

**CSC 212: Data Structures and Abstractions**  
**Spring 2018**  
**University of Rhode Island**  
**Weekly Problem Set #8**

Due Thursday 3/29 before 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. The only library you're allowed to use in your answers is `iostream`.

## 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) The 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.

The following is considered optional.

1. Research and implement Tim Sort. A link about Tim Sort
2. Find a closed-form equivalent of the following recurrence:

$$f(1) = 3; f(n) = f\left(\frac{n}{2}\right) + 1$$