

Student Name: \_\_\_\_\_

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**CSC 228-01 Data Structures and Algorithms, Spring 2018**

Instructor: Dr. Natarajan Meghanathan

**Exam 3** (Take Home Part)

Max. Points: 100

Due on: April 25th @ 1 PM, in-class for the 1 PM section CSC 228-01

Print this exam and answer in the space provided. Staple and submit in class at the above time.

Given an array of integers, do the following (SHOW ALL THE STEPS; just writing the final answer will get only ZERO):

(a - 15 pts) Construct a max heap of the array. Show the initial essentially complete binary tree and the transformation of the binary tree to a max heap via the reheapify operations at the indices of the internal nodes (as shown in the slides).

(b - 15 pts) Sort the max heap version of the array obtained from (a) to obtain a sorted array of integers. Show the structural changes in the max heap in each iteration.

(c - 7 pts) Transform the max heap of (a) to a binary search tree.

(d - 8 pts) For the binary search tree obtained in (c), determine the average number of comparisons for a successful search and the average number of comparisons for an unsuccessful search.

(e - 8 pts) Use the sorted array of (b) to construct a binary search tree.

(f - 7 pts) For the binary search tree obtained in (e), determine the average number of comparisons for a successful search and the average number of comparisons for an unsuccessful search.

(g - 7 pts) Construct a hash table of the given array using a hash function  $H(K) = K \bmod 5$ .

(h - 8 pts) For the hash table of (g), determine the average number of comparisons for a successful search and the worst case number of comparisons for an unsuccessful search.

(i - 25 pts) Consider the elements of the array assigned to you are known only one at a time. Construct a sequence of priority queues (as max heaps) with the insertion (enqueue) of one element at a time, as shown in the slides.

1	Shonta Alford	[14, 14, 2, 10, 18, 7, 3, 3, 15, 10, 27, 23]
2	Rolonda Bingham	[17, 13, 16, 7, 25, 11, 4, 22, 10, 21, 28, 29]
3	Julien Clarke	[16, 12, 11, 29, 21, 17, 8, 19, 18, 10, 10, 3]
4	Christopher Crump	[18, 28, 2, 27, 18, 16, 29, 2, 0, 6, 8, 9]
5	Thomas Depas	[20, 13, 12, 6, 13, 14, 10, 9, 9, 14, 12, 20]
6	Bobby Dunbar	[11, 27, 27, 5, 29, 6, 22, 22, 16, 7, 27, 19]
7	Cordell Echols	[26, 9, 29, 9, 0, 23, 5, 23, 23, 24, 2, 18]
8	Lilian Ernest	[10, 18, 22, 28, 5, 2, 12, 4, 7, 19, 2, 26]
9	Charity Greenfield	[11, 0, 20, 26, 22, 0, 13, 14, 28, 26, 3, 27]
10	Brannon Hardison	[2, 8, 9, 3, 28, 26, 8, 19, 1, 10, 19, 10]
11	James Harris	[22, 24, 24, 18, 15, 5, 7, 0, 3, 20, 20, 13]

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12	Larriel Hester	[12, 27, 0, 16, 6, 23, 28, 16, 3, 13, 29, 26]
13	Shanice Hopson	[3, 14, 14, 29, 26, 19, 20, 27, 26, 0, 17, 27]
14	Samuel Johnson	[25, 13, 14, 21, 25, 3, 10, 27, 18, 25, 15, 25]
15	Quincy Jones	[15, 3, 18, 16, 8, 6, 14, 15, 28, 12, 23, 18]
16	Phillip Kilgore	[17, 3, 18, 27, 0, 5, 19, 19, 9, 4, 8, 13]
17	Jordyn Moore	[6, 15, 16, 20, 23, 6, 11, 18, 17, 1, 18, 22]
18	Keefa Nelson	[2, 1, 23, 28, 27, 5, 11, 25, 19, 14, 29, 11]
19	Kalen Orey	[25, 20, 17, 28, 28, 11, 23, 6, 1, 14, 27, 27]
20	Centryanna Patterson	[21, 15, 1, 16, 11, 2, 29, 11, 8, 16, 23, 25]
21	Jabari Payton	[29, 12, 3, 10, 19, 20, 10, 24, 6, 18, 25, 25]
22	Sherrod Perry	[8, 22, 28, 11, 22, 11, 23, 3, 0, 12, 8, 1]
23	Justice Prelow	[24, 24, 14, 17, 7, 25, 27, 17, 22, 4, 0, 11]
24	Claudia Robinson	[3, 27, 18, 25, 23, 14, 3, 24, 3, 17, 10, 12]
25	Jetnya Simmons	[9, 10, 28, 2, 5, 21, 8, 10, 4, 4, 10, 26]
26	Jewaun Smith	[24, 22, 18, 9, 20, 10, 25, 21, 3, 3, 14, 7]
27	Hervey Tchounwou	[5, 11, 20, 1, 18, 6, 8, 16, 12, 24, 4, 24]
28	Alexander Thomas	[13, 0, 8, 6, 21, 21, 9, 7, 22, 20, 0, 5]
29	Brandon Walker	[8, 12, 9, 25, 11, 2, 15, 6, 15, 22, 24, 9]
30	Jessica Woodberry	[15, 14, 21, 28, 3, 4, 24, 26, 25, 6, 17, 21]

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