CIS 110 Fall 2015 — Introduction to Computer Programming
6 Oct 2015 — Midterm Exam
Answer Key

0.) The Easy One (1 point total)

Check cover sheet for name, recitation #, PennKey, and signature.

1.) Value Judgments (9 points total)

Fill in the data type and final value of the variable `a`. (Assume `a` is always declared with the most appropriate data type.) Write "**CE**" as the data type if the statements will cause compiler error, or "**RE**" if they will cause a run-time error. Give the reason for the error in the third column. The first row has been filled in for you.

	Type of `a`	Value of `a`/Error explanation
`_____ a = 2;`	`int`	`2`
`int[] b = new int[5];` `_____ a = b.length;`	`int`	`5`
`String s = "CIS";` `_____ a = s + 110;`	`String`	`"CIS110"`
`String s = "CIS";` `_____ a = s - 110;`	CE	Subtraction not defined for `Strings`
`_____ a = 5 % -4;`	`int`	`1`
`_____ a = Integer.parseInt(3);`	CE	`parseInt()` takes a `String` argument
`_____ a = "A" == "A";`	`boolean`	`false`
`_____ a = 'A' == 'A';`	`boolean`	`true`
`_____ a = 4 + 7 / 2;`	int	`7`
`_____ a = 8.0 / ((int) 4.0);`	`double`	`2.0`

2.) Loopy Loop-de-Loops (10 points total)

Consider the following program:

```
public class Amusement {
    public static void main(String[] args) {
        int foo = 100;
        for (int i = 5; i < 25; i+= 10) {
            System.out.println(foo / i + "?");
            for (int j = 0; j <= 3; j++) {
                System.out.print(args[j] + "!");
            }
        }
    }
}
```

Assume you run the program at the DrJava interactions pane using the command below, then answer the questions:

```
java Amusement Loop-de-loop roller coasters are fun
```

2.1) (2 points) How many question marks (?) will get printed? 2

2.2) (2 points) How many exclamation points (!) will get printed? 8

2.3) (6 points) What does the program print?

```
5?
Loop-de-loop!roller!coasters!are!15?
Loop-de-loop!roller!coasters!are!
```

3.) Changing Gears (5 points total)

Study the following program, then answer the questions.

```
public class VWDiesel {
    public static void main(String[] args) {
        int smog = Integer.parseInt(args[0]);
        int emissions = 0;

        while (smog != 0) {
            emissions = 10 * emissions;
            emissions = emissions + (smog % 10);
            smog = smog / 10;
        }

        System.out.println(emissions);
    }
}
```

3.1) (2 points) What gets printed when you run "`java VWDiesel 143`"?
341

3.2) (3 points) In **15 words or less**, explain in simple English what the `VWDiesel` program does.
`VWDiesel` prints the reversed digits of its argument.

4.) So the pope opens a restaurant... (15 points total)

Although it wasn't widely publicized, the pope opened a trendy new restaurant in Old City during his recent visit. The city did publish a short press release about the event, but the Secret Service classified much of the pope's long-planned remarks by garbling the text. Fortunately, an enterprising CIS 110 TA discovered a recursive program that can ungarble them among Edward Snowden's NSA leaks. Unfortunately, the leaked code is missing certain key elements.
Complete the program below, then tell us what the pope said at his new restaurant's opening.

4.1) (11 points) Complete the program:

```
public class PopeUngarbler {
public static String  ungarble(String  code, int  start, int  end) {
if (end < start) return  ""; // base case
int mid = (start + end) / 2; // mid-point
char a = code.charAt (mid); // character at mid-point

// recursively ungarble            return a + ungarble (code, start, mid - 1) +
ungarble (code, mid + 1, end);
}

public static void  main(String[] args ) {
String a = "EEHSECTESAK";
String b = "EAHEVN";
String c = "TIRM-ED";
System.out.println("Welcome to " +
ungarble(a, 0, a.length() - 1) + " " +
ungarble(b, 0, b.length() - 1) + ". " +
"I will be your " + ungarble(c, 0, c.length() - 1) + ".");
}
}
```

4.2) (4 points) What did the pope say at the restaurant opening?
Welcome to CHEESESTEAK HEAVEN. I will be your MITRE-D.

5.) The Trump Exam Question (8 points total)

Real-estate, gambling, reality TV mogul, and Wharton-alumnus Donald Trump is famous for his business empire of branded skyscrapers, resorts, casinos, and presidential campaigns. A fan of poker and blackjack, Trump is rumored to despise the card game bridge because it values No Trump bids above all others.
We are proud to offer you his latest — and potentially most profitable ever — luxury, Trump-branded venture: the first in what promises to be a long line of lucrative Trump Exam Questions.

```
public static int trump(int tower, int tajmahal) {
    if (tajmahal == 0)
        return 0;
    else if (tajmahal % 2 == 0)
        return trump(tower + tower, tajmahal / 2);
    else
        return trump(tower + tower, tajmahal / 2) + tower;
}
```

5.1) (2 points) What is the value returned by `trump(2, 1)`?
2

5.2) (2 points) What is the value returned by `trump(2, 4)`?
8

5.3) (2 points) What is the value returned by `trump(3, 3)`?
9

5.4) (2 points) What was the name of this function before Trump purchased the naming rights? (We will accept any reasonable answer.)
`multiply` or `multiplication` or `product` or `times`

6.) Coding (20 points total)

Write a function `risingSequence` that takes an array of integers, and returns the length of the longest sequence of consecutive, rising numbers in the array. For example, the longest sequence of consecutive rising numbers in the array `{3, 45, 6, 12, 18, 21, 21, 19, 41, 2}` is `{6, 12, 18, 21}`, so `risingSequence` would return 4 for this array. If the array is `null`, return 0. As long as the array has at least one element, the longest sequence of consecutive rising numbers should be at least 1.
Do not write the class structure, only write the function itself. Make a reasonable effort to indent your code, but it does not have to be perfect. Comments will not be graded, so you do not have to include any at all. However you are welcome to include them — writing comments may well help you work out the solution.

```
public static int risingSequence(int[] arr) {
    if (arr == null)     return 0;
    if (arr.length == 0) return 0;

    int maxLength = 1, count = 1;
    for (int i = 1; i < arr.length; i++) {
        if (arr[i] > arr[i - 1]) {
            count++;
        } else {
            maxLength = Math.max(maxLength, count);
            count = 0;
        }
    }

    return count;
}
```