

Question bank
End-Sem Examination- Winter 2023

Academic Year:2023-2024

Semester: I

Name of Programme:Pattern: 2022

Name of Course:Fundamentals of Data Structure

CourseCode:COMP222001

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UNIT 1

1 Explain the relationship between ADT and data structure.

Q.2 Write an algorithm to find smallest number among N numbers and determine the efficiency

Q.3 Write an algorithm to search a key, among N numbers and determine the efficiency

Q.4 What is an algorithm?write the essential properties characteristics of a good algorithm.

Q5. Find time complexity of the following code

For i=1 to n do

For j=i+1 to n do

For k=j+1 to n do

x=x+1

5. What is software,Program, give the need of it. [5 Marks] Blooms Level 2

6. Which are the different data types available in programming languages you know, Explain it.

Explain best case, average case and worst case time complexity?Give suitable examples.

a) Explain data types and compare , build in and user defined data types.

c) Explain following terms with suitable example

1) Data structure 2) Data object 3) Data type

- d) Explain best case, average case and worst case time complexity ? Give a suitable example.
- e) Explain static and dynamic data structures with suitable examples
- f) Describe the measures used to assess the efficiency of an algorithm

- 7. Explain Persistent and ephemeral data structures, static and dynamic data structure
- 8. What is Abstract Data Type? Write an ADT for rational number

UNIT 2

- 1. What is a sparse matrix ? Explain with *one* example
- 2. Write an algorithm for fast transpose of sparse matrix and find out its time complexity.
- 3. Show how a two-dimensional array is stored in memory. Assume that array start at the address 4000.
- 4. Explain how a polynomial is represented using an array with *one* example.
- 5. Write the algorithm for sparse matrix addition
- 6. Consider a Matrix of 3*3 [10, 0, 0, 21, 19, 0, 45, 28, 15]
 - a. convert it to a sparse triplet representation
 - b. convert it to a Transpose by simple transpose algorithm
 - c. write a algorithm of simple transpose
- 7. Explain how a polynomial is represented using an array with the following example.
 $4x^5 + 10x^3 - 30$. Write a CPP program to implement a polynomial using an array and perform its evaluation.
- 8. Write a 'C++' program to implement polynomial using array and perform its multiplication
- 9. What is Abstract Data Type (ADT) ? Write an abstract data type for Arrays
- 10. Define the following terms with example:

i) Data object

ii) Data structure

iii) Abstract Data Type

iv) Explain Big-oh,

11. Explain the two-dimensional array in detail with column and row major representation and address calculation in both the cases.

Write an ADT for an Array (3 marks)

Develop a pseudocode for inserting an element into an array. (3 marks)

Write the algorithm for sparse matrix addition (3 marks)

Compare ADT and Data structure

e) What is a sparse matrix ? Explain its representation (3 marks)

f) Write a 'C++' program to implement polynomial using array and perform its addition

12. Explain polynomial representation of an array and also write data structure declaration with suitable example.

13. Explain concept Generalized Linked List and representation polynomial using array with given example:

$$4x^3 + 2x^2 + 6xy + 7xy^3.$$

14. Explain concept of arrays with suitable examples.

15. What is the need of fast transpose algorithm?

15. Write pseudo C/C++ code to perform simple transpose of sparse matrix.

16. State the different characteristics of an algorithm.

17. What is sparse matrix ? Explain its representation with an example.

18. Explain the need for fast transpose of sparse matrix. Comment on its time complexity.

19. Give pseudo C/ C++ code to concatenate two strings.

20. Define and explain the following terms :

- (a) Linear data structure
- (b) Non-linear data structure
- (c) Time complexity
- (d) Space complexity

21. Explain fast transpose of sparse transpose with examples.

22. Derive address calculation formula one dimensional array with one example.

23. Difference between array & ordered list.

24. Multidimensional array & their address calculation with example.

25. Write & explain fast transpose algorithm of sparse matrix.

26. Give pseudo C/ C++ code to concatenate two strings.

UNIT 3

a) Design a program to implement a doubly linked list for inserting an element at the given position, and calculate its time complexity.

b) Develop a pseudocode for deleting an element from singly linked list at the given position and explain the same using pictorial representation.

c) List various operations performed on the singly linked list and explain search operation in detail.

d) Show how to reverse a singly linked list

e) Develop and explain a pseudo-code to merge two singly linked lists.

f) What are the fields of a node of singly and doubly link list and explain how to point the first node in the link list.

g) Write a function to delete a node with a specific value from a Singly linked list.

h) Show how to detect a cycle in a Singly linked list and also find the starting node of the cycle.

i) Write ADT for Circular Linked List.

j) What is a doubly linked list? Explain the process of deletion of an element from a doubly linked list with an example.

k) Use Generalized Linked List to represent a polynomial of the following example.

a) $9x^5 + 7xy^4 + 10x$

l) List various operations performed on the doubly linked list and explain search operation in detail.

m) Write a CPP function to insert a new node at the end of a singly linked list.

n) Write different types of linked list and compare them.

o) Develop a pseudocode for representation of a polynomial using singly linked list.

p) Develop a pseudocode for inserting a new header element at the beginning of the circular linked list.

q) Write a CPP program to copy one linked list into another linked list.

r) Use a Generalized Linked List to represent the following example.

