

Washington State University  
School of Electrical Engineering and Computer Science  
Spring 2022

CptS 223 Advanced Data Structures in C++

**Homework 8 - Solution**

Due: March 23, 2022 (11:59pm pacific time)

1. See attached main.cc. The output.csv file is the program output for './main 1000'.
2. Below is my actual plot from a Mac Mini with 3.2GHz Intel Core i7 and 32GB RAM. See attached plot.py Python script for how the plot was generated.

*Discussion:* The plot shows that the Array is quite a bit slower than the Balanced BST and Hash Table, and that the Balanced BST is slightly slower than the Hash Table. This is to be expected given that the asymptotic running time for search is  $O(N)$  for the Array,  $O(\log N)$  for the Balanced BST, and  $O(1)$  for the Hash Table. The jaggedness in the plots could be due to the random shuffling occasionally generating an insert/search order that leads to the worst-case behavior of the data structures. The jaggedness could also be due to occasional increased load on the system from other processes.

