

Data Structures

1. What are data structures?

A data structure is a mathematical or logical way of organizing data in the memory that consider not only the items stored but also the relationship to each other and also it is characterized by accessing functions.

2. Give few examples for data structures?

Stacks, Queue, Linked list, Trees, graphs

3. What is Dynamic Data structure?

It becomes possible to allocate old storage when it is needed and to discard old storage when it is needed during the program of execution.

4. What is Static Data Structure?

It becomes to fixed amount of storage must be pre allocated, remain through correct the execution of the program.

5. List the operation performed by the data structure.

- Operating to create and destroy a data structure
- Delete elements from to data structure
- Insert element into the data structure
- Access elements with in a data structure.

6. What is Algorithm?

Algorithm is a solution to a problem independent of programming language. It consist of set of finite steps which, when carried out for a given set of inputs, produce the corresponding output and terminate in a finite time.

7. What are the features of an efficient algorithm?

The features of an efficient algorithm are

- Free of ambiguity
- Completeness
- Efficient in execution time
- Definiteness
- Concise and compact
- Finiteness

8. What are the qualities of a good algorithm?

- (i) They are simple but powerful and general solutions
- (ii) They can be easily understood by others
- (iii) They can be easily modified if necessary
- (iv) They are correct for clearly defined situation
- (v) They are able to understood on a number of levels.

9. What do you mean by program verification?

Program verification refers to the application of Mathematical proof application of Mathematical proof techniques to establish that the results obtain by the execution of a program with arbitrary inputs are in accord with formally defined output specification.

10. Differentiate between deterministic and stochastic system?

A deterministic system is one where the final outcome can be predicted if the initial state and input to the system are known.

In a true stochastic system there is known explanation for its randomness.

11. What is simulation and what are its advantages?

Simulation is process of forming an abstract model from a real situation in order to understand the impact of modifications and the effect of introducing various strategies on the situation.

Simulation is very powerful tool if applied correctly. The main advantage of simulation is that it permits experimentation without modifying the real situation.

12. What is simulate algorithm?

Algorithm Simulate

- a. Initialize all simulation clocks.
- b. Main loop
- c. Print statistics finished.

13. What are four applications of data structures?

Applications of data structures are

- Compiler design
- Database Management system
- Operating System
- Network analysis

14. What is Storage structure?

The Representation of a particular data structure in the memory of a computer is called a storage structure.

15. What is file structure?

A storage structure representation in auxiliary memory is often called a file structure.

16. What is a flip - flop?

The state of information associated with a memory unit is stored in a piece of sequential circuitry called flip - flop. It is a simple two state device.

17. What are data, atom and bit?

Data is set of elementary items or atoms. An atom usually consists of single elements such as integers, bits, characters or a set of such items. A bit is a measure of information.

18. What are the two methods for using the data structures?

- Computed address method
- Link addressing method.

19. What is an abstract data type (ADT)?

An ADT is a set of operation, a useful tool for specifying the logical properties of a data type is the abstract data type. ADT refers to the basic mathematical concept that defines the data type. Eg.

- Objects such as list, set and graph along their operations can be viewed as ADT's.
 - (i) Rational ADT
 - (ii) Pseudocode of Rational ADT

20. What are the operations of ADT?

Union, Intersection, size, complement and find are the various operations of ADT.

21. What is list ADT?

List ADT is a sequential storage structure. General list of the form $a_1, a_2, a_3, \dots, a_n$ and the size of the list is 'n'. Any element in the list at the position i is defined to be a_i , a_{i+1} the successor of a_i and a_{i-1} is the predecessor of a_i .

22. What are the two parts of ADT?

- ♦ Value definition
- ♦ Operator definition

23. What are the various operations done under list ADT?

The various operations done under list ADT are

- Print list
- Insert
- Make empty
- Remove
- Next
- Previous
- Find k^{th}

24. What are the four basic data types?

Four basic data types are

- int
- float
- char
- double

25. What is a Rational number?

A Rational number is a number that can be expressed as the quotient of two integers. Operations on Rational number:

1. Creation of rational number from two integers.
2. Addition
3. Multiplication
4. Testing for equality.

26. What is a Sequence?

A sequence is simply an ordered set of elements. A sequence S is sometimes written as the enumeration of its elements, such as

$$S = \langle S_0, S_1, \dots, S_{n-1} \rangle$$

If S contains n elements, then length of S is n.

27. What are len(S), first(S), last(S), nilseq?

Len(S) is the length of the sequence S.

First(S) returns the value of the first element of S

Last(S) returns the value of the last element of S

nilseq Sequence of length 0 is nilseq .ie., contains no element.

