

CSC 212: Data Structures and Abstractions
Fall 2018
University of Rhode Island
Weekly Problem Set #5

Due Thursday 10/25 at the beginning of class. Please turn in neat, and organized, answers hand-written on standard-sized paper **without any fringe**. At the top of each sheet you hand in, please write your name, and ID.

1 Recurrences

1. Find a closed-form equivalent of the following recurrences:

(a) The Towers of Hanoi:

$$T(0) = 0; T(n) = 2T(n-1) + 1$$

(b) Merge Sort:

$$T(1) = 1; T(n) = 2T\left(\frac{n}{2}\right) + n$$

(c) Generic:

$$T(0) = 1; T(n) = T(n-1) + 2^n$$

(d) Generic:

$$T(1) = 1; T(n) = T\left(\frac{n}{3}\right) + 1$$

2 Merge Sort

1. Determine the running-time of merge sort for a) sorted input; b) reverse-ordered input; c) random input; d) all identical input. Justify your answers.
2. Show the steps to sort the following array using Merge Sort: 6 1 7 11 4 10 2 5 9 3 8

3 Unimodal Array

1. Write a recursive algorithm to find the maximum of a weakly unimodal array of integers given the array and its start and end indices.
2. Define and solve a recurrence relation for the number of comparisons for the worst case for your algorithm. Let c be the number of comparisons per function call and $T(1) = 1$.