



Cairo University



Faculty of Computers and Artificial Intelligence - Final Exam

Department: CS

Date: 4-3-2021

Duration: 2 hours

Course Name: Data Structure

Course Code: CS214

Total Marks: 60

Instructor(s): Basheer Youssef

Choose the correct answer 1.25 point for each one

1. Which of the following data structure is more appropriate to represent a heap?

- (A) Two-dimensional array (B) Doubly linked list (C) Linear Array (D) Linked list

2. Minimum number of fields in each node of a doubly linked list is ____.

- (A) 2 (B) 3 (C) 4 (D) None of the above

3. A graph is a tree if and only if graph is

- (A) Directed graph (B) Contains no cycles (C) Planar (D) Completely connected

4. The elements of a linked list are stored in

- (A) Structure (B) array (C) Anywhere the computer has space for them (D) contiguous memory locations

5. A parentheses checker program would be best implemented using

- (A) List (B) Queue (C) Stack (D) Any of the above

6. To perform level-order traversal on a binary tree, which of the following data structure will be required? (A) Hash table (B) Queue (C) Binary search tree (D) Stack

7. Which of the following data structure is required to convert arithmetic expression in infix to its equivalent postfix notation? (A) Queue (B) Linked list (C) Binary search tree (D) None of above

8. A binary tree in which all its levels except the last, have maximum numbers of nodes, and all the nodes in the last level have only one child it will be its left child. Name the tree.

- (A) Threaded tree (B) Complete binary tree (C) M-way search tree (D) Full binary tree

9. Which of following data structure is more appropriate for implementing quick sort iteratively?

- (A) Deque (B) Queue (C) Stack (D) Priority queue

10. A binary search tree whose left subtree and right subtree differ in height by at most 1 is called

- (A) AVL tree (B) Red-black tree (C) Lemma tree (D) None of the above

11. Inserting an item into the stack when stack is not full is called Operation and deletion of item from the stack, when stack is not empty is calledoperation.

- (A) push, pop (B) pop, push (C) insert, delete (D) delete, insert

12. Is a pile in which items are added at one end and removed from the other.

- (A) Stack (B) Queue (C) List (D) None of the above

13. is very useful in situation when data have to stored and then retrieved in reverse order

- (A) Stack (B) Queue (C) List (D) linked list

14. Which of the following data structure cannot store the non-homogeneous data elements?

- (A) Arrays (B) Records (C) Pointers (D) Stacks

15. Which of the following is non-linear data structure?

- (A) Stacks (B) List (C) Strings (D) Trees

16. To represent hierarchical relationship between elements, Which data structure is suitable?

- (A) queue (B) stack (C) Tree (D) array

17. Match the following

(a) Completeness i) How long does it take to find a solution

(b) Time Complexity ii) How much memory need to perform the search

(c) Space Complexity iii) Is the strategy guaranteed to find the solution when there in one

- (A) a-iii, b-ii, c-i (B) a-i, b-ii, c-iii (C) a-iii, b-i, c-ii (D) a-i, b-iii, c-ii

18. In, search start at the beginning of the list and check every element in the list.

- (A) Sequential search (B) Binary search (C) Hash Search (D) Binary Tree search

19. State True or False

- i) Binary search is used for searching in a sorted array
 ii) The time complexity of binary search is $O(\log n)$

(A) True, False (B) False, True (C) False, False (D) True, True

20. Which of the following is not in place sort?

(A) Insertion Sort (B) Bubble Sort (C) Merge Sort (D) Heap Sort

21. Which of the following statement is true?

- i) Using singly linked lists and circular list, it is not possible to traverse the list backwards.
 ii) To find the predecessor, it is required to traverse the list from the first node in case of singly linked list.

(A) i-only (B) ii-only (C) Both i and ii (D) None of both

22. The advantage of is that they solve the problem if sequential storage representation. But disadvantage in that is they are sequential lists.

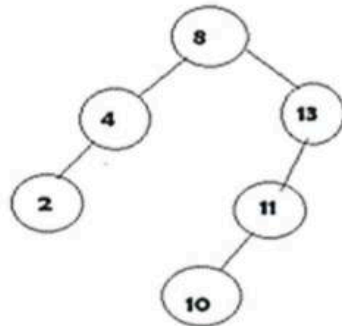
(A) Lists (B) Linked Lists (C) Trees (D) Queues

23. is not the operation that can be performed on queue.

