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Second Exam

CS 331 — Data Structures
Spring 2014
Wednesday, November 12, 2014 15:15–16:30

This is a **closed book** and **closed notes** exam.
You are **not** allowed to use calculators or computers during this exam.
Do **ALL** problems in this booklet. Read each question very carefully.
You may detach pages, but **you must return all pages of this exam.**
Your exam will be digitized for grading. **The back sides of pages will be considered scratch paper, and will be ignored for grading.** If you need extra space to write an answer, "overflow" sheets are provided at the end of the exam.

Name

IIT Email

Multiple Choice

Each question has exactly one correct answer. **You are allowed to select more than one answer.** You get one point for showing up to the exam, three points for circling the correct answer, and lose one point for every incorrect answer you circle. Thus, leaving a question blank will score one point. Circling the correct answer and an incorrect answer scores three points. Circling three incorrect answers scores negative two points. Thus, you can get partial credit, but you will be penalized for guessing.

     If the idea of negative points scares you, circle only one answer for each problem and it will score exactly like a traditional multiple choice exam.

     Select your choice by circling the corresponding letter. If you make a mistake, draw an "X" through the choice. If you really mess it up, cross them all out and draw a box clearly labeled with your answer. In the event that your answer is hard to read, all reasonable interpretations will be used. For example, a letter that looks like both an 'a' and a 'd' will be considered both. So be neat.

Question 1)$_{1280}$ (4 points)
     What do lists have that sequences do not have in Clojure?

a) A specific implementation

b) a `next` operation

c) a `first` operation

d) an ordering to the data

Question 2)$_{1281}$ (4 points)
     The following code calls `rest` on a Clojure vector. What will be the result?
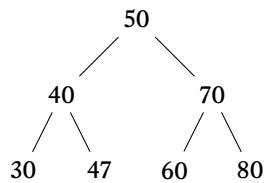
```
1       (map inc [2 4 6 8])
```

a) A vector `[5 7 9]`

b) A list `(5 7 9)`

c) A sequence `(5 7 9)`

d) An exception

Question 3)$_{1282}$ (4 points)
     What advantages is there to using sequences?

a) they take less memory

b) they are more flexible

c) they are more efficient

d) they are more accurate

Question 4)$_{1283}$ (4 points) Consider the following tree:

```
          50
        /    \
      40      70
     /  \    /  \
   30   47  60   80
```
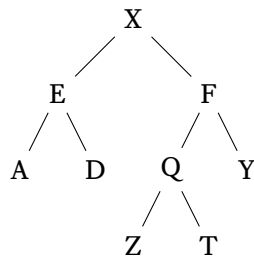
Which of the following is a preorder traversal?

a) 30,40,47,50,60,70,80

b) 47,30,40,60,80,70,50

c) 50,40,70,30,47,60,80

d) 50,40,30,47,70,60,80

Question 5)$_{1284}$ (4 points)
Consider the following tree:

```
          X
        /    \
      E        F
     / \      / \
   A    D    Q   Y
           /  \
          Z    T
```
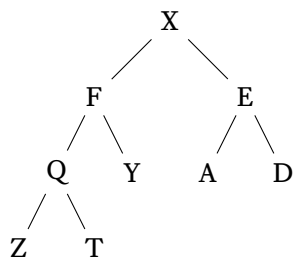
Note that this tree is not a BST. Which of the following is a postorder traversal?

a) A,E,D,X,Z,Q,T,F,Y

b) A,D,E,Z,T,Q,Y,F,X

c) X,E,F,A,D,Q,Y,Z,T

d) X,E,A,D,F,Q,Z,T,Y

Question 6)$_{1287}$ (4 points)
Consider the following tree:

```
             X
           /    \
         F        E
        / \      / \
       Q   Y    A   D
      / \
     Z   T
```

Note that this tree is not a BST. Which of the following is a level-order traversal?

a) X,F,E,Q,Y,A,D,Z,T

b) X,F,Q,Z,T,Y,E,A,D

c) Z,Q,T,F,Y,X,A,E,D

d) Z,T,Q,Y,F,A,D,E,X

Question 7)$_{1285}$ (4 points)
  Which of the following is an advantage of breadth-first search vs. depth-first search?

a) It returns the solution closest to the root.

b) It takes less memory.

c) It is always faster.

d) It handles wider data structures.

