

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE, PERAMBALUR
DEPARTMENT OF MCA
CA5102 DATA STRUCTURES AND ALGORITHMS
QUESTION BANK

UNIT 1 FUNDAMENTALS OF ALGORITHM
PART A

1. What is an algorithm?

An algorithm is a finite set of instructions that, if followed, accomplishes a particular task.

2. How to validate algorithms?

Once an algorithm is devised, it is necessary to show that it computes the correct answer for all possible loyal inputs. We refer to this process as algorithm validation.

3. How to analyze algorithms?

This field of study is called analysis of algorithm. As an algorithm is executed, it uses the computer's control processing unit to perform operations and its memory to hold the program and data. Analysis of algorithms or performance analysis refers to the task determining how much computing time and storage an algorithm requires.

4. What is one type of procedure?

An algorithm consists of a heading and a body. The heading takes the form
Algorithm Name (parameter List)

Where Name is the name of the procedure and is a listing of other procedure parameters. The body one or more statements enclosed within braces.

5. Find the example for algorithm?

1. Algorithm MAX(A,K)
2. // A is an array of size n
3. {
4. Result:=A[1];
5. for i=2 to n do
6. if A[i]>Result then result:=a[i];
7. return result;

6. What is type of Recursive algorithm?

An algorithm that calls itself is direct recursive. Algorithm A is said to be indirect recursive if it calls another algorithm which in turn calls A.

7. What is mean by best case?

The best-case step cannot be the minimum number of steps that can be executed for the given parameters.

8. What is mean by worst case?

The worst case stop count is the maximum number of steps that can be executed for the given parameters.

9. What is space complexity?

The space complexity of an algorithm is the amount of memory it needs to run to completion.

10. What is time complexity?

The time complexity of an algorithm is the amount of computer time it needs to run to completion.

11. What is the Input size?

One of the instance characteristics that are frequently used in the literature is the input size.

The input size of any instance of a problem is defined to be the number of words needed to describe that instance.

PART B

1. Explain in detail about Efficiency of Analysis of Algorithm?
2. Explain in detail about Complexity Notations?

UNIT 2 STACK AND ITS APPLICATIONS

PART A

1. Define double circularly linked list?

In a doubly linked list, if the last node or pointer of the list, point to the first element of the list, then it is a circularly linked list.

2. What is the need for the header?

Header of the linked list is the first element in the list and it stores the number of elements in the list. It points to the first data element of the list.

3. List three examples that uses linked list?

- Polynomial ADT
- Radix sort
- Multi lists

4. Give some examples for linear data structures?

- Stack
- Queue

5. What is a stack?

Stack is a data structure in which both insertion and deletion occur at one end only. Stack is maintained with a single pointer to the top of the list of elements. The other name of stack is Last-in -First-out list.

6. Write postfix from the expression $-A+B-C+D$?

$A-B+C-D+$

7. How do you test for an empty queue?

To test for an empty queue, we have to check whether $READ=HEAD$ where REAR is a pointer pointing to the last node in a queue and HEAD is a pointer that pointer to the dummy header. In the case of array implementation of queue, the condition to be checked for an empty queue is $READ<FRONT$.

8. What are the postfix and prefix forms of the expression?

$A+B*(C-D)/(P-R)$

Postfix form: $ABCD-*PR-/+$

Prefix form: $+A/*B-CD-PR$

9. Explain the usage of stack in recursive algorithm implementation?

In recursive algorithms, stack data structures is used to store the return address when a recursive call is Encountered and also to store the values of all the parameters essential to the current state of the procedure.

10. Write down the operations that can be done with queue data structure?

Queue is a first - in -first out list. The operations that can be done with queue are addition and deletion.

11. What is a circular queue?

The queue, which wraps around upon reaching the end of the array is called as circular queue.

PART B

1. Explain in detail about Stack?
2. Explain in detail about Queue?
3. Explain in detail about Application of Stack?
4. Detailed Description about Singly Linked List?
5. Detailed Description about Doubly Linked List?
6. Detailed Description about Circularly Linked List?