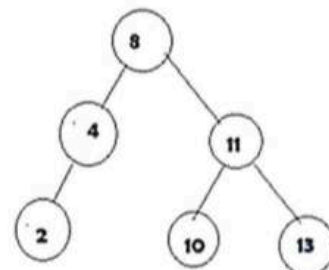
(A) Insertion (B) Deletion (C) Retrieval (D) Traversal

24. Which of the below diagram is following AVL tree property?

i



ii



(A) only i (B) both i and ii (C) only ii (D) i is not a binary search tree

25. What is the maximum height of an AVL tree with p nodes?

(A) p (B) $\log(p)$ (C) $\log(p)/2$ (D) $p/2$

26. To restore the AVL property after inserting a element, we start at the insertion point and move towards root of that tree. is this statement true? (A) true (B) false

27. Given an empty AVL tree, how would you construct AVL tree when a set of numbers are given without performing any rotations?

- (A) just build the tree with the given input
 (B) find the median of the set of elements given, make it as root and construct the tree
 (C) use trial and error (D) use dynamic programming to build the tree

28. Consider the below left-left rotation pseudo code where the node contains value pointers to left, right child nodes and a height value and Height() function returns height value stored at a particular node.

```

avltree leftrotation(avltreenode z)
{
  avltreenode w = x->left; x->left = w->right; w->right = x;
  x->height = max(Height(x->left), Height(x->right)) + 1;
  w->height = max(missing) + 1 ; return w; }
  
```

What is missing?

(A) Height(w->left), x->height (B) Height(w->right), x->height (C) Height(w->left), x (D) Height(w->left)

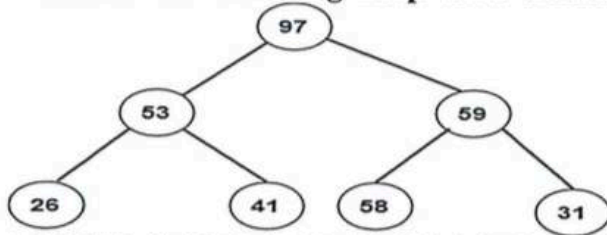
29. On which algorithm is heap sort based on?

(A) Fibonacci heap (B) Binary tree (C) Priority queue (D) FIFO

30. In what time can a binary heap be built?

(A) $O(N)$ (B) $O(N \log N)$ (C) $O(\log N)$ (D) $O(N^2)$

31. Consider the following heap after buildheap phase. What will be its corresponding array?



- (A) 26,53,41,97,58,59,31 (B) 26,31,41,53,58,59,97
(C) 26,41,53,97,31,58,59 (D) 97,53,59,26,41,58,31

32. What is the typical running time of a heap sort algorithm?

- (A) $O(N)$ (B) $O(N \log N)$ (C) $O(\log N)$ (D) $O(N^2)$

33. What is the time taken to perform a delete min operation?

- (A) $O(N)$ (B) $O(N \log N)$ (C) $O(\log N)$ (D) $O(N^2)$

34. Which of the following operations is performed more efficiently by doubly linked list than by singly linked list?

- (A) Deleting a node whose location is given (B) Searching of an unsorted list for a given item
(C) Inverting a node after the node with given location (D) Traversing a list to process each node

35. Consider an implementation of unsorted singly linked list. Suppose it has its representation with a head and tail pointer. Given the representation, which of the following operation can be implemented in $O(1)$ time?

- i) Insertion at the front of the linked list ii) Insertion at the end of the linked list
iii) Deletion of the front node of the linked list iv) Deletion of the last node of the linked list
(A) I and II (B) I and III (C) I, II and III (D) I, II and IV

36. Consider an implementation of unsorted singly linked list. Suppose it has its representation with a head pointer only. Given the representation, which of the following operation can be implemented in $O(1)$ time?

- i) Insertion at the front of the linked list ii) Insertion at the end of the linked list
iii) Deletion of the front node of the linked list iv) Deletion of the last node of the linked list
(A) I and II (B) I and III (C) I, II and III (D) I, II and IV

37. Consider an implementation of unsorted doubly linked list. Suppose it has its representation with a head pointer and tail pointer. Given the representation, which of the following operation can be implemented in $O(1)$ time?

