
- (c) Consider the following set of processes with the length of the CPU-burst time given in milliseconds: 04

| <u>Process</u> | <u>Arrival Time</u> | <u>Burst Time</u> |
|----------------|---------------------|-------------------|
| P1             | 0                   | 10                |
| P2             | 1                   | 1                 |
| P3             | 3                   | 2                 |
| P4             | 4                   | 1                 |
| P5             | 6                   | 5                 |

Find average waiting time for (a) FCFS (b) SJF

- (d) How do non-preemptive and preemptive algorithms differ from one another? 02
4. (a) Discuss the impact of time quantum in Round Robin scheduling. What happens if the quantum is too large or too small? 03
- (b) Consider the set of 6 processes whose arrival time and burst time are given below: 07

| Process | Arrival Time | Burst Time |
|---------|--------------|------------|
| P1      | 5            | 5          |
| P2      | 4            | 6          |
| P3      | 3            | 7          |
| P4      | 1            | 9          |
| P5      | 2            | 2          |
| P6      | 6            | 3          |

**PART-B**

(Answer any three questions)

5. (a) Describe the concepts of internal and external fragmentation. Explain how memory management techniques like paging and segmentation deal with them. 04
- (b) Given memory partitions of 100 KB, 500 KB, 200 KB, 300KB and 600KB, how each storage allocation algorithms place processes of 212KB, 417KB, 112KB, and 426KB? Explain which algorithm makes the most efficient use of memory? 03
- (c) What is compaction in memory management, and in what situations it is most beneficial? 03
6. (a) What are the necessary conditions for a deadlock to occur? How does the system detect deadlocks? 04
- (b) Consider the following snapshot of a system: 4+2

| Process | Allocation |   |   |   | Max |   |   |   | Available |   |   |   |
|---------|------------|---|---|---|-----|---|---|---|-----------|---|---|---|
|         | A          | B | C | D | A   | B | C | D | A         | B | C | D |
| P1      | 1          | 0 | 0 | 1 | 2   | 1 | 0 | 1 | 3         | 2 | 1 | 1 |
| P2      | 0          | 1 | 1 | 0 | 0   | 2 | 2 | 1 |           |   |   |   |
| P3      | 1          | 2 | 2 | 1 | 3   | 3 | 2 | 2 |           |   |   |   |
| P4      | 1          | 1 | 0 | 0 | 2   | 2 | 1 | 1 |           |   |   |   |
| P5      | 0          | 0 | 1 | 1 | 1   | 1 | 2 | 2 |           |   |   |   |

- i) Determine whether the system is in safe state or not. If yes, write down the safe sequence.
- ii) If a request from process P4 arrives for (0, 1, 0, 0), can it be granted immediately?
7. (a) What is the need of Page replacement? Consider the following reference string: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. Find the number of Page Faults with FIFO, Optimal Page replacement and LRU with four free frames which are empty initially. Which algorithm gives the minimum number of page faults? 04
- (b) A disk drive has 2000 cylinders (0 – 1999). The drive is currently serving at 143 and the previous was at 125. The queue of pending requests in FIFO order is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. What is the total distance for each of the following disk scheduling algorithm? 06
- i) FCFS    ii) SSTF    iii) SCAN    iv) LOOK    v) C-SCAN.
8. (a) A system uses segmentation with the following segment table: 04

| Segment | Base | Limit |
|---------|------|-------|
| 0       | 1000 | 400   |
| 1       | 2000 | 500   |
| 2       | 3000 | 600   |

Translate the following logical addresses (segment, offset) into physical addresses:

- (0, 120)
- (1, 430)
- (2, 610)

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

Final Examination, 2023

2<sup>nd</sup> Year 2<sup>nd</sup> Semester

Course No: MATH 401

Course Title: Matrices, Vectors, Fourier Analysis and Laplace Transform

Time: 03 (Three) hours

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) Define with example: 1+1+2+2=6
- i. Symmetric matrix
  - ii. Rank of a matrix
  - iii. Eigen values and Eigen vectors
  - iv. Vector space
- (b) Define inverse of a matrix. For any two nonsingular matrices A and B, Show that 4
- $$(AB)^{-1} = B^{-1}A^{-1}$$
2. (a) Determine the values of  $\lambda$  and  $\mu$  such that the linear system has 6
- i) no solution
  - ii) a unique solution
  - iii) more than one solution
- $$x + y + z = 2, \quad x + 2y + 3z = 4, \quad x + 2y + \lambda z = \mu$$
- (b) Define subspace of a vector space. Determine whether the following set is a subspace of  $R^3$ . 4
- $$\{(a, b, c) : 3a + 2b - c = 0; a, b, c \in R\}$$
3. (a) Find the Eigen values and corresponding Eigen vectors for the matrix, 7
- $$A = \begin{bmatrix} -3 & 1 & -1 \\ -7 & 5 & -1 \\ -6 & 6 & -2 \end{bmatrix}$$
- (b) Define divergence and Curl of a vector. 3
4. (a) State and prove the Green's theorem on a plane. 6
- (b) If  $\vec{A} = x^2yz\hat{i} - 2xz^3\hat{j} - xz^2\hat{k}$  and  $\vec{B} = 2z\hat{i} + y\hat{j} - x^2\hat{k}$ . Find  $\frac{\partial^2}{\partial x \partial y}(\vec{A} \times \vec{B})$  at (0, 1, -2). 4

**PART-B**

(Answer any three questions)

5. (a) Define Gradient of a scalar function. Show that  $\nabla r^n = nr^{n-2}\underline{r}$  and hence show that  $\nabla \cdot \underline{r} = 3$  5
- (b) Define Fourier Transformation. State and prove the convolution theorem of Fourier transformation. 5
6. (a) Define with examples: i) Fourier series ii) Even and odd functions 3
- (b) Find the Fourier series of the following function: 7
- $$f(x) = \begin{cases} 0, & -5 < x < 0 \\ 3, & 0 < x < 5 \end{cases}$$
7. (a) State and prove the Persival's identity. 4
- (b) Using the Fourier sine transformation solve: 6