

## 2003 Paper 5 Question 6

### Compiler Construction

- (a) A Java static method is defined in class `C` by

```
class C {  
    public static int f(int x, int y) { int z = x; ...; return x+y*z;  
    }  
}
```

where ‘...’ represents commands the details of which are not important to this question. It is called in an expression  $e$  of the form

`f(f(1,2), f(3,4))`

Give JVM (or other stack machine) code corresponding to the expression  $e$  and explain how this is derived from the syntax tree for  $e$ . [6 marks]

- (b) Explain how the body of `f` above is mapped into JVM (or other stack machine) code, explaining the rôle of the registers `FP` and `SP` (precise details are not important, but their rôle should be well explained). You may write ‘...’ for the translation of the ‘...’ in `f`. [6 marks]

- (c) Consider the Java class definitions:

```
class A {  
    public int a1, a2;  
    public void m() { println("I am an A with " + a1 + " and " + a2);  
    }  
}  
class B extends A {  
    public int b1, b2;  
    public void m() { println("I am a B with " + a1 + " and " + a2 +  
        " also with " + b1 + " and " + b2);  
    }  
}
```

Describe the run-time storage layout for objects of class `A` and for those of class `B`, particularly noting the size and offsets of members and how a *cast* of an object of type class `B` to one of class `A` can be achieved.

Explain how calls to `m()` work, particularly in code like:

```
public static void g(B x) { h(x); }  
public static void h(A x) { x.m(); }
```

[8 marks]