OOP Examples Sheet 3

Dr Andrew Rice
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(Material by Dr Robert Harle)

Practical exercises are listed on the course materials page on the department webpages.

**Practical exercises associated with this supervision**

- Alice in Wonderland

**Lecture 10: Covariance and functional features (badly named Copying Objects in the notes!)**

10.1. **(W)** Give an example of how covariant arrays in Java can create runtime errors.

10.2. **(W)** Compare Inner-classes, method-local classes, anonymous inner classes and lambda functions. What general advice would you give someone who is trying to choose which one to use?

10.3. **(W)** Complete the Alice in Wonderland practical task

**Lecture 11: Design Patterns**

11.1. **(W)** Explain the difference between the State pattern and the Strategy pattern.

11.2. **(W)** In lectures the examples for the State pattern used academic rank. Explain the problems with the first solution of using direct inheritance of Lecturer and Professor from Academic rather than the State pattern.

11.3. A drawing program has an abstract Shape class. Each Shape object supports a draw() method that draws the relevant shape on the screen (as per the example in lectures). There are a series of concrete subclasses of Shape, including Circle and Rectangle. The drawing program keeps a list of all shapes in a List<Shape> object.

(a) Should draw() be an abstract method?

(b) Write Java code for the function in the main application that draws all the shapes on each screen refresh.

(c) Show how to use the Composite pattern to allow sets of shapes to be grouped together and treated as a single entity.

(d) Which design pattern would you use if you wanted to extend the program to draw frames around some of the shapes? Show how this would work.

11.4. **(*)** Explain how Java uses the Decorator pattern with Reader (yes, research will be required).