

Student Name: _____ Student ID # _____

UOSA Statement of Academic Integrity

On my honor I affirm that I have neither given nor received inappropriate aid in the completion of this exercise.

Signature: _____ Date: _____

Notes Regarding this Examination

Open Book(s) You may consult any printed textbooks in your immediate possession during the course of this examination.

Open Notes You may consult any printed notes in your immediate possession during the course of this examination.

No Electronic Devices Permitted You may not use any electronic devices during the course of this examination, including but not limited to calculators, computers, and cellular phones. All electronic devices in the student's possession must be turned off and placed out of sight (for example, in the student's own pocket or backpack) for the duration of the examination.

Violations Copying another's work, or possession of electronic computing or communication devices in the testing area, is cheating and grounds for penalties in accordance with school policies.

Question 1: Quicksort (30 points)

```
Algorithm Quicksort (A, left, right)
  if (left < right)
    pivot ← A[left]
    i ← left
    j ← right + 1
    do
      do
        i ← i + 1
        while (i < A.size) and (A[i] < pivot)
          do
            j ← j - 1
            while (A[j] > pivot)
              if (i < j) then swap (A[i], A[j])
            while (i < j)
              swap A[left], A[j])
            Quicksort (A, left, j-1)
            Quicksort (A, j+1, right)
          endif
    endif
```

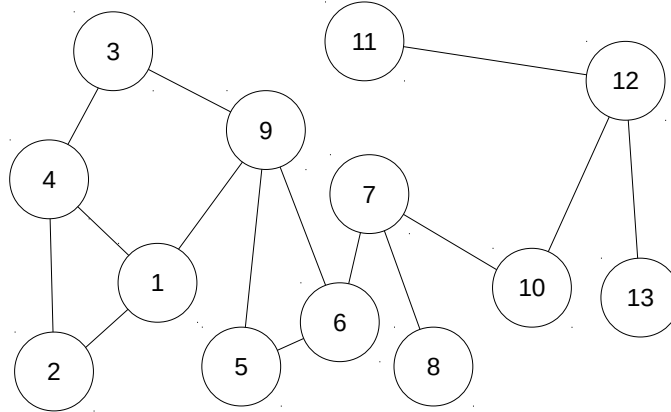
Show the steps followed by the Quicksort algorithm given above in pseudocode when sorting the following array. Draw one figure for each call to Quicksort.

value	88	6	63	36	43	16	11	32	13	25
index	0	1	2	3	4	5	6	7	8	9

Additional space for Question 1.

Question 2: Graphs (20 points)

Explain the order of node traversal for the following graph for the specified search type. Assume that nodes with lower node numbers will be traversed before nodes with higher node numbers when multiple nodes are available as successors of a given node. Start at node 1.



A. Depth-First Search

B. Breadth-First Search

Question 3: Ethics (20 points)

Haley works for Goggles, a major hypothetical search engine and information management corporation and her team from Goggles been contracted to help fix HealthyCare.gov, a hypothetical troubled government website intended to work with insurance companies, hospitals and other medical and health-related organizations, and private physicians. HealthyCare.gov went live last month and is supposed to be helping individuals find the healthcare they need while minimizing their out-of-pocket costs but, instead, is turning into a giant fiasco. Haley and her team are assigned to help rectify problems the site is experiencing in trying to interface with corporate websites from which it is supposed to draw information and to which it is supposed to provide information. This morning, when Haley comes in to work, she is greeted by Gregor, who is beaming.

“Why the big smile, Gregor?” she asks.

“I fixed it, boss!” is his reply. “I stayed up all night doing it but HealthyCare.gov now talks just fine with Metna. Login, file transfers, searches, health insurance, patient files, everything!”

“Outstanding! How did you do it?”

“Oh, well,” he hesitates, “you don’t want to know.”

“I’m pretty sure I need to know.”

Now Gregor looks sheepish. “I, uh. Look, I admit it. It isn’t the best fix of all time. In fact, it is really only good as a temporary thing, right? But it is working now and people can get things done and we don’t have time for perfection. The benefit of getting people the healthcare they need now is worth cutting some corners for, don’t ya think? Anyway, I do. And it’ll make us look good to get this going quickly. You know, whatever. Anyway, I promise I’ll come back and fix it right later on, once we get everything else patched, at least temporarily. Really, I will.”

