

VERSION A

1 Sorting

1.1

Fill in the missing code. The number of lines corresponds to the answer key. Your code may vary.

```
public class Bug implements Comparable {
    int num_legs; // sort by this first
    int num_eyes; // sort by this if num_legs is equal
    @Override
    public int compareTo(Object o) {

        -----

        -----

        -----

        -----
    }
}
```

1.2

What kind of sort is this? Rewrite it to use ArrayList.

```
static void sort(int start,int[] values) {
    if(values.length-start < 2)
        return;
    int m = start;
    for(int i=start+1;i<values.length;i++)
        if(values[i] < values[m])
            m = i;
    int tmp = values[m];
    values[m] = values[start];
    values[start] = tmp;
    sort(start+1,values);
}
```

2 Anonymous Inner Classes

2.1

Given the interface defined like this:

```
public interface KeyListener {
    void keyPressed(char key);
    void keyReleased(char key);
}
```

Write a complete program that uses an anonymous inner class that implements this interface, then calls `keyPressed()` to print the key character 'A' to the screen.

3 Recursion

3.1

You want to implement combat within a role playing game on a computer. Specifically, the game rules for damage inflicted by a hit are:

- In order to figure out damage from one hit, you throw a N-sided die.
- The result of one throw will be between 1 and N (including both, e.g., a 6-sided die has six sides, labeled 1 to 6).
- If the result is 1 to N-1, that is the resulting damage from the hit.
- If the result is N, however, you hit critically, and you throw again, adding the results.
- If you throw again, the same rules apply, potentially resulting in doubly or more critical hits.

For example, if you use a 4-sided die and throw a 3, the damage is 3. If you throw a 4 instead, you throw again. If that results in a 3, the total damage is 7. If you happen to throw two 4s after each other and then a 2, the total damage is 10. Fill in the missing code. The number of lines corresponds to the answer key. Your code may vary.

```
final static Random rand = new Random();
public static int damage(int n) {
    -----
    -----
    -----
}
```

3.2

What is wrong with the following program, what happens when you run it? If this method would have been implemented using a loop, and would have a similar error, what would happen then if run?

```
public class JavaIsToJavascriptWhatCarIsToCarpet {
    public static int factorial(int n) {
        return(n * factorial(n-1));
    }
}
```

```
public static void main(String args[]) {  
    factorial(4);  
}  
}
```

4 Big O

4.1

What is the Big-O notation for the following function?

$$T(N) = 100000 + 10N + N^{-2}$$

4.2

What is the Big O speed for a binary search? For a bubble sort? For a quick sort?