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.

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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 (25 points)

Old Man Richardson wants to personally invite all of his descendants and all of their spouses to a giant celebration for his 100th birthday. Unfortunately for him, he doesn't have contact information for all of his grandchildren, great-grandchildren, great-great-grandchildren, etc. In fact, he has lost track of just how many descendants he actually has by now. Moreover, he doesn't have contact info for most of his descendants' spouses. Fortunately, though, Old Man Richardson does have contact information for his children and knows that they each have contact information for their own spouses (if any), their own children (if any), and for him. Further, he is pretty sure that all of his other family members have contact information for their own spouses, children, and parents.

Describe a recursive method by which Old Man Richardson can collect up contact information for all of his descendants and all of his descendants' spouses so that he can send them invitations. In your description, make sure that Old Man Richardson only gets one copy of each contact information record. List and *explain* the basis case(s), what happens in each basis case, and under what conditions each basis case is used, as well as the recursive case(s), what happens in each recursive case, and under what conditions each recursive case is used.

You may write Java code or pseudo code for this recursive method, describe it in English, draw figures, or some combination of these descriptive elements, as long as the answer is clear.

Question 2: Applets (10 points)

A. Art has written a Java applet that shows a picture and plays a tune. If the user points with the mouse near the top if the picture, Art's applet plays the tune more quickly. If the user points near the bottom, it plays more slowly. However, Art notices that the tune keeps playing, even when he navigates to another web page and can no longer see the picture. He decides that users may find this annoying. *Explain* what has gone wrong and what Art should do to fix his applet.

B. Bart has written a Java applet with lots of buttons, sliders, and other graphical elements with which users can interact to create songs. Because he knows that the applet size is defined in the `<applet>` tag, he specified where each graphical element should be by using (x,y) coordinates for each of them. With his applet now completed and looking and working great on his computer, Bart loads it and an appropriate html page onto his webserver, strolls over to Melanie's desk, and has her enter the URL for his applet page. Much to Bart's dismay, when Melanie loads the applet on her computer, the layout is all screwed up with some elements partly on top of others. *Explain* what has gone wrong and what Bart should do to fix his applet.
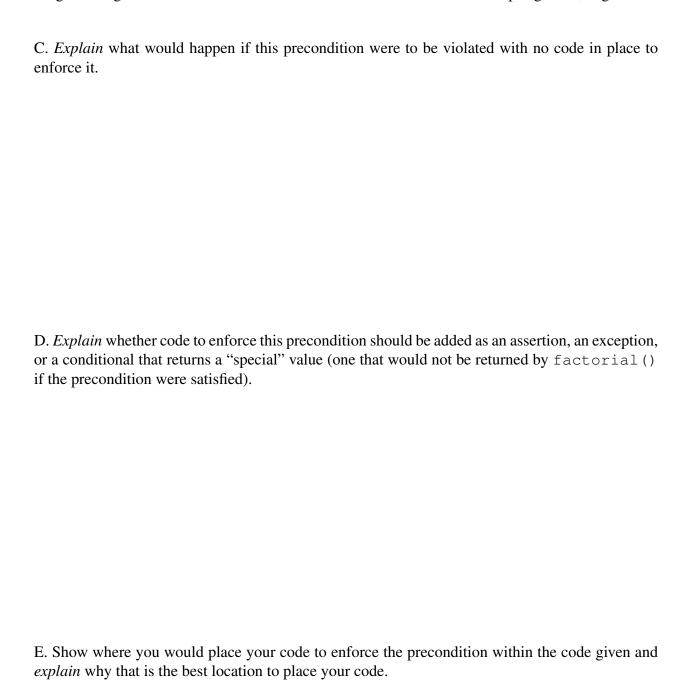
Question 3: Preconditions, Assertions, Exceptions, and Object-Oriented Programming (25 points)

Imagine that you are asked to write a factorial method to go into a Java math library for widespread use and you are provided with the following code from which to start:

```
_____  static long factorial (int n) {
    if (0 == n)
        return 1;
    else
        return n * factorial (n-1);
}
```

A. Show and *explain* whether you would make this method private, package-private (default), protected, or public.

B. *Explain* a useful precondition to add to this method.

C. *Explain* what would happen if this precondition were to be violated with no code in place to enforce it.

D. *Explain* whether code to enforce this precondition should be added as an assertion, an exception, or a conditional that returns a "special" value (one that would not be returned by `factorial()` if the precondition were satisfied).

E. Show where you would place your code to enforce the precondition within the code given and *explain* why that is the best location to place your code.

Question 4: Applets Redux (15 points)

The Java source code for this question is taken with modifications from:
`http://java.sun.com/docs/books/tutorial/deployment/applet/lifeCycle.html`

```java
import java.applet.Applet;
import java.awt.Graphics;

public class Simple extends Applet {
    StringBuffer buffer;

    public void init() {
        buffer = new StringBuffer();
        addItem("initializing... ");
    }

    public void start() {
        addItem("starting... ");
    }

    public void stop() {
        addItem("stopping... ");
    }

    public void destroy() {
        addItem("preparing for unloading...");
    }

    private void addItem(String newWord) {
        System.out.println(newWord);
        buffer.append(newWord);
        repaint();
    }

    public void paint(Graphics g) {
        g.drawString(buffer.toString(), 5, 15);
    }
}
```

A. *Explain* what should be printed by this applet when one opens this applet in a Java-enabled browser.

B. *Explain* what should be printed by this applet when one navigates away from and back to this applet using a Java-enabled browser.

C. *Explain* what should be printed by this applet when one hits the reload button while looking at this page in a Java-enabled browser.

Question 5: Ethics (25 points)

First Federal Bank of Norman (FFBN) just bought out Pohonkaville Savings and Trust (PST). Holly, the head of IT at FFBN, and Scott, who formerly worked in IT for PST but now works under Holly at FFBN, have been working all weekend to ensure that both of the former PST branch banks will be ready to open for business on Monday morning under the banner of FFBN. They think they have converted all PST data and software over to FFBN format so now all accounts for both banks should be available on all FFBN computers. The only thing remaining is to test the system.

"Okay," says Holly, sitting at a former PST computer, "give me a name to search for."

Scott is holding a printout of the names and account numbers of all former PST account holders. "Coach Porch," he replies, without even looking at the list. "He comes in here all the time."

"Okay, uh, sure," stumbles Holly and types in 'Porch' on her keyboard. "Let's see. Looks like four Porch accounts. Robert. Another Robert. April. And another Robert. Is that right?"

"Checks out here," Scott confirms, now looking at the printout. "Even the account numbers are right. What does he have for a balance on those accounts?"

"Um," she hesitates, "uh, alright, I guess, then, let me pull those up."

And so it goes, with one name after another until long after Holly and Scott are convinced the system is working just fine.

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 Holly abided by (that is, followed) the principle you listed and *explain* how you came to that conclusion.

C. Give one likely motivation for Holly'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 Hollys decisions and *explain* how you concluded that was a likely problem.

E. *Explain* a strategy that Holly could use to improve her ethical decision making.