

# CS 317 Fall 2024

## Midterm 1 (Practice)

There are 17 questions on this test.

You may get partial credit for questions 16 and 17. If you finish early, use the extra time to double check your work. You may use slides or programs given on Moodle, as well as a page of handwritten notes. All cell phones and other mobile devices must be put away during the exam.

Good luck!

Full Name \_\_\_\_\_

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**Do not write below this line. Your exam begins on the next page.**

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EXAM SCORES

Q1-Q10	Q11-15	Q16	Q17	Total

**Circle True or False in questions 1-10 (1 point each)**

1. A data structure is the organization of data in a computer's memory or in a disk file. (FALSE / TRUE)
2. The time taken to insert a data item into an unsorted array depends on the number of items already in the array. (FALSE / TRUE)
3. The logarithm to the base B of a number A is (roughly) the number of times you can successively divide A by B before the result is less than 1. (FALSE / TRUE)
4.  $O(N \log_2 N)$  time is faster than  $O(N^2)$  time. (FALSE / TRUE)
5. The Tower of Hanoi problem can only be solved using recursion. (FALSE / TRUE)
6. Bubble sort uses the same number of comparisons and swaps as selection sort. (FALSE / TRUE)
7. Arrays are abstract data types. (FALSE / TRUE)
8. MergeSort is stable. (FALSE / TRUE)
9. Radix Sort sorts in place. (FALSE / TRUE)
10. QuickSort is not stable. (FALSE / TRUE)

**Choose the correct answer: (2 points each)**

11. The time complexity for push() and pop() in a stack are:
  - a.  $O(n)$  and  $O(n)$
  - b.  $O(1)$  and  $O(1)$
  - c.  $O(1)$  and  $O(n)$
  - d.  $O(n)$  and  $O(1)$
12. Which of these is not a data structure?
  - a. Linked list
  - b. Queue
  - c. Bubble Sort
  - d. Binary Tree
13. When parsing an input to check correctness of left and right brackets, we use:
  - a. A tree
  - b. A queue
  - c. A stack
  - d. An ordered array
14. When our database needs to be searched often but updated rarely, we store it in:
  - a. Stack
  - b. Queue
  - c. Array
  - d. Ordered array
15. Deleting an element from an ordered array takes:
  - a.  $O(\log_2 n)$  time
  - b.  $O(1)$  time
  - c.  $O(n)$  time
  - d.  $O(n^2)$  time

16. Write a recursive method (**just the method**) in Java to check if a given string is a palindrome. A string is a palindrome if:  
its length is 1 or 0, and  
its first and last characters are the same, and the rest forms a palindrome. **[15 points]**

17. A method called `pqSort(int[] arr)` uses a priority queue for sorting an array. It inserts all elements of the array to be sorted into an empty priority queue, then removes them one by one and puts them in the output array. Assuming the code for the `priorityQueue` **is already written** in a class with `add()`, `remove()` and `isEmpty()` methods, write the `pqSort` method in Java. What is the time and space complexity of this sorting algorithm in terms of the array size  $N$  (big-O notation)? **[15 points]**