Show all of your work clearly in the space provided or on the additional page at the end of the exam. Be sure to **read each problem carefully**. Note that the exam is double sided.

1. (4 points) For each of the following expressions, indicate whether or not the isTrue() method will be called. If no, explain why not.

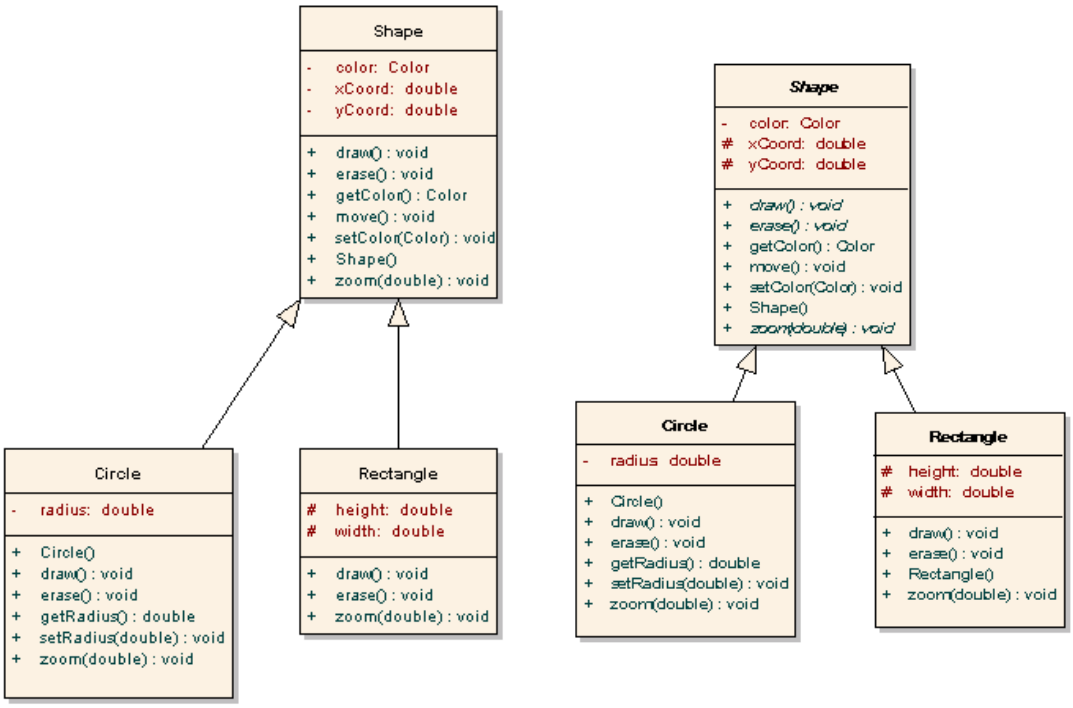
1. true || isTrue()
2. true && isTrue()
3. false || isTrue()
4. false && isTrue()

2. (5 points) Explain how pre- and post- increment/decrement operators differ in functionality. Use examples to clarify your explanation.

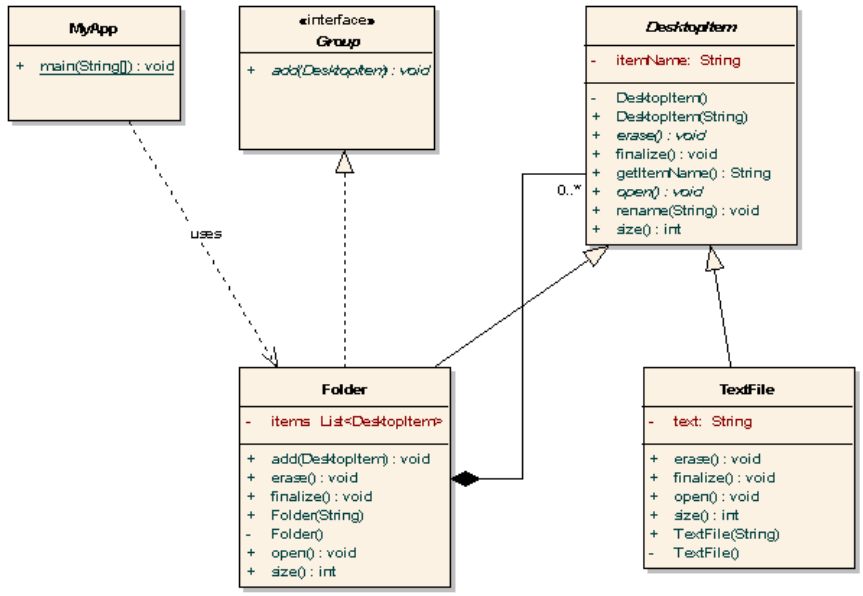
3. (5 points) Explain the difference between overriding a method and overloading a method.

4. (5 points) Explain why we can call the toString() on an object from a class that does not implement the toString() method.

5. (15 points) Consider the following two UML diagrams. List all of the things that you would need to do differently in the implementation of the Shape class in the diagram on the right compared to the diagram on the left.



6. (21 points) Using this UML class diagram, answer the following questions.



(a) List the names of the interface(s) in the diagram.

(b) List the names of the abstract class(es) in the diagram.

(c) Fill in the blank: Folder _____ Group.

(d) Fill in the blank: Folder _____ DesktopItem.

(e) Folder _____ DesktopItem. Fill in the blank with something different than your answer in (d):

(f) What does the black diamond in the diagram signify?

7. (20 points) Assume code for the diagram in the previous problem has been correctly implemented. For each of the following, identify which code snippets will produce compiler errors and explain why.

(a)

```
Group grp = new Group();
```

(b)

```
Group grp = new Folder("Folder");
```

(c)

```
Folder fldr = new Folder("Folder");
```

(d)

```
Folder fldr = new Group();
```

(e)

```
Folder fldr = new Folder("Folder");
fldr.add(new DesktopItem("help"));
```

(f)

```
Folder fldr = new Folder("Folder");
fldr.add(new TextFile("file.txt"));
```

(g)

```
DesktopItem item = new Folder("Folder");
item.add(new TextFile("file.txt"));
```

(h)

```
DesktopItem item = new Folder("Folder");
item.size();
```

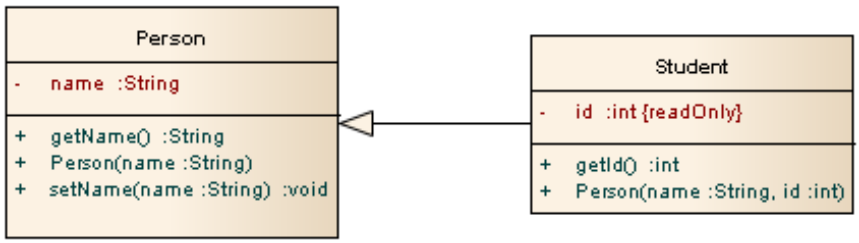
(i)

```
DesktopItem item = new Folder("Folder");
item = new TextFile("file.txt");
```

(j)

```
Group grp = new Folder("Folder");
grp.add(new Folder("Folder2"));
```

8. (25 points)



Assume that the Person class has already been implemented. Implement the Student class shown in the diagram above. The functionality of the class should be obvious, but please ask your instructor if you have any questions.

Additional space — indentify which problem your work is associated with.

Additional space — indentify which problem your work is associated with.