28. What are the two things specified in declaration of variables in C?

It specifies the amount of storage that must be set aside for objects declared with that type.

How data represented by strings of bits are to be interpreted.

29. What is a pointer?

Pointer is a variable, which stores the address of the next element in the list. Pointer is basically a number. The address of a node is to store the specified address in the computer memory. These addressing mode are referred as pointer. It is also called link addressing.

30. What is an array?

An array is a group of logically related data items of the same data - type addressed by a common name and all items are stored in contiguous memory. Array may be defined abstractly as a finite ordered set of homogenous elements. Finite means there is a specific number of elements in the array.

31. What are the two basic operations that access an array?

Extraction: Extraction operation is a function that accepts an array a, an index i, and returns an element of the array.

Storing: Storing operation accepts an array, a, an index i, and an element x.

32. What is Structure?

A Structure is a group of items in which each item is identified by its own identifier, each of which is known as a member of the structure.

33. What is Union?

Union is collection of structures, which permits a variable to be interpreted in several different ways.

34. What is a list?

A list is an ordered set containing of a variable with number of elements to which insertion & deletion can be made.

35. What are Automatic and External variables?

Automatic variables are variables that are allocated storage when the function is invoked.

External variables are variables that are declared outside any function & are allocated storage at the point at which they are first encountered for the remainder of the program's execution.

36. Differentiate between array and list.

An array is an ordered set which consists of a fixed number of objects. No deletion or insertion operations are performed on array.

A list is an ordered set, consisting of a variable number of elements to which insertion & deletion can be made.

37. What are the uses of array?

1. The array is a powerful tool that is widely used in computing.
2. Arrays provide us with a very simple efficient way of referring to & perform computations on collections of data that share some common attribute.
3. Arrays can be used to build and simulate finite state automata.

38. What is ASCII?

One of the most widely used coding systems is called the American standard Code for information interchange or ASCII. It is fixed 8 - bit code used for representing characters.

39. What do you mean by debugging?

Debugging is defined as the process of carrying out a number of tests to ensure that the program is behaving correctly according to its specification. It is also used for detecting logical errors.

40. What is Recursion?

Recursion is a function calling itself again and again.

41. What are the types of recursion?

- i) Direct recursion (Primitive recursive fn. Or Recursively defined fn.)
- ii) Indirect recursion (Non primitive or recursive or recursive use of a procedure)

42. Write the steps in the general algorithm for recursive procedure?

- i) *Prologue*- saves the parameters, local variables and return address
- ii) *Body* - If the base criterion has been reached then perform the final computation and go to step3, otherwise perform the partial computation and go to step1.
- iii) *Epilogue* -Restore the most recently saved parameters local variables & return address. Go to return address.

43. What are the steps available in iterative processes?

- (i) Initialization
- (ii) Decision
- (iii) Computation
- (iv) Update

44. What is a Fibonacci sequence?

Fibonacci sequence is the number of integers 0, 1, 1, 2, 3, 5, 8, 13, 21, 34,

Each element in this sequence is the sum of the two preceding elements.

45. Give some examples for linear data structures?

- ♦Stack
- ♦Queue

46. What is a Stack?

A Stack is an ordered collection of items into which new items may be inserted and from which items may be deleted at one end, called the top of the stack. In a stack $S = (a_1, \dots, a_n)$, a_1 is the bottom most element and element a_i is on top of element a_{i-1} . Stack is also referred as Last in First out (LIFO) list.

47. What are the two operations of Stack?

- PUSH
- POP

48. How do you test for an empty stack?

The condition for testing an empty stack is $top = 0$.

49. What are the various Operations performed on the Stack?

The various operations that are performed on the stack are

- i) *CREATE(S)* - Creates S as an empty stack
- ii) *ADD (i, s)* - inserts the element I onto the stack s and returns the new stack.
- iii) *DELETE(S)* - remove the top element of stack s and returns the new stack.
- iv) *TOP(S)* - returns the top element of stack s.
- v) *ISEMPTS(S)* - returns true if s is empty else false.

50. Write postfix from of the expression -A+B-C+D?

A-B+C-D+

51. 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

52. Name two applications of stack?

1. Stack is used to explain the processing of subroutine calls and their returns.
2. Recursive procedures and evaluation of expressions can be implemented using stack.

53. Write the general algorithm for solving the Tower of Hanoi problem?

- a. Only one disc may be moved at a time.
- b. A disc may be moved from any needle to any other
- c. At no time may a larger disc rest upon a smaller disc.

54. What is the meaning of AVAIL pointer?

Where the pointer variable AVAIL contains the address of the top node in the stack.

