CS 4520-6520 Test #1

Goli Harsha

TOTAL POINTS

38 / 115

QUESTION 1

Big-O comparison 10 pts

1.1 0 / 5

✓ **- 5 pts Wrong answer. Check the comments.**

Both are efficient.
2log(n^4) = 8log(n) ||| 4log(n^2) = 8log(n).

1.2 0 / 5

✓ **- 5 pts Wrong. Please check the comments.**

n^n > n!.
n^n = n*n*n*....(n times)
n! = 1*2*3*.....*n
Therefore 250n! is efficient.

QUESTION 2

2 2 proof Big-O 10 / 15

✓ **- 5 pts Please check the comments.**

How did 8/log(n) and 200/log(n) become '0'?

QUESTION 3

3 3 Quicksort 0 / 20

✓ **- 20 pts Procedure is wrong.**

In the 1st iteration 50, 4 is swapped (4<19).
In the 2nd iteration 50, 15 is swapped (15<19).
In the 3rd iteration 76, 17 is swapped (17<19).
Then swap 19 and 35.

QUESTION 4

Master theorem 16 pts

4.1 1 4 / 4

✓ **- 0 pts Correct**

Keep it up.

4.2 2 4 / 4

✓ **- 0 pts Correct**

Keep it up.

4.3 3 4 / 4

✓ **- 0 pts Correct**

Keep it up.

4.4 4 1 / 4

✓ **- 4 pts Wrong/No estimation.**

+ 1 Point adjustment

Use Master's theorem to estimate.
a=16, b=8, k=1
log8 (16) = 1.3333333
1.333333 > k
O(n^(log8 (16)))

QUESTION 5

Heap sort 20 pts

5.1 a) and b) 2 / 5

✓ **- 5 pts Wrong answer.**

+ 2 Point adjustment

It is a min heap tree. Each and every child is greater than its parent.

5.2 c) - sorting 0 / 15

✓ **- 15 pts Wrong/Not attempted.**

3 starts as a child of 7.

QUESTION 6

6 Tree parameters 8 / 9

✓ **- 1 pts Please check the comments.**

e) 4

QUESTION 7

7 Binary search tree 5 / 15

✓ **- 10 pts** **b) is wrong/not written.**

21> 15 => 21>20 => 21<23 => 21<22 So, 21 will be on the left side of 22.

QUESTION 8

8 EC #1 0 / 5

✓ **- 5 pts** **Unsolved**

QUESTION 9

9 EC #2 0 / 5

✓ **- 5 pts** **Not solved.**

CSc 4520/6520 TEST 1 Spring 2018

NAME Hunshu Goh

Honor Code Statement:

"I will not commit any act of academic dishonesty while completing this assignment. I am fully aware that any of my own personal actions while attempting this assignment that are interpreted as academic dishonesty, will be treated as such. I understand that if I am held accountable for an act of academic dishonesty that I will receive a grade of "0" (zero) for this assignment and the incident will be reported to the Dean of Students Office."

Student signature: _____ Date: _____

#1. In each of the following cases you are given running times of two algorithms. Determine, which algorithm is more efficient. Explain your answer.

a) $2\log(n^4)$ vs $4\log(n^2)$

$\log n^2$ has less operations per n compared to $\log n^4$

b) $10n^n$ vs $250n!$

$n^n = n \cdot n \cdot n \cdot n \cdot n \ldots$

$n! = n \cdot (n-1) \cdot (n-2) \cdot (n-3) \ldots$

Therefor n^n increases at a faster rate compared to $n!$

#2. Prove: $5n \log(n) + 8n - 200 = O(n \log(n))$

$$\frac{5n\log n}{n\log n} + \frac{8n}{n\log n} - \frac{200}{n\log n} = C$$

$$5 = C \quad \checkmark$$

#3. Given: sequence 50, 4, 76, 35, 15, 17, 19.
Perform Quicksort algorithm, where pivot is rightmost element (e.g. 19 is pivot to start with).
Find: the first swap is 35 and 17, the last swap is 4 and 17
the total number of swaps is 5.
8 operations

Show the procedure:

50	4	76	35	15	17	19	selecting pivot
50	4	76	17	15	35	19	swap
50	4	15	17	76	35	19	swap
17	4	15	50	76	35	19	swap
17	4	15	19	50	76	35	putting pivot
4	17	15	19	50	76	35	swap
4	15	17	19	50	76	35	putting pivot
4	15	17	19	35	50	76	putting pivot

#4. T(n) is a running time of an algorithm A, and it is described using recurrent relations below. Estimate worst-case running times of A.

