Exam 4

This is a preview of the published version of the quiz

Started: Apr 18 at 5:30pm

Quiz Instructions

Question 1

3 pts

Suppose we are performing a binary search on a sorted array called `numbers` initialized as follows:

```
// index          0   1   2   3   4   5   6   7   8   9  10  11  12  13  14
int[] numbers = {-1,  3,  5,  8, 15, 18, 22, 39, 40, 42, 50, 57, 71, 73, 74};

// search for the value 42
int index = binarySearch(numbers, 42);
```

Select the indexes of the elements that would be examined by the binary search (the `mid` values in our algorithm's code) and write the value that would be returned from the search. Assume that we are using the binary search algorithm done in class.

- ◯ [7,11,9] return 9
- ◯ [3, 8, 9] return 9
- ◯ [7,10,2] return 42
- ◯ [9,7,11] return -1

Question 2

3 pts

Write the state of the elements of the list below after each of the first 3 passes of the outermost loop of the selection sort algorithm.

```
// index     0   1  2   3   4   5   6   7
```

```
// values  {29, 17, 3, 94, 46,  8, -4, 12}
```

```
ArrayList<Integer> numbers =
    new ArrayList<Integer>(Arrays.asList(29, 17, 3, 94, 46,  8, -4, 12));
```

```
selectionSort(numbers);
```

```
Write your answers in three lines in the following format where each
line represents the new state of the array list.
```

after pass 1

after pass 2

after pass 3

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Question 3

2 pts

Approximate the runtime of the following code fragment, in terms of *n*:

Select the answer in the form of O(N) etc.

```
a)
int total = 0;
int n; // input data size

for (int i = 1; i <= n * 2; i++) {

    for (int j = 1; j <= n; j++) {

        total++;

    }

}

for (int k = 1; k < 100; j++) {

   for (int j = 1; j <= n; j++) {

    total++;

    total++;

}

}
```

- ◯ O(Log N)
- ◯ O(N^2 + N)
- ◯ O(N^2)
- ◯ O(200N+ N^2)

Question 4

2 pts

b) int sum =0;

int max=100;

```
for (int j = 1; j <= max; j++)
        sum+=100;
```

- ◯ O(N Log N)
- ◯ O(c) where c is a constant
- ◯ O(N^2)
- ◯ O(N)

Question 5

3 pts

Write a **recursive** method `repeat` that accepts a string *s* and an integer *n* as parameters and that returns a `String` consisting of *n* copies of *s*. For example:

Call	Value Returned
`repeat("hello", 3)`	`"hellohellohello"`
`repeat("this is fun", 1)`	`"this is fun"`
`repeat("wow", 0)`	`""`
`repeat("hi ho! ", 5)`	`"hi ho! hi ho! hi ho! hi ho! hi ho! "`

You should solve this problem by concatenating `String` objects using the `+` operator

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Question 6

2 pts

The following code will accurately perform a binary search on a sorted array of integers:

```
public static int binarySearch(int[] numbers, int value){
    if (numbers.length<=0) return -1;
    else return binarySearch(numbers, value, 0, numbers.length-1);
}
public static int binarySearch(int[] numbers, int value, int first, int last){
    if (first>last) return -1;
    int middle = (first+last)/2;
    if (value == numbers[middle] ) return middle;
  else if (value > numbers[middle]) return  binarySearch(numbers,value,first,  middle-1);
  else return binarySearch(numbers,value,middle+1,last);
}
```

- ○ True
- ○ False

Question 7

1 pts

Describe two major differences between empirical analysis and algorithm analysis in the context

of determining program complexity

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Question 8

4 pts

Write a recursive method **removeDuplicates** for the *LinkedIntList* class that removes duplicate occurrences that appear successively ie.

[1,1,2,1,2] returns [1,2,1,2]

[1,1,1,1] returns [1]

[4] returns [4]

[] - empty list throws *NullPointerException*

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