“Alright, Gregor, alright. I’ll go with that. Go home and get some sleep and come back tomorrow.”

A. Find at least one computer crimes law that is relevant to this scenario. List the name of the law and *explain* why you think it is relevant.

B. Say whether you think Gregor abided by (that is, followed) the law you listed and *explain* how you came to that conclusion.

C. Give one likely motivation for Gregor's action and *explain* how you concluded that was a likely motivation.

D. List one ethical-decision-making problem (interfering factor) that is likely to have contributed to at least one of Gregor's decisions and *explain* how you concluded that was a likely problem.

E. List one ethical-decision-making strategy that Gregor could employ to improve his ethical decision making and *explain* how he might employ that strategy in this situation.

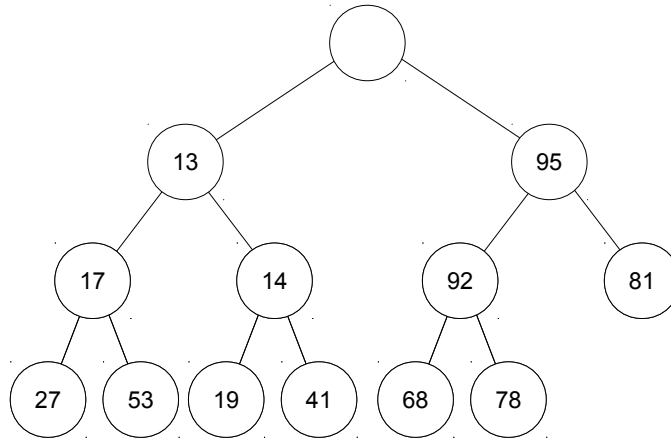
Question 4: Hashing (10 points)

A. Explain how it is possible for a hash table to retrieve elements in less than $O(\log_2 n)$ time.

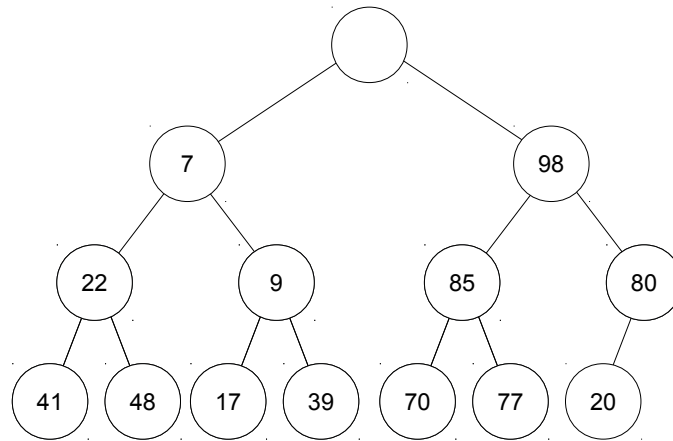
B. Explain why retrieving elements in less than $O(\log_2 n)$ time is considered significant.

Question 5: Double-Ended Priority Structures (20 points)

A. Show the steps required to add the the key “5” to the following Deap.



B. Show the steps required to remove the maximum key from the following Deap.



Question 6: BONUS QUESTION FOR EXAM 1 Arrays and Vectors (30 points)

[Completing this question will add from 0 to 30 points to your score from Exam 1. Your maximum possible score on Exam 1 including these bonus points is 100.]

A. Assume that you have two arrays, A and B, both of the same size. Array A contains n items in no particular order and array B is initially empty. Explain, using the concept of Big O, how long it would take to efficiently insert the items from A, one at a time starting with the first item in A and proceeding forward through to the last item in A, while ensuring that B is always ordered from smallest to largest.

B. Assume that you have two vectors, A and B. Vector A contains n items and vector B is initially empty. Further, assume that the initial size of B is some constant c and that when B becomes full, its size is increased by c elements. Explain, using the concept of Big O, the running time to efficiently add the items from A, one at a time, to B. Order is not important.

Question 7: BONUS QUESTION FOR EXAM 2 AVL Trees (30 points)

[Completing this question will add from 0 to 30 points to your score from Exam 2. Your maximum possible score on Exam 2 including these bonus points is 105.]

Explain the result of deleting an item with the key “19” from the following AVL tree. Show your work.

