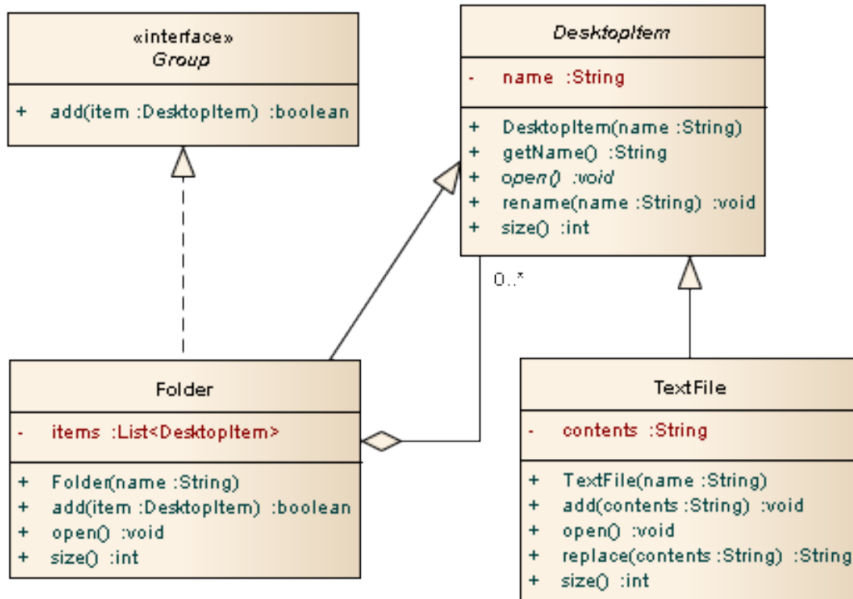


Show all of your work clearly in the space provided or on the additional page at the end of the exam. Be sure to **read each problem carefully**. Note that the exam is double sided. You are not required to provide comments in your code or include `import` statements.

1. (10 points) Describe what short-circuit evaluation is. Give an example of how it can be used to avoid a null-pointer exception from being thrown.

2. (10 points) Suppose a parent class has only one constructor that requires a `String` be passed to it. Explain why a child of this class must have a constructor defined within it.

3. Using the UML class diagram, answer the following questions.



(a) (20 points) Identify which of the following lines of code will cause a compiler error **AND** explain why.

Group a = `new Folder()`;

Group b = `new TextFile("stuff.txt")`;

DesktopItem c = `new TextFile("stuff.txt")`;

DesktopItem d = `new Folder("stuff.txt")`;

Object e = `new DesktopItem("stuff.txt")`;

Object f = `new TextFile("stuff.txt")`;

`System.out.println(f.size());`

`System.out.println(d.equals(f));`

(b) (2 points) What does the open diamond in the diagram signify?

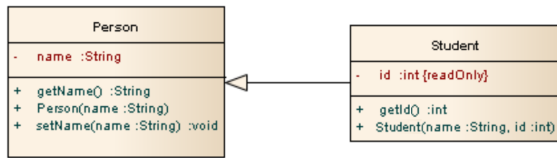
(c) (2 points) What does the open arrow from `TextFile` to `DesktopItem` signify?

(d) (6 points) Show the class declaration (just the first line) for the `Folder` class.

(e) (10 points) What methods (and constructors) are called by the following code (indicate both the method name and the class containing the method):

```
TextFile file = new TextFile("file.txt");  
file.open();  
file.size();
```

4. (10 points) Create an interface called `Physical` that provides the following methods that describe a physical object's mass and volume: `getMass()` and `getVolume()`. No arguments should be passed to the methods and they should each return a numeric value. Provide the complete contents for the `Physical.java` file.

5. (20 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.