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

```java
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]