- i) Insertion at the front of the linked list ii) Insertion at the end of the linked list
iii) Deletion of the front node of the linked list iv) Deletion of the end node of the linked list
(A) I and II (B) I and III (C) I, II and III (D) I, II, III and IV

38. In circular linked list, insertion of node requires modification of?

- (A) One pointer (B) Two pointer (C) Three pointer (D) None

39. The following C function takes a singly linked list as input argument. It modifies the list by moving the last element to the front of the list and returns the modified list. Some part of the code is left blank.

```
typedef struct node { int value; struct node* next; } Node;
```

```
Node* move_to_front(Node* head)
```

```
{ Node* p,*q; If((head==NULL)|| (head->next==NULL)) return head;
```

```
q=NULL; p=head; while(p->next != NULL) { q=p; p=p->next; } // blank return head;
```

```
} Choose the correct alternative to replace the blank line
```

- (A) $q=NULL$; $p \rightarrow next = head$; $head = p$; (B) $q \rightarrow next = NULL$; $head = p$; $p \rightarrow next = head$;
(C) $head = p$; $p \rightarrow next = q$; $q \rightarrow next = NULL$; (D) $q \rightarrow next = NULL$; $p \rightarrow next = head$; $head = p$;

40. The following C Function takes a singly- linked list of integers as a parameter and rearranges the elements of the lists. The function is called with the list containing the integers 1,2,3,4,5,6,7 in the given order. What will be the contents of the list after the function completes execution?

```
struct node{ int value; struct node* next; };
```

```
void rearrange (struct node* list)
```

```
{ struct node *p,q; int temp; if (! List || ! list->next) return; p=list; q=list->next;
  while(q) { temp=p->value; p->value=q->value; q->value=temp; p=q->next; q=p?p->next:0; } }
```

- (A) 1, 2, 3, 4, 5, 6, 7 (B) 2, 1, 4, 3, 6, 5, 7 (C) 1, 3, 2, 5, 4, 7, 6 (D) 2, 3, 4, 5, 6, 7, 1
41. The height of a BST is given as h . Consider the height of the tree as the no. of edges in the longest path from root to the leaf. The maximum no. of nodes possible in the tree is?
 (A) $2^{h-1} - 1$ (B) $2^{h+1} - 1$ (C) $2^h + 1$ (D) $2^{h-1} + 1$
42. The no of external nodes in a full binary tree with n internal nodes is?
 (A) n (B) $n+1$ (C) $2n$ (D) $2n + 1$
43. Which of the following statement about binary tree is CORRECT?
 (A) Every binary tree is either complete or full (B) complete binary tree is also a full binary tree
 (C) full binary tree is also a complete binary tree (D) A binary tree cannot be both complete and full
44. Suppose we have numbers between 1 and 1000 in a binary search tree and want to search for the number 363. Which of the following sequence could not be the sequence of the node examined?
 (A) 2, 252, 401, 398, 330, 344, 397, 363 (B) 924, 220, 911, 244, 898, 258, 362, 363
 (C) 925, 202, 911, 240, 912, 245, 258, 363 (D) 2, 399, 387, 219, 266, 382, 381, 278, 363
45. Which type of traversal of binary search tree outputs the value in sorted order?
 (A) Pre-order (B) In-order (C) Post-order (D) None
46. Suppose a complete binary tree has height $h > 0$. The minimum no of leaf nodes possible in term of h is? (A) $2^h - 1$ (B) $2^{h-1} + 1$ (C) 2^{h-1} (D) $2^h + 1$
47. the run time for traversing all the nodes of a binary search tree with n nodes and printing them in an order is (A) $O(n \lg(n))$ (B) $O(n)$ (C) $O(\sqrt{n})$ (D) $O(\log(n))$
48. If n numbers are to be sorted in ascending order in $O(n \log n)$ time, which of the following tree can be used (A) Binary tree (B) Binary search tree (C) Max-heap (D) Min-heap
49. A binary search tree is generated by inserting in order the following integers: 50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24 The number of the node in the left sub-tree and right sub-tree of the root, respectively, is (A) (4, 7) (B) (7, 4) (C) (8, 3) (D) (3, 8)
50. In which of the following tree, parent node has a key value greater than or equal to the key value of both of its children?
 (A) Binary search tree (B) Threaded binary tree (C) Complete binary tree (D) Max-heap