

CSE 202 Final Part (b)

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I. MULTIPLE CHOICE QUESTIONS (40 POINTS)

1. What is the value of *sum* after the following code fragment is executed?

```
int sum = 0;
for (i = 1; i <= N; i++)
    for (j = i; j <= N * i; j++)
        if (j % i == 0){
            sum++;
        }
```

- N
- $(N^2 + N)/2$
- N^2
- N^3
- N^4

2. Given the time complexity equation for a recursive algorithm as $T(N) = 8T(N/2) + \mathcal{O}(N^2)$. What is the time complexity of that algorithm?

- $\mathcal{O}(N)$
- $\mathcal{O}(N \log N)$
- $\mathcal{O}(N^2)$
- $\mathcal{O}(N^2 \log N)$
- $\mathcal{O}(N^3)$

3. What is the time complexity of the insertLast for singly linked list, doubly linked list, and circular linked list?

- $\mathcal{O}(1), \mathcal{O}(1), \mathcal{O}(1)$
- $\mathcal{O}(N), \mathcal{O}(N), \mathcal{O}(N)$
- $\mathcal{O}(N), \mathcal{O}(1), \mathcal{O}(1)$
- $\mathcal{O}(N), \mathcal{O}(1), \mathcal{O}(N)$
- $\mathcal{O}(1), \mathcal{O}(1), \mathcal{O}(N)$

4. Given that there are more than one node in a single linked list, which of the following code fragment **inserts** a new node at the **beginning** of the list?

- `newNode.next = first;`
- `first = newNode;`
`first.next = newNode;`
- `first.next = newNode;`
`first = newNode;`
- `newNode.next = first;`
`first = newNode;`
- `first = newNode;`

5. *a* is an empty stack, which of the following code fragment prints the numbers 1 to *N* in reverse order?

- `for (int i = 1; i <= N; i++){`
`a.push();`
`System.out.println(a.pop());`
`}`
- `for (int i = 1; i <= N; i++){`
`a.push();`
`}`
`for (int i = 1; i <= N; i++){`
`System.out.println(a.pop());`
`}`
- `for (int i = 1; i <= N; i++){`
`a.pop();`
`System.out.println(a.push());`
`}`
- `for (int i = 1; i <= N; i++){`
`a.pop();`
`}`
`for (int i = 1; i <= N; i++){`
`System.out.println(a.push());`
`}`
- None of the above

6. Which of the following operations on which implementations can give stack underflow (removing an element when stack is empty)?

- pop, array
- pop, linked list
- pop, array
pop, linked list
- push, array
pop, array
- push, linked list
pop, linked list

7. If the size of the queue is *N* (linked list implementation), how many elements can we store in that queue?

- N
- $N - 1$
- $N + 1$
- $N - 2$
- $N + 2$

8. For linked list implementation, what are the linked list operations to implement a LIFO (last in, first out)

queue?

- a) enqueue: insertFirst, dequeue: removeLast
- b) enqueue: insertLast, dequeue: removeFirst
- c) enqueue: removeLast, dequeue: insertFirst
- d) enqueue: removeFirst, dequeue: insertLast
- e) enqueue: insertFirst, dequeue: removeFirst

9. What are the minimum and maximum number of nodes in a 3-ary tree of depth 4?

- a) 4, 12
- b) 5, 31
- c) 3, 19
- d) 4, 40
- e) 6, 10

10. If we want to obtain a balanced binary search tree from numbers 1 to $2^n - 1$, what is the correct order of insertion of those numbers to the binary search tree?

- a) 1, 2, ..., $2^n - 1$
- b) $2^n - 1, \dots, 2, 1$
- c) $2^{n-1}, 2^{n-2}, \dots, 1$
- d) 1, 3, 5, ..., 2, 4, 6, ...
- e) $2^{n-1}, 2^{n-2}, 2^{n-1} + 2^{n-2}, \dots, 2^n - 1$

11. Which of the following numbers may be used as a hash table size?

- a) 18
- b) 33
- c) 101
- d) 128
- e) 217

12. Which of the following index(es) are better for queries like $(x == 10)$?

- a) Hash Index
- b) None
- d) Hash Index, sometimes Tree Index
- d) Tree Index
- e) Hash Index, Tree Index

13. What is the time complexity of search and insert for the min-heap?

- a) $\mathcal{O}(\log N), \mathcal{O}(\log N)$
- b) $\mathcal{O}(N), \mathcal{O}(\log N)$
- c) $\mathcal{O}(N), \mathcal{O}(1)$
- d) $\mathcal{O}(1), \mathcal{O}(1)$
- e) $\mathcal{O}(\log N), \mathcal{O}(1)$

14. If the height of the min-heap is h , what is the maximum number of elements that can we store in that heap?

- a) 2^{h-1}
- b) 2^h

- c) $2h - 1 + 1$
- d) $2^h - 1$
- e) $2^h + 1$

15. If heights of two disjoint sets are 4 and 4, what is the height of the resulting set if those sets are merged?

- a) 5
- b) 4
- c) 6
- d) 7
- e) 3

16. In the end of the disjoint set algorithm, what are the number of disjoint sets in terms of N (number of sets)?

- a) $2N$
- b) $N + 1$
- c) N
- d) $N - 1$
- e) 1

17. What is the maximum number of edges in a graph with N nodes?

- a) N
- b) N^2
- c) $(N^2 + N)/2$
- d) $(N^2 - N)/2$
- e) N^3

18. What is the time complexity of the algorithm (for a graph with N nodes) which checks if node i has no outgoing edges (i) adjacency matrix, (ii) adjacency list representation?

- a) $\mathcal{O}(\log N), \mathcal{O}(\log N)$
- b) $\mathcal{O}(\log N), \mathcal{O}(1)$
- c) $\mathcal{O}(N), \mathcal{O}(1)$
- d) $\mathcal{O}(1), \mathcal{O}(1)$
- e) $\mathcal{O}(1), \mathcal{O}(N)$

19. If you want to sort the students in a university with respect to their faculty, what will be your choice of sorting algorithm?

- a) Bucket Sort
- b) Insertion Sort
- c) Merge Sort
- d) Quick Sort
- e) Bubble Sort

20. If you want to sort a set of numbers which are nearly sorted, what will be your choice of sorting algorithm?

- a) Bucket Sort
- b) Insertion Sort
- c) Merge Sort
- d) Quick Sort
- e) Heap Sort