55. What is a suffix expression?

The notation used to write the operator at the end of the operands is called suffix notation.

Suffix _ operand operand operator

56. What is 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

57. What do you meant by fully parenthesized expression? Give eg.

A pair of parentheses has the same parenthetical level as that of the operator to which it corresponds. Such an expression is called fully parenthesized expression.

Ex: (a+((b *c) + (d * e))

58. What is a Queue?

A Queue is an ordered collection of items from which items may be deleted at one end called the front of the queue and into which terms may be inserted at the other end called rear of the queue. Queue is called as First -in-First-Out(FIFO)list.

59. What are the various operations performed on the Queue?

- ◆ *CREATEQ (Q)* - Create Q as an empty Queue
- ◆ *ADDQ (I, Q)* - adds the element I to the rear of a queue and returns the new queue.
- ◆ *DELETEQ (Q)* - remove the front element from the queue Q and returns the new queue
- ◆ *FRONT (Q)* - returns the front element of Q

60. How do you test for an empty Queue?

The condition for testing an empty Queue is $\text{front} = \text{rear}$. To test for an empty queue, we have to check whether $\text{READ} = \text{HEAD}$ 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 $\text{READ} < \text{FRONT}$.

61. What is Dequeue?

Double entered Queue. It is a linear list in which insertions and deletion are made or from either end of the structure.

62. What is a Priority Queue?

Priority queue is a data structure in which the intrinsic ordering of the elements does determine the results of its basic operations. Ascending and descending priority queue are the two types of Priority queue. Sometimes the user programs that are waiting to be processed from a waiting queue. This queue may not operate on a strictly first out basis, but on some complex priority scheme based on such factors as what compiler is being used the execution time required the number of print lines desired etc. the resulting queue is sometimes called a priority queue.

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

Queue is first-in-first-out list. The operations that can be done with queue are insert & remove.

64. What is Circular Queue?

Another representation of a queue, which prevents an excessive use of memory is to arrange elements $Q[1], Q[2], \dots, Q[n]$ in a circular fashion. The queue, which wraps around upon reaching the end of the array is called as circular queue.

65. What are the different ways to implement list?

- ♦ Simple array implementation of list
- ♦ Linked list implementation of list

66. What are the advantages in the array implementation of list?

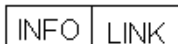
- ♦ Print list operation can be carried out at the linear time
- ♦ Find K^{th} operation takes a constant time

67. What is a linked list?

Linked list is a kind of series of data structures, which are not necessarily adjacent in memory. Each structure contains the element and a pointer to a record containing its successor.

68. What is node?

An element or node consists of two fields namely an information field called INFO and a pointer field called LINK. The name of the element is denoted by node.



69. Name the two fields of Linked list?

- ♦ Info field
- ♦ Next field

70. What is a doubly linked list?

In a simple linked list, there will be one pointer named as 'NEXT POINTER' to point the next element, where as in a doubly linked list, there will be two pointers one to point the next element and the other to point the previous element location.

71. What is 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.

72. Name the three fields of Doubly Linked list?

- ◆ Info field
- ◆ Left field
- ◆ Right field

73. 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.

74. List three examples that uses linked list?

- ◆ Polynomial ADT
- ◆ Radix sort
- ◆ Multi lists

75. Draw term of a polynomial in the variables x, y and z and explain?

Power X	Power Y	Power Z	Coeff	Link
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The first three fields represent the power of the variables X, Y and Z respectively. The fourth and fifth fields represent the coefficient of the term in the polynomial and address of the next term in the polynomial respectively.

76. What is one - way chain?

A simple way to represent a linear list is to expand each node to contain a link or pointer to the next node. This representation is called a one - way chain or singly linked linear list.

77. What is two -way chain?

It contains two links fields. The links are used to denote the predecessor and successor of a node. The link denoting the predecessor of a node is called the left link & that denoting the successor its right link. A list containing this type of node is called a doubly linked linear list or a two- way chain.

78. What is circular list and mention its disadvantages?

Last node points to first node is called circular list. A disadvantage in using circular list

- ◆ It is possible to get into an infinite loop.
- ◆ We are able to detect the end of the list.

80. What is System?

A System is a group of object interacting in order to produce some result. Types are

- ◆ Continuous System
- ◆ Discrete System

79. What are the applications of link list?

- ◆ The linear link list is used for the polynomial manipulation such as addition, subtraction, multiplication and division.
- ◆ Describe the organization for maintain a dictionary of names.

