

## 2005 Paper 6 Question 5

### Compiler Construction

- (a) Give a program which gives different results according to whether dynamic or static binding is used. [3 marks]
- (b) Summarise two different methods of implementing functions which have free variables statically bound in an outer nested function, paying particular attention to (i) the lifetime of any storage used and (ii) any language restrictions which the implementation requires. Note also, for each case, what the effect is of assignment to such free variables, e.g. when calls to `g()` and `h()` are interleaved in

```
f(int x)
{  int a = x+7;
   int g() { a++; }
   int h(int y) { return a+y; }
   ...
}
```

[8 marks]

- (c) Give a program in which a function is called recursively without any value or function being defined recursively. [3 marks]
- (d) Give a program which produces three distinct results according to whether parameters are passed by value, by reference, or by value-result. [3 marks]
- (e) Explain the likely storage layouts for Java objects *p* and *q* respectively of classes P and Q defined by

```
class P          { int a,b; int f() { <body1> } }
class Q extends P { int c; int f() { <body2> }
                  int g() { <body3> } }
```

[3 marks]