2003 Paper 12 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]