81. Differentiate between discrete and continuous system?

A *continuous system* has parameters which can take any real value in some given interval. Simulations of continuous system have parameters operate on these continuous parameters. *Discrete systems* have parameters which can only take values from a fixed number of choices.

82. What is non-linear data structure?

Data structure which is capable of expressing more complex relationship than that of physical adjacency is called non-linear data structure.

83. What is tree?

A tree is a data structure, which represents hierarchical relationship b/w individual data items.

84. What is leaf?

In a directed tree any node which has out degree 0 is called a terminal node or a leaf.

85. What is directed tree?

Directed tree is an acyclic digraph which has one node called its root with indegree while all other nodes have indegree 1. A directed tree is an acyclic digraph which has one node called its root with in degree while all other nodes have in degree 1. In a directed tree any node which has out degree is called a terminal node or a leaf all others nodes are called branch nodes.

86. What is an ordered tree?

In a directed tree if the ordering of the nodes at each level is prescribed then such a tree is called ordered tree.

87. What is a Binary tree?

A Binary tree 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 two subsets are themselves binary trees called the left and right subtrees.

88. What are the applications of binary tree?

Binary tree is used in data processing.

- ◆ File index schemes
- ◆ Hierarchical database management system

89. What is meant by traversing?

Traversing a tree means processing it in such a way, that each node is visited only once.

90. What are the two methods of binary tree implementation?

- a. Linear representation.
- b. Linked representation

91. What are the different types of traversing in binary tree?

The different types of traversing are

- a. Pre-order traversal-yields prefix form of expression.
- b. In-order traversal-yields infix form of expression.
- c. Post-order traversal-yields postfix form of expression.

92. What is pre-order traversal?

Pre-order traversal entails the following steps;

- a. Visit the root node
- b. Traverse the left subtree
- c. Traverse the right subtree

93. What are the steps of post-order traversal?

Post order traversal entails the following steps;

- a. Traverse the left subtree
- b. Traverse the right subtree
- c. Visit the root node

94. What are the steps of in -order traversal?

In-order traversal entails the following steps;

- a. Traverse the left subtree
- b. Visit the root node
- c. Traverse the right subtree

95. What is the length of the path in a tree?

The length of the path is the number of edges on the path. In a tree there is exactly one path from the root to each node.

96. What are expression trees?

The leaves of an expression tree are operands such as constants or variable names and the other nodes contain operators.

97. What is strictly binary tree?

If every non-leaf node in a binary tree has nonempty left and right subtrees, the tree is termed as a strictly binary tree.

98. What is complete binary tree?

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

99. What is an almost complete binary tree?

A binary tree of depth d is an almost complete binary tree if Each leaf in the tree is either at level d or at level $d-1$. For any node n_d in the tree with a right descendant at level d , all the left descendants of n_d that are leaves are at level d .

100. What is right - in-threaded tree?

Right -in -threaded binary tree is defined as one in which threads replace NULL pointers in nodes with empty right subtrees.

101. What is left - in -threaded tree?

A left-in-threaded binary tree may be defined as one in which each NULL pointers is altered to contain a thread to that node's inorder predecessor.

102. What are the types of Threaded binary tree?

♦Right-in-threaded binary tree

♦Left-in-threaded binary tree

103. What is Graph?

A graph G consist of a nonempty set V which is a set of nodes of the graph, a set E which is the set of edges of the graph, and a mapping from the set for edge E to a set of pairs of elements of V . It can also be represented as $G=(V, E)$.

104. What are adjacent nodes?

Any two nodes which are connected by an edge in a graph are called adjacent nodes. For Eg. if and edge $x \in E$ is associated with a pair of nodes (u,v) where $u, v \in V$, then we say that the edge x connects the nodes u and v .

105. What is a directed graph?

A graph in which every edge is directed is called a directed graph.

106. What is a undirected graph?

A graph in which every edge is undirected is called a directed graph.

107. What is a loop?

An edge of a graph which connects to itself is called a loop or sling.

108. What is a simple graph?

A simple graph is a graph, which has not more than one edge between a pair of nodes than such a graph is called a simple graph.

109. What is a weighted graph?

A graph in which weights are assigned to every edge is called a weighted graph.

110. What are a degree, out degree and total degree?

In a directed graph for any node V the numbers of edges which have V as their initial node is called the out degree of the node V . The number of edges which have as their terminal node is called the in degree of V and the sum of the out degree and in degree of a node V is called its total degree.

111. What is indegree of a graph?

In a directed graph, for any node v , the number of edges which have v as their terminal node is called the indegree of the node v .

112. What is path in a graph?

The path in a graph is the route taken to reach terminal node from a starting node

113. What is a simple path?

A path in a diagram in which the edges are distinct is called a simple path or edge simple.