(1). $T(n) = 8T(n/4) + n^{1.7}$

$a \quad b \quad k$

$8 \quad 4^{1.7} \quad a < b^k \quad O(n^{1.7})$

(2). $T(n) = 9T(n/3) + n^2$

$a \quad b \quad k$

$9 = 3^2 \quad O(n^2 \log n)$

(3). $T(n) = 12T(n/3) + n^2$

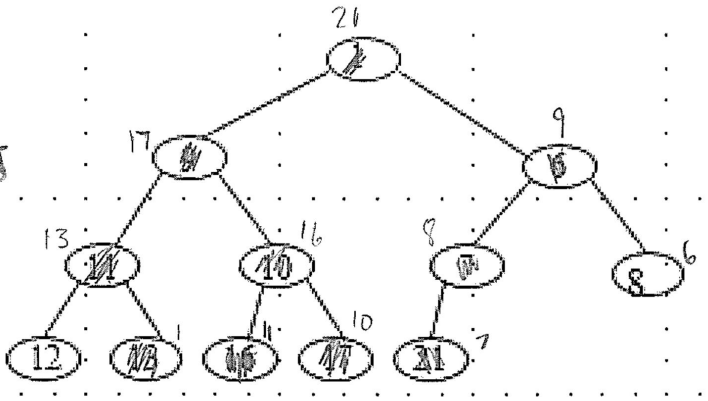
$12 > 9 \quad O(n^{\log_3 12})$

(4). $T(n) = 16T(n/8) + n/3$

$O(16^{\log_8 n})$

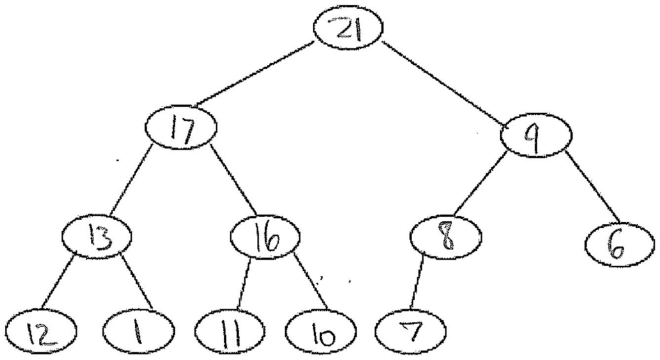
#5.

a) Is it a heap? No
Why yes, or why not? largest value is not root

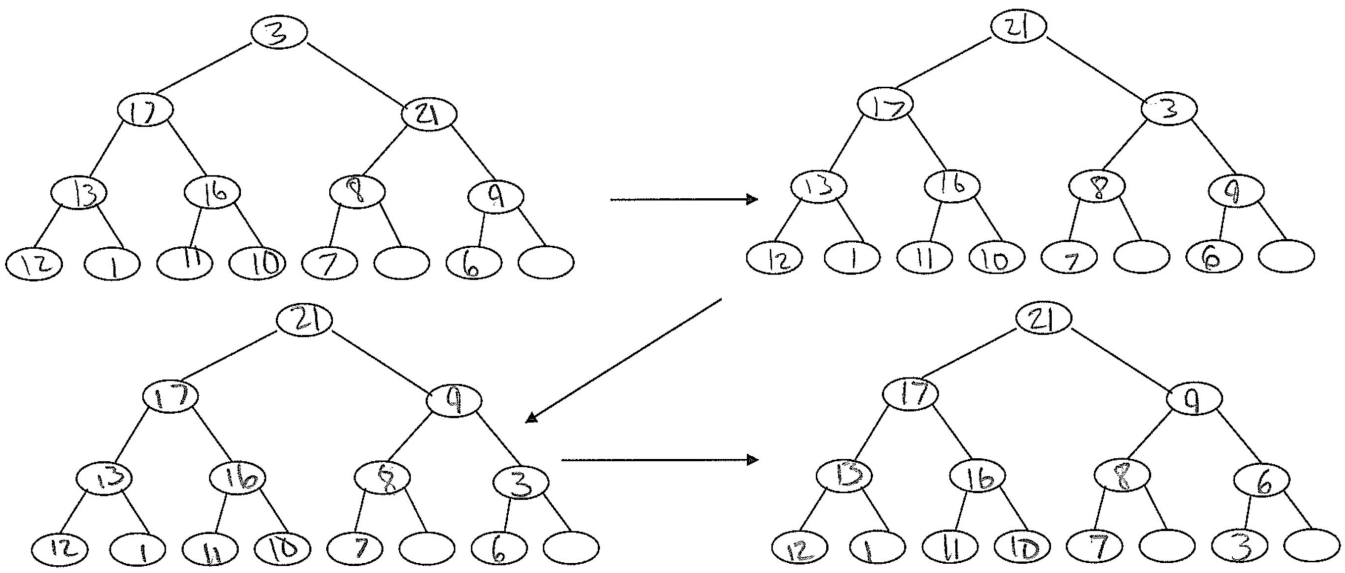


If yes, proceed to step c), if not, first do b) and then c)

