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 (25 points)

MainMixer.java:

```java
public class MainMixer {
    public MainMixer(){
        Friend reuben = new Friend("Reuben");
        Friend soumitra = new Friend("Soumitra");
        Friend ken = new Friend("Ken");
        Friend elisa = new Friend("Elisa");
        Friend isaac = new Friend("Isaac");

        reuben.addFriend(soumitra);
        reuben.addFriend(ken);

        soumitra.addFriend(reuben);

        ken.addFriend(reuben);
        ken.addFriend(elisa);

        elisa.addFriend(ken);
        elisa.addFriend(isaac);

        isaac.addFriend(elisa);

        printFriends(elisa, 2);
    }

    private void printFriends(Friend friend, int distance) {
        if (distance == 0){
            System.out.println(friend);
        }
        else {
            for (Friend f : friend.getFriends()){
                printFriends (f, distance - 1);
            }
        }
    }

    public static void main(String[] args) {
        new MainMixer();
    }
}
```

Friend.java:

```java
import java.util.ArrayList;

public class Friend {
    private String name;
    private ArrayList<Friend> friendList = new ArrayList<Friend>();

    public Friend(String name) {
        this.name = name;
    }

    public void addFriend(Friend friend){
        friendList.add(friend);
    }

    protected ArrayList<Friend> getFriends(){
        return friendList;
    }

    public String toString(){
        return name;
    }
}
```

A. Given the code above, what will be printed when this program is run? *Explain* your answer.

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

C. If you were to convert the recursive parts of this code to use iteration instead, 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: Recursion and Iteration (10 points)

A. Given the code from Question 1, are any of the methods iterative, recursive, both, or neither? *Explain* your answer.

B. Given the code from Question 1, are any of the methods self-recursive, mutually recursive, both, or neither? *Explain* your answer.

Question 3: Preconditions and Recursion (10 points)

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

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

Question 4: Preconditions, Assertions, Exceptions, and Object-Oriented Programming (20 points)

For each of the following method signatures, *explain* whether checking a precondition in that method should be done with an assertion, a conditional with an exception, either, both, or neither.

A.   `public method1 (Object o)`

B.   `public static method2 (Object o)`

C.   `private method3 (Object o)`

D.   `private static method4 (Object o)`

Question 5: Exceptions (10 points)

```
ObjectOutputStream objectOutputStream =
    new ObjectOutputStream(new FileOutputStream(filename));
objectOutputStream.writeObject(paper);
objectOutputStream.close();
```

Explain the two basic approaches one could use to deal with the exceptions that might be thrown by the code above and *explain* why each might be appropriate.

A. One Approach.

B. Another Approach.

Question 6: Ethics (25 points)

Dyson works for *reefridge*, a highly successful Internet company. Among their many successful services is *reemail*, an ad-sponsored email service that it provides to anyone who signs up and accepts an agreement that says reefridge may analyze their emails in order to target ads to them.

Reefridge has not succeeded, however, in the social networking sphere. They've tried with *reebook* but continue to be overshadowed by the much more successful *Serface* social network.

One day it occurs to Dyson that many people who use reemail for their email also use the Serface social network. Moreover, many of those people have Serface set up to send them emails regarding messages posted to Serface, emails that are, therefore, coming into the reemail servers!

This thought really gets Dyson's mental wheels rolling! Maybe, rather than just targeting ads to reemail users, reefridge could mine these emails to understand the social networks found in Serface! Maybe they could recreate these networks for users inside reebook, to make it inviting for people to transition from Serface to reebook! Or, maybe they could just build up the social network information itself without needing to have anyone use reebook at all—after all, detailed social network information could be valuable to other companies!

The possibilities race through Dyson's head but he pushes them aside and focuses on feasibility. He writes some scripts to determine how many different reemail users get emails from Serface and how many such emails each one gets. While those scripts are running, he starts writing some code to build graphs from the data in the emails—who is "friends" with who, who is a member of what groups, what interests people appear to share, and so on. As he does this, he begins to wonder how he can verify that the networks his software is constructing correspond to actual social network. Maybe match them up with networks in reebook? So much to think about!

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

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

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

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