

2011 Paper 1 Question 9

Object-Oriented Programming with Java

Consider the following Java class that is intended to represent a specific day in an eight-week University term.

```
public class TermDay {  
    public int day;    // The day of the week as a number 0-6  
    public int week;  // The week of the term as a number 0-7  
};
```

- (a) Create a class `EncapsulatedTermDay`, which applies the principles of data encapsulation as an alternative to `TermDay`. Your modified class should throw an exception if an invalid day of the week or week number is specified. [4 marks]
- (b) The use of two `int` variables to represent the day and the week requires 64 bits of storage. How many bits are actually required? Adapt `EncapsulatedTermDay` class to achieve the same functionality using only one member variable of a primitive type. You should justify your choice of type. [4 marks]
- (c) Create a class `ImmutableTermDay` that is an immutable version of `TermDay`. [3 marks]
- (d) By applying one or more appropriate design patterns and adapting `ImmutableTermDay` appropriately, show how to ensure that only one `ImmutableTermDay` object is ever created for a given day/week combination. [9 marks]