Question 8)$_{1286}$ (4 points)
  Which of the following is an advantage of depth-first search vs. breadth-first search?

a) It returns the solution closest to the root.

b) It takes less memory.

c) It is always faster.

d) It handles deeper data structures.

Question 9)$_{1288}$ (4 points)
  Suppose you just read an integer from memory location 1000. According to the principle of temporal locality, which of the following can we expect?

a) The content of location 1000 will be temporary.

b) We will access the location 1001 soon.

c) We will need a local copy of location 1000.

d) We will access memory location 1000 again soon.

Question 10)$_{1289}$ (4 points)
  Suppose you just read an integer from memory location 1000. According to the principle of spatial locality, which of the following can we expect?

a) The content of location 1000 will be temporary.

b) We will access the location 1001 soon.

c) We will need a local copy of location 1000.

d) We will access memory location 1000 again soon.

Question 11)$_{128a}$ (4 points)
  The swap heuristic is...

a) Fast and stable

b) Fast and unstable

c) Slow and stable

d) Slow and unstable

Question 12)$_{128b}$ (4 points)
    Suppose we have a list with content (1 2 4 8 16). We access element 8. What will be the result of the move-to-front heuristic?

a) (1 2 4 8 16)

b) (8 16 1 2 4)

c) (1 2 8 4 16)

d) (8 1 2 4 16)

Question 13)$_{128c}$ (4 points)
    Suppose we have the vector [4 2 6 1 3 5 7]. What will be the first three elements selected if we run selection sort on it?

a) 1,2,3

b) 4,2,6

c) 3,5,7

d) 5,6,7

Question 14)$_{128d}$ (4 points)
    Suppose we have the vector [4 2 6 1 3 5 7]. What will be the first three elements inserted if we run insertion sort on it?

a) 1,2,3

b) 4,2,6

c) 3,5,7

d) 5,6,7

Question 15)$_{128e}$ (4 points)
    Which of the following is a special ability of insertion sort?

a) It can sort most arrays in $\mathcal{O}(n)$ time.

b) It can give useful results if interrupted before it has finished.

c) It can return the elements closest to the beginning of the vector.

d) It runs in $\mathcal{O}(n)$ time if the data is already sorted.

Question 16)$_{128f}$ (4 points)
    Which of the following is a special ability of selection sort?

a) It can sort most arrays in $\mathcal{O}(n)$ time.

b) It can give useful results if interrupted before it has finished.

c) It can return the elements closest to the beginning of the vector.

d) It runs in $\mathcal{O}(n)$ time if the data is already sorted.

Question 17)$_{1290}$ (4 points)
    The quicksort algorithm performs very badly when

a) the pivot chosen is always the largest or smallest.

b) the data is too random.

c) the pivot chosen is always toward the middle.

d) the pivot is chosen randomly.

Question 18)$_{1291}$ (4 points)
    What is the worst-case performance of quicksort?

a) $\mathcal{O}(1)$

b) $\mathcal{O}(n)$

c) $\mathcal{O}(n \lg n)$

d) $\mathcal{O}(n^2)$

Question 19)$_{1292}$ (4 points)
    How can we prevent the worst-case performance of quicksort?

a) Check if the data is already sorted first.

b) Always chose a pivot in the middle of the array.

c) Chose a random pivot.

d) Always chose the first element as a pivot.

Question 20)$_{1293}$ (4 points)
    If you have a linked list, the sorting algorithm below most likely to run quickly is:

a) quicksort

b) merge sort

c) selection sort

d) bubble sort

Question 21)$_{1294}$ (4 points)
    If you have an array/vector, what does merge sort need to run efficiently?

a) An immutable array

b) A preprocessing phase

c) A randomization phase

d) Extra storage space

Meta Questions   Name (optional):

These questions are optional, and do not count toward your grade. Don't spend any time on them unless you are already finished with the exam. This page will be separated from the exam, so the data will be anonymous unless you put your name on it.

- How do you think you did just now? What percentage would you estimate to be your score?

- The purpose of this course is to enable you to become an expert at data structures. What is one area in which this course is accomplishing its purpose? Give examples if you can.

- What is an improvement that could be made that would allow the course to accomplish its purpose even better?

- What is one strength as a student you have developed or improved since the last midterm?

- What is one thing you could do to improve your role as a student for the rest of the course?