UNIT 3 TREES

PART A

1. Define Binary tree

It is a finite set of elements that is either empty or is partitioned into three disjoint subsets. The first subset contains, a single element called the root of the tree. The other subsets are themselves binary tree, called the left and right sub tree.

2. Define Node

Each element of binary tree is called a node of the tree.

3. What is strictly binary tree?

Every non leaf node in a binary tree has non empty left and right sub trees. The tree is termed a strictly binary tree.

4. What is Depth of the Tree?

It is a binary tree of the maximum level of any leaf in the tree. This equal of the longest path from the root to any leaf.

5. What is complete binary tree?

A complete binary tree of depth “d” is the strictly binary tree all of whose level are at level d.

6. Define Binary search tree?

The property that all elements in the sub tree of a node n are less than the contents of n, and all elements in the right sub tree of n are greater than or equal to the contents of n. A binary tree that has this property is called a binary search tree.

7. What is Linked array representation?

Each node in a tree is taken from the available pool when needed and returned to the available pool when no longer in use. This representation is called Linked Array Representation.

8. What is Dynamic node representation?

The routines get node and free node simply allocate and free nodes using the routines malloc and free. This representation is called the dynamic node representation.

9. What is Linked representation (or) Node representation?

Both the linked array representation and the dynamic node representation are implementations of an abstract linked representation [also called the node

representation] in which explicit pointer links together the nodes of a binary tree.

10. What is internal node and external node?

When this distinction is made between non leaf and leaf nodes. Non leaves are called internal node and leaves are called external node.

11. What is Sequential representation or implicit array?

The implicit array representation of these almost complete binary trees, and by extension of the original binary trees. The implicit array representation is also called the sequential representation.

12. What is Huffman Trees?

The action of combining two symbols into one suggests the use of binary tree. Each node of the tree represent a symbol of the original alphabet.. The binary tree constructed by this method for the alphabet and frequency table. Such are called Huffman trees.

13. Define Root?

A tree is finite non empty set of element in which one element is called the root.

14. Define ordered tree?

It is defined as a tree in which the sub trees of each node from an ordered set.

15. Define Search?

The concept of an ordered set of elements is one that has considerable impact on our daily lives. The process of finding a telephone number in a telephone directory. This process, called search.

16. Define Record

A file of size n is a sequence of n items $r[0], r[1], \dots, r[n-1]$. Each item in the file is called a record.

17. Define Internal Record and external record

A sort can be classified as being internal if the records that it is sorting are in main memory. External if some of the records that is sorting are in auxiliary storage.

18. What is Stable

It is possible for two records in a file to have the same key. A sorting technique is called stable.

19. What is Sorting by address

An auxiliary table of pointer may be used these pointers are moved instead of the actual data it is called sorting by address.

20. Define Straight selection sort

The straight selection sort or push-down sort implements the descending priority queue as an unordered array. The input array x is used to hold the priority queue. Thus eliminating the need for additional space.

21. Define Heap sort

The drawbacks of the binary tree sort are remedied by the heap sort, an inplace sort that requires only $O(n \log n)$ operations regardless of the order of the input.

22. What is Internal key and external key

The key contained within the record at a specific offset from the start of the record is called internal key. There is a separate table of keys that includes pointers to the record is called external key.

23. Define Primary key

Every file there is at least one set of key that is unique such a key is called a primary key.

24. Define Secondary key

The state is used as the key for a particular search; it will probably not be unique. Since there may be two records with the same state in the file such a key is called as secondary key.

25. What is Retrieval

If a search is unsuccessful it may be desirable to add a new record with the argument as its key. An algorithm that does this is called a search and insertion algorithm. A successful search is often called retrieval.

26. Define Unordered table:

No relation is resumed to exist among the records or their associated keys. The table that we have specified is called an unordered table.

27. Define Ordered table:

Possible to refer to the first element of a table, the last element of a table and the successor of a given element. A table that supports these additional facilities is called an ordered table.

28. What is dictionary

A table of records in which a key is used for retrieval is often called a search table or a dictionary.