$(p, q(r, s(t, u, v), w)x, y) = L$

s) Design a program that merges two sorted linked lists into a single sorted linked list.

t) Develop a function to detect a loop in a linked list and break the loop if one exists.

u) Evaluate the trade-offs between a singly linked list and a doubly linked list in terms of memory usage and performance.

v) Assess the advantages and disadvantages of using a linked list compared to an array for dynamic data structures.

w) Compare the time complexity of inserting an element at the beginning of a linked list with inserting at the end.

x) Write a function to insert a new node at the end of a singly linked list

y) How does a doubly linked list differ from a singly linked list in terms of structure and advantages?

UNIT 4

a) Explain STACK as an ADT using sequential organization

b) Use STACK for postfix expression evaluation solve following postfix expressions clearly indicating the contents of stack Assumeing values $A = 10$, $B = 2$, $C = 13$

$A B + C - B A - C + -$

$ABC + * C B A - + *$

c) Solve the following infix expression to postfix, clearly write all contents of stack $(A+B) * C - D * F + C$

d) Explain QUEUE as an ADT using array representation (5 marks)

e) What are the limitations of a linear queue? How do circular queues help to overcome the disadvantages of linear queue explain with suitable example

f) Apply the concept of double ended queue with suitable example and write empty() and Full() conditions for the same

g) Define the following terms with example:

i) Dequeue

ii) Priority Queue

h) compare linear queue and circular queue using arrays. what are the advantages and limitations of each of them

i) Explain in brief the need for use of stack in implementing function call

j) Using stack develop a C++ pseudocode to determine if a given string is palindrome or not

k) Convert following arithmetic infix expression to postfix

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

l) Explain following operations performed on stack

i) Push()

ii) Pop()

iii) display_Top()

m) show the detailed contents of stack and trace the algorithm to evaluate the given postfix expression

1 2 3 + * 3 2 1- + *

n) Develop a C++ functions for following operations on simple and circular queue
insert an element 2 delete an element

o) How multiple queue can be represented in a single large array

p) write and explain an ADT for double ended queue

q) A linear queue using an array has a size of 3. perform the following operations on this queue and show the sequence of steps with the help of diagram indicating values of rear ,front and contents of queue

1 . insert 10 2 insert 20 3. insert 30 4. delete an element 5. insert 40 6. delete an element 7 . delete an element 8 delete an element 9 insert 50

r) Solve the following infix expression to postfix , clearly write all contents of stack $A * (B + C * D) + E$

s) Define what a stack is and explain its Last In First Out (LIFO) property.

t)What is a queue, and how does it differ from a stack in terms of the order in which elements are processed?

u) Write a function to reverse the elements of a stack.

v) Design a program that uses both a stack and a queue to check if a given string is a palindrome.

w)Design a program that uses both a stack and a queue to check if a given string is a palindrome.

x)Design a program that uses both a stack and a queue to check if a given string is a palindrome.

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UNIT 5

a) Using divide and conquer strategy explains the merge sort algorithm with an example.

b)Explain Fibonacci search with example. State its time complexity

c)Write pseudo C++ code for insertion sort.

d) Write an algorithm for searching an element using binary search. Discuss the time complexity of algorithm in best case and worst case.

e) Sort the following numbers using quick sort :
55, 85, 45, 11, 34, 05, 89, 99, 67

f)Explain an algorithm of selection sort .

g) Compare sequential search and binary search with appropriate example. Comment on their time complexity and space complexity.

h)Construct a pseudo C++ code to sort the data using bucket sort in ascending order.

i)Write Merge sort algorithm & using it sort the following numbers :
18, 13, 12, 22, 15, 24, 10, 16, 19, 14, 30.

j) Write an algorithm for fibonacci search & discuss its time complexity

k)Explain the term stability of sorting. Give an example of a stable sort. Explain any one stable sort in short.

l)Show the algorithmic steps of shell sort & sort the given list using it
08,03,02,11,05,14,00,02,09,04,20

m) Solve the following numbers using quick sort
25, 82, 17, 23, 38, 7, 64, 86, 21
State its time complexity and space complexity.

n) Explain linear search with example. State its time complexity and compare it with binary search.

o) solve the the following numbers using insertion sort :
55, 85, 45, 11, 34, 05, 89, 99, 67.
Write its time complexity and space complexity

p) Write an algorithm for Binary search with its time complexity.

q) Write an algorithm for Bubble sort . Discuss its time complexity

r) Suppose 9 cards are punched as follows:

384, 143, 361, 423, 538, 128, 321, 543, 366

Apply radix sort to sort the numbers.

s) Develop a sorting algorithm that is suitable for sorting linked lists.

t) Compare the time complexity of quicksort and mergesort, highlighting their strengths and weaknesses.

u) Write a function to perform binary search on a sorted array.

v) Implement the bubble sort algorithm for sorting an array.

w) Explain the difference between binary search and linear search and when each is most appropriate.

x) Define linear search and describe its basic algorithm.