

COP 3502 Section 2 Final Exam - Part C (Analysis, Timing, Sums/Recurrences)

Date: 7/29/2020

Start Time: 5:00 pm EST

End Time: 5:30 pm EST

Directions: Please type up answers in either a Word Document (.doc, docx) or a Text Document (.txt) or scan your written work to a .pdf file and upload your document AND SUBMIT IT to the appropriate assignment in Webcourses COP 3502 Section 2. Don't recopy the questions due to the time constraints, but clearly label which question number your work corresponds to. On the document you submit, put your first and last name in the top left hand corner. On the following line, write "My Exam 1 Part C Answers", centered. Following that, place your answers, numbered, in order (1, 2, 3).

1) (10 pts) What are the **worst case run times** of each of the following operations? Make sure to list your answer in terms of the appropriate variables in the prompt. Note that on occasion, some of the run times won't be dependent on some of the variables listed in the prompt.

(a) Inserting an item to the front of a linked list of n elements. _____

(b) Sorting n integers using Quick Sort. _____

(c) Merging a sorted list of a elements with a sorted list of b elements. _____

(d) Inserting an item into a binary heap of n elements. _____

(e) Deleting an item from a binary search tree of n elements. _____

(f) Deleting an item from an AVL tree of n elements. _____

(g) Printing out each permutation of n elements, where printing one value takes $O(1)$ time. _____

(h) Calculating $a^b \bmod c$ where individual multiplications and mods take $O(1)$ time, using fast modular exponentiation. _____

(i) A floodfill on a grid with r rows and c columns. _____

(j) Dequeuing an item from a queue of n elements. _____

2) (5 pts) An algorithm answers a query on a database of n elements in $O(\sqrt{n})$ time. For a database of size $n = 10^6$, it takes 2 seconds to perform 5,000 queries. How many seconds should it take to answer 3,000 queries on a database of size $n = 10^8$? (Note: all credit is based on the work and not the answer.)

3) (10 pts) Determine the following summation in terms of n . Please express your answer in the form, $an^2 + bn + c$, for constants a , b and c .

$$\sum_{i=n}^{3n-1} (5i + 7)$$