29. What is Index

An auxiliary table, called an index, is set aside in addition to the sorted file itself.

30. What is Indexed sequential

To improve search efficiency for a sorted file, but it involved as increase in the amount of space required. This is called the indexed sequential.

31. What is Padded list

Binary search in the presence of insertions and deletions if the maximum number of element known involves a data structure known as padded list.

32. What is Greedy method

To construct near-optimum binary search tree is called a greedy method.

33. What is Hash function

A function that transforms a key into a table index is called hash function.

34. What is Hash collision or hash clash:

Two record cannot occupy the same position such a situation is called a hash collision or hash clash.

35. What is Rehashing

Explore both in detail in the remainder of this section. Then the first technique is called rehashing.

36. What is Secondary Clustering

Although these methods eliminate primary clustering, they do not eliminate another phenomenon, known as secondary clustering.

37. What is Chaining

In this method a rehash function is not required at all. The technique is therefore the second major method of collision resolution called chaining.

38. What is EISCH

Early Insertion Standard Coalesced Hashing. A variation of standard coalesced hashing insert a new element into its chain immediately following item at its hash location rather than at the end of the chain. This technique is called EISCH.

39. What is Insertion coalesced hashing

The early insertion method yields worse retrieval times than if elements are added at the end of the chain in general coalesced hashing. A combination of two techniques called valid insertion coalesced hashing.

40. What is General coalesced hashing

A generalization of the standard coalesced hashing method, which we call general coalesced hashing, adds extra positions to the hash table that can be used for list nodes.

41. What is Linear Hashing

It is proposed by Litwin and modified by Lorson, permits a hash table to expand and shrink dynamically without requiring an index.

42. What is Partial Expansions or full expansions

Regular growth under LH2P take place in a series of simple expansions, grouped into partial expansions.

43. What is LH2D

Linear Hashing with Two Partial expansions. The basic technique does require the use of overflow buckets, unlike dynamic and extendible hashing. The version that we present is called LH2D.

PART B

1. Explain in detail about Binary Tree Traversal?
2. Explain in detail about Hashing?
3. Explain in detail Representing List as Binary Trees?
4. Explain in detail about Internal Sorting?
5. Explain in detail about External Sorting?
6. Explain in detail about Searching Techniques?
7. Explain in detail about Binary Tree Representation?

UNIT IV GRAPHS AND THEIR APPLICATIONS
PART A

1. Define graphs

A graph consists of a set of nodes (or vertices) and a set of arcs (or edges). Each arc in a graph is specified by a pair of nodes.

The set of nodes is {A,B,C,D,E,F,G,H}

And the set of arcs is {(A,B),(A,D),(A,C),(C,D),(C,F),(E,G),(A,A)}.

If the pairs of nodes that make up the arcs are ordered pairs. The graph is said to be a directed graph or digraph.

2. Define weighted graph

- The number associated with each arc is the remainder obtained by dividing the integer at the head of the arc by the integer at the tail.

- Such a graph, in which a number is associated with each arc, is called a weighted graph or a network.
- The number associated with an arc is called its weight.

3. Define cycle

- A path from a node to itself is called a cycle.
- If a graph contains a cycle, it is cyclic; otherwise it is acyclic.
- A directed acyclic graph is called a dag from acronym.

4. Define adjacency matrix

- The array field arc is a two-dimensional array representing every possible ordered pair of nodes.
- The value of $\text{arcs}[i][j]$ is either true or false depending on whether or not j is adjacent to node i .
- The two-dimensional array $\text{g.racs}[][]$ is called an adjacency matrix.

5. Define transitive closure

- The matrix path is often called the transitive closure of the matrix adj.

6. Define Warshall's Algorithm:

- Thus the $\text{path}[k+1][i][j]$ equals true if and only if one of the following two conditions holds:
- $\text{Path}[i][j] == \text{true}$
- $\text{Path}[k][i][k] == \text{true}$ and $\text{path}[k+1][j] == \text{true}$.
- This technique increases the efficiency of finding the transitive closure to $O(n^3)$. The method is often called Warshall's algorithm.

