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: Recursion (30 points)

Given the following code:

```
private static void printStrings(String first, String second) {
    if (second.length() == 1) {
        System.out.println(first + second);
    }
    else {
        for (int i = 0; i < second.length(); i++) {
            String front = second.substring(0, i);
            String mid = second.substring(i, i + 1);
            String back = second.substring(i + 1);
            printStrings(first + mid, front + back);
        }
    }
}
```

A. What will be the result if `printStrings` is called with `""` for `first` and `"top"` for `second`? *Explain* your answer.

B. In principle, should it be easy to convert this recursive code to iterative code that prints the same output given the same initial input? *Explain* your answer.

C. If you were to convert this code to use iteration instead of recursion, would you expect it to run faster, slower, or exactly the same speed as this recursive version? *Explain* your answer.

D. If you were to convert this code to use iteration instead of recursion, would you expect it to use more, fewer, or exactly the same number of local variables? *Explain* your answer.

Question 2: Preconditions, Assertions, Exceptions, and Object-Oriented Programming (15 points)

A. Given the code from Question 1, what would be a reasonable precondition to add to this function? *Explain* your answer.

B. Would it be better to encode this precondition as an assertion, a conditional with an exception, both, or neither? *Explain* your answer.

C. Where in the code would you place this precondition? *Explain* your answer.

Question 3: Ethics (25 points)

Ulrich is 10 and he loves Bild-E-Blox. Wolfgang is not surprised. He loved Bild-E-Blox back when he was a kid and his son Ulrich is like him in many other ways too. However, Ulrich's friends tend to prefer other block building toys. When Wolfgang asks them why, they tell him about all sorts of online connections to their favorite block building systems, particularly computer aided design (CAD) tools that allow them to assemble virtual models from blocks that they may not own themselves. Well, Wolfgang is a software developer—he can make a similar tool for Bild-E-Blox! So, he does.

Development is slow going because Wolfgang's full-time job as a software developer not only keeps him busy during the day but can mentally exhaust him as well. Still, for an entire year Wolfgang spends most of his evenings and weekends writing up an outstanding Bild-E-Blox CAD tool in Java, which he has his son and his son's friends test out, and turning it into an applet backed by a database that allows him to save the generated designs on his own server. Soon the website is up and running. It is a big hit with kids all over the world, both those who create the designs and those who simply browse the huge library of designs that other kids have created. For the payoff, Wolfgang starts running targeted advertising and starts to make some very good money.

A. Find at least one ethical principle from a professional code of ethics that is relevant to this scenario. List the principle, give its source, and *explain* why you think it is relevant.

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

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

D. List one ethical-decision-making problem that is likely to have contributed to at least one of Wolfgangs decisions and *explain* how you concluded that was a likely problem.

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

Question 4: Model, View, Controller and Applets (30 points)

Cassandra has developed a Java application following the MVC design pattern. Now she wants to make it into an applet.

A. *Explain* one change she might need to make to the model(s) of her software to convert it from an application to an applet.

B. *Explain* one change she might need to make to the view(s) of her software to convert it from an application to an applet.

C. *Explain* one change she might need to make to the controller(s) of her software to convert it from an application to an applet.

D. *Explain* one way in which the model(s) will communicate with the view(s) even after the conversion from application to applet.

E. *Explain* one way in which the view(s) will communicate with the controller(s) even after the conversion from application to applet.

F. *Explain* one way in which the controller(s) will communicate with the model(s) even after the conversion from application to applet.