

2006 Paper 10 Question 1

Foundations of Programming

- (a) Explain the term *overloading* in the context of Java constructors and methods. [2 marks]
- (b) Without describing the details of either, outline the relationship between the Java methods `System.out.printf()` and `String.format()`. [2 marks]

The ISO representation for the time of day is `hh:mm:ss` where (for the purposes of this question) `hh` is a two-digit integer in the range 00 to 23 and each of `mm` and `ss` is a two-digit integer in the range 00 to 59.

The following Java test program exercises a proposed class `Time` which enables a time to be represented in ISO format and allows one time to be added to another:

```
public class TimeProg
{
    public static void main(String[] args)
    {
        Time t1 = new Time(15,10,5);
        t1.add(5,10,15);
        t1.add(10,20);
        t1.add(5);
        System.out.printf("%s\n", t1); // outputs 20:30:45
        Time t2 = new Time(60,70,80);
        System.out.printf("%s\n", t2); // outputs 13:11:20
        t1.add(t2);
        System.out.printf("%s\n", t1); // outputs 09:42:05
        Time t3 = new Time();
        System.out.printf("%s\n", t3); // outputs 00:00:00
    }
}
```

It may be assumed that only positive arguments are used but note that out-of-range values for minutes and seconds are treated sensibly (thus 80 seconds results in 1 being added to the number of minutes). An out-of-range value for hours is held modulo 24.

- (c) Outline suitable specifications for the two versions of the constructor `Time()` and the four versions of the `add()` method. [6 marks]
- (d) Write a class `Time` that would work with the test program above. [10 marks]