114. What are multi graph and weighted graph?

Any graph which contains some parallel edges called a multi graph.

A graph in which weights are assigned to every edge is called a weighted graph.

115. What is elementary path?

A path in which all nodes through which it traverses are distinct is called an elementary path.

116. What is a cycle or a circuit?

A path which originates & ends in the same node is called a cycle or circuit.

117. What is an acyclic graph?

A simple diagram which does not have any cycles is called an acyclic graph.

118. What is meant by strongly connected in a graph?

An undirected graph is connected, if there is a path from every vertex to every other vertex. A directed graph with this property is called strongly connected.

119. What is biconnected graph?

A graph is called biconnected if there is no single node whose removal causes the graph to break into two or more pieces. A node whose removal causes the graph to become disconnected is called a cut vertex.

120. Write the minimal spanning tree algorithm

1. Check off nodes in the first edge
2. Set loop and repeat until all edges have been examined
3. Finished.

121. When is a graph said to be weakly connected?

When a directed graph is not strongly connected but the underlying graph is connected, then the graph is said to be weakly connected.

122. Name the different ways of representing a graph?

- a. Adjacency matrix
- b. Adjacency list

123. What is an undirected a cyclic graph?

When every edge in an acyclic graph is undirected, it is called an undirected acyclic graph. It is also called as undirected forest.

124. What are the two traversal strategies used in traversing a graph?

- a. Breadth first search
- b. Depth first search

125. What is spanning trees?

A spanning tree of a graph is an undirected consisting of only those edges necessary to connect all the nodes in the original graph. A spanning tree has the properties that for any pair of nodes there exists only one path between them and the insertion of any edge to a spanning tree from a unique

126. What is a minimum spanning tree?

A minimum spanning tree of an undirected graph G is a tree formed from graph edges that connects all the vertices of G at the lowest total cost.

127. What is a forest?

A forest may be defined as an acyclic graph in which every node has one or no predecessors. A tree may be defined as a forest in which only a single node called root has no predecessor. A set of disjoint tree is a forest.

128. What is PERT graph?

A PERT graph is a finite digraph with no parallel edges or cycles, in which there is exactly one source and one link.

129. What are converse preceding definitions?

We obtain three new traversal orders which are called the converse preorder, converse in order and converse post order respectively.

130. What is converse in order, converse preorder and converse post order?

The words left and right are interchanged in the preceding definitions. We obtain three new traversal orders which are called the converse preorder, converse in order & converse post order respectively.

131. Write the recursive preorder algorithm?

Procedure Preorder (T)

1. Process the root node
2. Process the left sub tree
3. Process the right sub tree
4. Finished

132. What is adjacency matrix?

An $n \times n$ matrix A whose elements a_{ij} are given by $A_{ij} = 1$ if $(v_i, v_j) \in E$ 0 otherwise is called the adjacency matrix of the graph G .

133. What is hit matrix or Boolean matrix?

Any element of the adjacency matrix is either 0 or 1. Any matrix whose elements are either 0 or 1 is called a bit matrix or a Boolean matrix.

134. What is reach ability matrix or path matrix?

Let $G = (V, E)$ be a simple digraph which contains n nodes that are assumed to be ordered. An $n \times n$ matrix P whose elements are given by $P_{ij} = 1$ if there exists a path from v_i to v_j 0 otherwise is called the path matrix or reach ability matrix of the graph G .

135. What is meant by order?

A transitive relation defined on the element of the list and specified by the sequence in which the elements appear with in the list.

136. What is depth?

The depth of a list is the maximum level attributed to any element with in the list with in any sub list in the list.

137. What is length?

The number of elements at level 1 list. For eg, the length of list (a, (b, c), d) is 3.

138. What are the types of recursion?

Two types of recursion

1. Recursively defined functions. Ex. Factorial
2. Recursive use of a procedure Ex: Ackermann's function.

139. Write the space and time requirement for the WARSHALL algorithm?

The timing requirement of the algorithm is $O(u^3)$.

The space requirement is $O(n^2)$.

140. What is the use of BFS?

BFS can be used to find the shortest distance between some starting node & the remaining nodes of the graph. The shortest distance is the minimum number of edges traversed in order to travel from the start node the specific node being examined.

141. Write the time complexly of BFS algorithm

The time analysis for the BFS algorithm is $O(n + e)$.

Where the number of edges and n is is the number vertices.