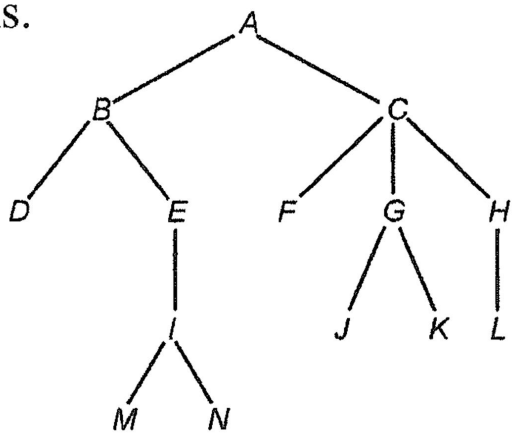
b) if it is not a heap, make necessary changes to make it a heap.



#5c) Show how to insert new element "3" in the heap (to preserve all necessary properties). You should start with a heap (either from a) or from b) – depending on your previous answers).
Make adjustments to the drawing, if necessary.



#6. For a given tree, answer the questions.



a) Which nodes are leaves D, M, N, F, J, K, L

b) Which node is a root A

c) Which node is a parent of node A None, A is root

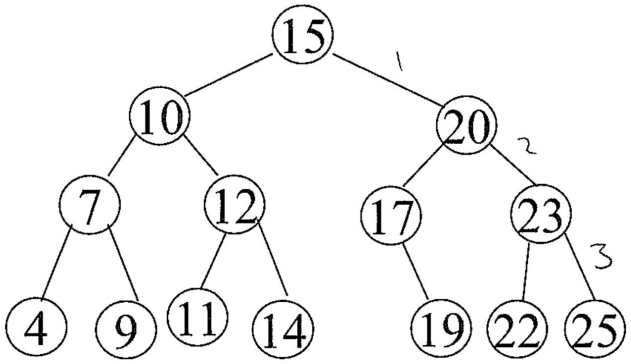
d) Name the children of node D None, D is leaf

e) What is the height of the tree 5

f) How many different paths of length 3 are there in a tree 4

g) Is it a binary tree? No Why yes, or why not? C has 3 children

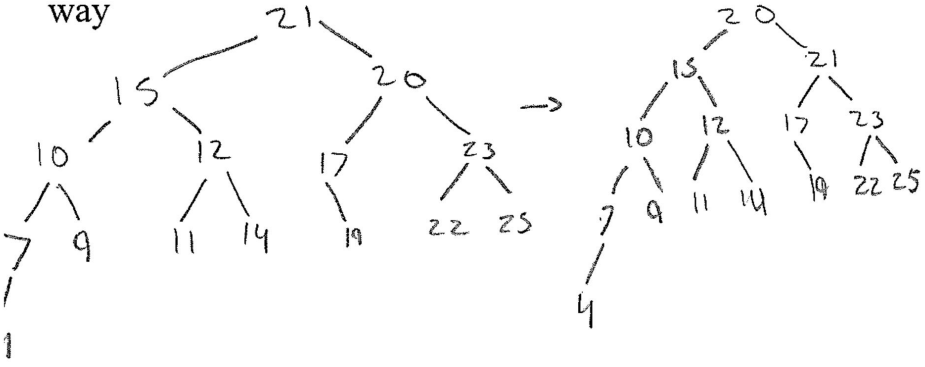
#7. Given Binary Search Tree



a. How many steps are required to find element 25?

3

b. Insert element 21 as a root and draw the obtained tree, as well as all trees on the way



This problem is mandatory for graduate students and is extra credit for undergraduate students.

EC #1 (undergrad) / #8 (grad)
(Thinking!) Propose an efficient (better than quadratic) algorithm for the following problem and estimate its running time:

Given: array of integers.
Find: if all elements are unique.

EC #2.

You are given a set of n balls among which there is 1 radioactive.
During each test, you put any number of balls in a box, push a button and a bulb will be on if there is a radioactive ball in the box and will be off otherwise.

Propose a non-exhaustive-search method that allows to find 1 radioactive ball among n balls. Estimate its time complexity in terms of Big-O.