

**Question I: Choose the correct answer**

1. The Big O of accessing a vector item by index (where the number of elements of a vector is  $n$ ) is:
  - a.  $O(n)$
  - b.  $O(1)$
  - c.  $O(n \log n)$
  - d.  $O(n^2)$
2. In linked lists, what is the advantage of iterators over index-based navigation?
  - a. Iterators are easier to use.
  - b. Index is error-prone.
  - c. Iterators are more efficient.
  - d. Index is not defined on lists.
3. In a singly linked list, the big O of searching for an item:
  - a.  $O(n)$
  - b.  $O(1)$
  - c.  $O(n \log n)$
  - d.  $O(n^2)$
4. Stacks can be implemented using:
  - a. Vectors
  - b. Singly linked lists
  - c.  $a + b$
  - d. None of the above
5. One of the following is a realistic application of stacks.
  - a. Evaluating arithmetic expressions.
  - b. Waiting lists.
  - c. Print jobs
  - d. None of the above.
6.  $(m-d)*a/b$  is equivalent to the following expression in postfix.
  - a.  $mdab-* /$
  - b.  $md-a*b /$
  - c.  $mda*-b /$
  - d. None of the above.
7. The big O of popping an item from a queue
  - a.  $O(n)$
  - b.  $O(1)$
  - c.  $O(n \log n)$
  - d.  $O(n^2)$

8. The advantage of using a circular-array based queue over a regular-array based queue is:
- A circular-array queue is more flexible.
  - A circular-array queue is more efficient.
  - A circular-array queue doesn't require allocating more capacity.
  - b+c
9. A real application of queues is
- Print jobs
  - Evaluating postfix expressions
  - Databases
  - None of the above
10. In the best case, the number of exchanges for selection sort is:
- $O(n)$
  - $O(1)$
  - $O(n \log n)$
  - $O(n^2)$
11. In the worst case, the number of comparisons for bubble sort is:
- $O(n)$
  - $O(1)$
  - $O(n \log n)$
  - $O(n^2)$
12. Which algorithm is best for sorting medium-sized arrays?
- Shell sort
  - Bubble sort
  - Insertion sort
  - Selection sort
13. On average, which sorting algorithm has the least number of comparisons?
- Merge sort
  - Bubble sort
  - Shell sort
  - Insertion sort
14. Which of the following sorting algorithms is **not** a quadratic sorting algorithm?
- Selection sort
  - Bubble sort
  - Merge sort
  - Insertion sort
15. Which algorithm is particularly good for an array that is already sorted?

- a. Selection sort
- b. Quick sort.
- c. Bubble sort
- d. Merge Sort

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**Question II:**

Write a recursive function that partitions a doubly linked list around a value  $x$ , such that all nodes less than  $x$  come before all nodes greater than or equal to  $x$ .

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**Question III:**

A company allows customers to call to report problems or ask for clarifications, etc. There are many employees that work in the center to respond to calls from customers. When a customer calls, she has to wait until the next employee is available to talk to her. However, there are two types of customers the company supports: A regular customer that uses basic services, and a premium customer that uses advanced services. The call center prioritizes the premium customers over the regular customers. For every two premium customers that are served, one regular customer is served.

Which data structure will you use to model the waiting of customers? Why?

Write pseudo-code algorithms for the call (join line), and serve customer functions.