

2004 Paper 6 Question 8

Compiler Construction

(a) Explain the differences (illustrating each with a small program) between

(i) static and dynamic binding (scoping); [4 marks]

(ii) static and dynamic typing. [2 marks]

(b) Java is sometimes said to be “dynamically typed” in that a variable whose type is (class) C can be assigned a value of (class) D provided that D extends C ; conversely a variable of type D can be assigned a value of type C using a cast. By considering storage layouts, explain why the former assignment is always valid and the latter *sometimes* invalid. [4 marks]

(c) A new programming language has the notion of “statically scoped exceptions” in which the program

```
exception foo;
void f()
{  try
   {  void g() { raise foo; }
     try {
       g();
     }
     except (foo) { C2 }
   }
   except (foo) { C1 }
}
```

would execute $C1$ rather than $C2$ as the former was in scope at the **raise** point. By analogy with statically scoped variables, or otherwise, explain how such exceptions might be implemented on a stack. [10 marks]