

## 2001 Paper 3 Question 2

### Further Java

- (a) Describe the differences and similarities between abstract classes and interfaces in Java. How would you select which kind of definition to use? [5 marks]
- (b) An enthusiast for programming with *closures* proposes extending Java so that the following method definition would be valid:

```
Closure myCounter (int start) {
    int counter = start;
    return {
        System.out.println (counter ++);
    }
}
```

The programmer intends that no output would be produced when this method is executed, but that it would return an object of a new type, `Closure`, and that invoking `apply()` on that object would cause successive counter values to be printed.

By using an *inner class* definition, show how this example could be re-written as a valid Java program. [5 marks]

- (c) A common programming mistake is to try to define a class to have more than one superclass. For example a naïve programmer may write

```
class AutoTree extends Thread, BinaryTree {
    ...
}
```

when defining a new kind of data structure which uses an additional thread to keep the tree balanced. Describe *three* ways in which this problem can be resolved to produce (one or more) valid class definitions. State, with a brief justification, which you would use here. [10 marks]