142. Write DFS algorithm

Procedure DFS (index, count)

1. Update the depth first search number, set and mark current node
2. Set up loop to examine each neighbor of current node
3. If node has been marked label it and make recursive call
4. Return to point of all

143. Write BFS algorithm

1. Initialize the first node's dist number and place in queue
2. Repeat until all nodes have been examined
3. Remove current node to be examined from queue
4. Find all unlabeled nodes adjacent to current node
5. If this is an unvested node label it and add it to the queue
6. Finished.

144. What are the properties available in list structures?

1. Order
2. Depth
3. Length

145. What is meant by sorting?

Ordering the data in an increasing or decreasing fashion according to some relationship among the data item is called sorting.

147. What is meant by external sorting?

External sorting is a process of sorting in which large blocks of data stored in storage devices are moved to the main memory and then sorted.

146. What are the two main classifications of sorting based on the source of data?

- a. Internal sorting
- b. External sorting

148. What is meant by internal sorting?

Internal sorting is a process of sorting the data in the main memory.

149. What is the other name for shell sort?

Diminishing increment sort.

150. What are the various factors to be considered in deciding a sorting algorithm?

- a. Programming time
- b. Execution time of the program
- c. Memory needed for program environment

151. What is the main idea in Bubble sort?

The basic idea underlying the bubble sort is to pass through the file sequentially several times. Each pass consists of comparing each element in the file with its successor ($x[i]$ & $x[i+1]$) & interchanging the two elements if they are not in proper order.

152. What is the main idea behind insertion sort?

The main idea of insertion sort is to insert in the i th pass the i th element in $A(1) A(2) \dots A(i)$ in its rightful place.

153. What is the main idea behind selection sort?

The main idea behind the selection sort is to find the smallest element among in $A(1) A(2) \dots A(n)$ and then interchange it with a (J) . This process is then repeated for each value of J .

154. What is the basic idea of shell sort?

Instead of sorting the entire array at once, it is first divide the array into smaller segments, which are then separately sorted using the insertion sort.

155. What is the purpose of quick sort?

The purpose of the quick sort is to move a data item in the correct direction, just enough for to reach its final place in the array.

156. What is the advantage of quick sort?

Quick sort reduces unnecessary swaps and moves an item to a greater distance, in 1 move.

157. What is the average efficiency of heap sort?

The average efficiency of heap sort is $O(n \log_2 n)$ where, n is the number of elements sorted.

158. What is segment?

When large blocks of data are to be sorted, only a portion of the block or file is loaded in the main memory of the computer since, it cannot hold the entire block. This small portion of file is called a segment.

159. What is max heap?

A heap in which the parent has a larger key than the child's is called a max heap.

160. Name some of the external sorting methods?

- ♦ Polyphase merging
- ♦ Oscillation sorting
- ♦ Merge sorting

161. When is a sorting method said to be stable?

A sorting method is said to be stable, if two data items of matching values are guaranteed to be not rearranged with respect to each other as the algorithm progresses.

162. Name some simple algorithms used in external sorting?

- ♦ Multiway merge
- ♦ Polyphase merge
- ♦ Replacement selection

163. When can we use insertion sort?

Insertion sort is useful only for small files or very nearly sorted files.

164. How many passes is required fork-way merging?

The number of passes required using k-way merging is $\lceil \log_k (n/m) \rceil$ because the N H S get k times as large in each pass.

165. What is min heap?

A heap in which the parent has a smaller key than the child is called a min heap.

166. What is the idea behind Address calculation sort?

This sorting is also called Hashing. In this method a function f is applied to each key. The result of the function determines into which of several subfiles the record is to be placed. The function should have the property that if $x \leq y, f(x) \leq f(y)$. Such a function is called order preserving

167. What is fixed block storage allocation?

Function GET BLOCK (Head)

- ◆ Overflow
- ◆ Allocate block
- ◆ Finished.

168. What is external fragmentation?

Decomposing the total available storage into a larger number of relatively small blocks is called external fragmentation.

169. What is internal fragmentation?

Partitioning the total unused storage into available blocks and allocating these blocks with some portion of the blocks remaining unused but not available is called internal fragmentation.

170. What is access time?

The access time $A(i)$ associated with a particular I/O operation I can be expressed as the sum of the latency time and the latency time and the seek time for i . That is $A(i) = L(i) + S(i)$

171. Write allocate first algorithm?

Function Allocate first (Avail, n min)

1. Initialize
2. Find block large enough for request
3. No suitable block

172. What are tracks?

The cylindrical surface of the drum is divided into a number of parallel bands called tracks.

173. Write allocate buddy algorithm

Function Allocate Buddy (N)

1. Determine size code
2. Find first available block
3. Split as required until correct size is reached
4. Allocate block P of size F_i .