7. Define shortest-path algorithm:

- The shortest path is defined as a path from s to t such that the sum of the weights of the arcs on the path is minimized.
- The algorithm maintains a variable, current that is the node that has been added to perform most recently. Initially, $\text{current} = s$.

8. Define Flow Problem

In this section we consider a real-world problem and illustrate a solution that uses a weighted graph.

- There are number of formulations of this problem whose solutions carry over to a wide range of applications.
- We present one such formulation here and refer the reader to the literature for alternate various.

9. Define a capacity function:

- A capacity function, $c(a,b)$, where a and b are nodes as follows.
- If $\text{adjacent}(a,b)$ is true (that is, if there is a pipe from a to b) is the capacity of the pipe from a to b .
- If there is no pipe from a to b , $c(a,b)=0$.

10. Define a flow function

- A flow function, $f(a,b)$, where a and b are nodes, as 0 if b is not adjacent to a , and as the amount of water flowing through the pipe from a to b otherwise.

11. Define optimal?

- We wish to find a flow function that maximizes the value of v , the amount of water going from S to T . Such a flow function is called optimal.

12. Define Header nodes?

- an alternative is to construct a multilinked structure in the following way
- The nodes of the graph (hereafter referred to as graph nodes) are represented by a linked list of header nodes.
- Each such header node contains 3 fields.
 Info
 Next node
 Arc pointer

13. Define allocated node?

- The term allocated node is used to refer to either a header or a list node of a multilinked structure representing a graph.
- We also refer to an adjacency list node as an arc node.

14. Define Dijkstra's algorithm?

- We presented an implementation of Dijkstra's algorithm for finding the shortest path between two nodes in a weighted matrix.
- That implementation was $O(n^2)$, where n is the number of nodes in the graph.
- We now the algorithm can be implemented more efficiently in most arcs if the graph is implemented using adjacency lists.

PART B

1. Explain in detail about Graph Traversal?
2. Explain in detail about Graph Representation?

3. Explain in detail about Flow Problem?
4. Explain in detail about Shortest Path Algorithm?
5. Explain in detail about Dijkstra's Algorithm?
6. Explain in detail about Transitive Closure and Warshall's algorithm?
7. Explain in detail about Linked Representation of Graphs?

UNIT V STORAGE MANAGEMENT PART A

1. What is Garbage Collection?

Garbage Collection finds blocks of memory that are inaccessible and returns them to the free list.

Garbage Collection is a form of automatic memory management.

2. What is Dangling Pointer Bugs?

Dangling Pointer Bugs which occurs when a piece of memory is freed while there are still pointers to it, and one of those pointers is used.

3. What is Double Free Bugs?

Double Free Bugs which occurs when the program attempts to free a region of memory that is already free.

4. What is Memory Leaks?

Memory Leaks, in which a program fails to free memory that is no longer referenced by any variable, leading over time to memory exhaustion.

5. What is Mark and Sweep algorithm?

Mark and Sweep algorithm consists of two phases:

1. It finds and marks all accessible objects. This phase is called the Mark Phase.
2. The garbage collection algorithm scans through the heap and reclaims all the unmarked objects. This phase is called the Sweep Phase.

6. What is compaction?

The new location of each block is calculated to determine the distance the block will be moved.

Then each pointer is updated by adding to it the amount.

Finally the data is actually moved.

7. What is an Element?

A list is simply a sequence of objects called elements. Associated with each list element is a value.

8. What are external pointer and internal pointer?

The pointer list which consists of direct or linear list is called an external pointer.

The pointer list which consists of secondary list is called an external pointer.

9. What are the two methods of implementing the add-on and tail operations?

1. Pointer Method
2. Copy Method

10. Define Simple node?

A node containing a simple data item is called Simple node.

11. What is Reference count?

Each node has an additional count field that keeps a count of the number of Pointers to that node.

PART B

1. Explain in detail about General Lists?
2. Explain in detail about Automatic List Management?
3. Explain in detail about Garbage Collection?
4. Explain in detail about Collection and Compaction?