174. Write Free Buddy algorithm

Function Free buddy (P)

1. Perform all possible merges
2. Merge block
3. We get here if only if P is the maximal block

175. What are external storage devices?

The primary uses for external storage devices include

- a. Backup or overlay of programs during execution
- b. Storage of programs and subprograms for future use
- c. Storage of information in files

1. Magnetic Tapes

2. Magnetic drums

176. What are the operations performed on stacks?

- i) Procedure push (S, top, X)
- ii) Function pop (S, top)
- iii) Function peep (S, top, I)
- iv) Procedure change (S, top, X, I)
- v) Algorithm recognize

177. What are the elements available in transmission of information?

Five element system

- ◆Source ◆Originator ◆Message ◆Transmitter ◆Encoder.

178. What is multiple buffering?

Multiple buffering makes use of a queue of buffers which are normally controlled by the operating system

179. What are the aspects available in transmission of information?

It has three aspects.

Syntactic - Physical form of the information transmitted.

Semantic - It refers to the meaning.

Pragmatic - A result of the interpretation of the information

180. What is logical information?

Two logical constants exist: true and false. The three most common logical operations are "anding", "oring" and "complementing" and the operators are \wedge , \vee and \neg respectively. Expressions involving logical operands commonly arise when using the relational operators $<$, $<=$, $=$, $<>$, $>$, $>=$

181. What is pointer information?

A pointer (or link) is a reference to a data structure. Methods for accessing data structures.

i) Computed address method

ii) Link addressing method

The address of a pointer may reference a data structure in one of two modes, Absolute or relative. Absolute mode implies that the value is an offset into a region of memory relative to some base location for that region. This base location is often stored in a special register called a base register.

182. Write any three indexed sequential files?

1. The structure of indexed sequential files
2. Processing indexed sequential files
3. Indexed sequential files in PL I

183. What are the different direct files?

- i) The structure of direct files
- ii) Processing direct files
- iii) Direct files in PL I

184. What is prime area?

Prime area is an area into which data records are written when the file is first created.

185. What is master index?

A master index is used for an extremely large file where a search of the cylinder index is too time consuming.

186. What are the two entries in track indexes?

1. A normal entry
2. Overflow entry

187. What is cylinder overflow area?

A cylinder overflow area is a number of dictated tracks on a cylinder that contains a number of prime area tracks.

188. What is direct file?

In a direct file a transformation or mapping is made from the key of a record to the address of the storage location at which that record is to reside in the file.

189. Write is sequential algorithm in processing indexed sequential files?

Algorithm is sequential

- ♦ Initialize
- ♦ Process records from first cylinder to the last cylinder as derived from the cylinder index.
- ♦ Process prime track record and their associated overflow records for a given cylinder
- ♦ Read records on a prime track and process.
- ♦ Read from linked list of overflow records and process.
- ♦ Finished.

190. What are the two steps in sequential algorithm.

1. Open master files for input
2. Repeat while not end of master file read the next record; process transactions posted against MTR REC.

191. Write the transaction types?

- ♦ READ
- ♦ ALTER
- ♦ DELETE
- ♦ ADD

192. What are the two components in hashing algorithm?

1. A hashing function
2. A collision resolution technique

193. What are the parts of iterative process?

The four parts of iterative process:

- ♦ *Initialization* - parameters of fix are set to their initial values.
- ♦ *Decision* - determine whether to remain in the loop
- ♦ *Computation*.
- ♦ *Update* - The decision parameter is updated to transfer to the next interaction result.

194. What is doubly linked linear lists?

In certain applications the links are used to denote the predecessor and successor of a node. The link denoting the predecessor of a node is called the left link and that denoting its successor is right link. A list containing this type of node is called a doubly linked linear list or a two-way chain.

195 What are list structures?

A list to be any finite sequence of zero or more atoms where an atom is taken to be any object. The representation of a structure is called the list structure. The manipulation of such a structure is known as list processing.

Characteristics of list structures

1. Unpredictable storage requirements.
 2. Extensive manipulation of the stored data is required.
- Ex: (a, (b,c,d), e, (f,g))

196. What is the breadth first search algorithm?

It can be used to find the shortest distance between some starting node and the remaining nodes of the graph. The shortest distance is the minimum number of edges traversed in order to travel from the start node to the specific node being examined.

197. What is the Depth first search algorithm?

- ♦As each new node is encountered, it is marked to show that the node has been visited.
- ♦A node s is picked as a start node and marked.
- ♦An unmarked adjacent node to s is now selected and marked, becoming the new start node.
- ♦The search continues in the graph until the current path ends at a node with outdegree zero or at a node with all adjacent nodes already marked.
- ♦Now the search returns to the last node which still has unmarked adjacent nodes and continues marking until all nodes are marked.

198. Explain about first-fit storage allocation with algorithm?

- ♦Introduces the problem of fragmentation in storage allocation.
- ♦The phenomenon of decomposing the total available storage into a large number of relatively small blocks is called external fragmentation.
- ♦The phenomenon of partitioning the total unused storage into available blocks and allocating these blocks with some portion of the blocks remaining unused, but not available, is called internal fragmentation.
- ♦Fragmentation is the major factor in making storage management algorithms more complicated than those for fixed size blocks.

199. What are the uses of External Storage Devices?

The uses of external storage devices are:

- ♦Backup or overlay of programs during execution.
- ♦Storage of programs or subprograms for future use.
- ♦Storage of information in 'files'.

200. What are the uses of Magnetic Tapes?

Uses of Magnetic Tapes

- ♦A tape is made up of plastic material coated with ferrite substance which is easily magnetized
- ♦It looks like the one used for the sound recording.
- ♦A number of channels or tracks run the length of the tape.
- ♦An additional channel is usually used for parity check bits.
- ♦Information is read or written into it by using a magnetic tape drive.
- ♦It is processed by the commands from the processor.
- ♦A certain length of the path is passed over and is called as the interrecord gap.
- ♦When a block of records is read or written, it is transferred from an area from the main memory called the buffer.

201. What are the uses of Magnetic Drums?

- ♦A magnetic drum is a metallic cylinder, from 10 to 36 inches in diameter, which has an outside surface coated with a magnetic recording material.
- ♦The cylindrical surface of the drum is divided into a number of parallel bands called tracks.
- ♦These tracks are further subdivided into sectors or blocks.
- ♦The sectors are the smaller addressable unit.
- ♦It is also referred to a direct access storage device.

202. What are the uses of Magnetic Disks?

- ♦This is also a same type of device.
- ♦The cost of this is low compared to drums.
- ♦This also offers high speed data transfer.
- ♦Two type of disk devices namely fixed disks and exchangeable disks.
- ♦Information is transferred through read/write transfer heads.
- ♦A seek is a movement of read/write head to locate cylinder in which particular track resides.

203. What is Mass Storage Devices?

The basic principle of operation for these devices involves the selection of a card from a group and the transportation of this card to a revolving cylinder or capstan. They have an access time greater than the one-half second. The IBM which uses the 3851 Mass Storage Facility is called the 3850 Mass Storage System.

204. What are the uses of Intermediate Storage Devices?

- ♦ Electronic disk is the new invention in this field.
- ♦ It provides fast access times without mechanical movement.
- ♦ Example devices are charge-coupled devices.
- ♦ The technology is the semi conductor technology.
- ♦ The average access time they provide is 60 microseconds.

205. What are sequential files?

In a sequential file, records are stored one after the other on a storage device. All types of external storage devices support a sequential-file organization.

206. What is serial processing?

Serial processing is the accessing of records, one after the other, according to the physical order in which they appear in the file. Sequential processing is the accessing of records, one after the other, in ascending order by a key or index of item of the records.

207. What are the advantages of sequential process?

Sequential process is most advantageous if a large number of transactions can be batched to form a single run on the file. A new file should be created if there are any additions and a significant number of deletions requested. Quick response time should not be expected for a transaction or a batch of transactions. □ The requirement that the records in a sequential file be ordered by a particular key is not essential if the file is being scanned to perform the same operation on every record.

208 What are Indexed Sequential files?

The Structure of Indexed Sequential files

- ♦ The prime area is an area into which data records are written when the file is created.
- ♦ The second important area of an indexed sequential file, the index area.
- ♦ The lowest level of the index is the track index.
- ♦ A track index contains 2 entries
 - ▶ Normal entry
 - ▶ Overflow entry
- ♦ Only one cylinder is shown in the prime area of m tracks.
- ♦ A master index is used for an extremely large file where a search of a cylinder index too time consuming.

209. What are direct files?

The Structure of Direct Files

- ♦ In a direct file, a transformation or mapping is made from the key of a record to the address of the storage location at which that record is to reside in the file.
- ♦ One mechanism used for generating this transformation is called a hashing algorithm.
- ♦ It is similar to one used in tables.
- ♦ The differences are due to the physical characteristics of external storage.
- ♦ The time here is in microseconds to access a record in a table.
- ♦ The time is in milliseconds to access a record in main memory.
- ♦ Records in a file are stored in buckets.
- ♦ The address space A of size m and integer constant C is
 $A = \{C + 1, C + 2, \dots, C + m\}$