UNIVERSITY OF EDINBURGH

FACULTY OF SCIENCE AND ENGINEERING

MASTER OF SCIENCE IN COMPUTER SCIENCE

MOBILE COMPUTATION

Tuesday 2 May 2000

4:00 to 5:30

Examiners:

I. Watson (External)

R.N. Ibbett (Chairman)

INSTRUCTIONS TO CANDIDATES

Answer any TWO questions.

All questions carry equal weight.

1. (a) Explain what is meant by the term *serialisation* and the key role that it plays in code mobility. In what sense can serialising an applet be easier than serialising other types of Java object? [*5 marks*]

   (b) When deserialising an object, a Java programmer encounters the exception `java.io.InvalidClassException`. Explain what has happened to make this occur. [*5 marks*]

   (c) Java exceptions are said to be *precise*. What is meant by this? What constraints are placed on the implementor of a Java run-time system by this requirement? [*5 marks*]

   (d) What is meant by the term *denial of service attack*? Why is it difficult for the run-time system to detect such an attack? [*5 marks*]

   (e) Consider the following fragment of a Java program

```
static class IntRef {
    int x = 0;
}

static void updateRef(IntRef r) {
    r.x = 7;
    r = new IntRef();
    r.x++;
}
```

   If `r` is an object of class `IntRef` what will be the value of `r.x` after an invocation of the method `updateRef(r)` has completed? Justify your answer. [*5 marks*]

2. (a) Explain three ways in which the reference to an arbitrary CORBA object can be retrieved. Outline in each case what references already need to be available and the method invocations which are required. [*6 marks*]

   (b) Give two advantages for performance and robustness of the *mobile agent* programming paradigm over the *remote procedure call* paradigm. [*4 marks*]

   (c) Could the advantages which you outlined in your answer to part (b) still be achieved using the *code-on-demand* paradigm? Explain your answer. [*4 marks*]

   (d) Three message passing schemes are supported by Aglets. Name them and describe the behaviour of each one. [*6 marks*]

   (e) To what extent is an Aglet Proxy equivalent to the skeleton of a CORBA object? [*5 marks*]

3. (a) What are the three forms in which applets can be specified in an HTML page? Explain the differences between these in terms of the capabilities which they offer. In what way would having limited network bandwidth influence the use of one of these forms over the others? [*9 marks*]

   (b) Fetching code from a remote host necessitates the ability to describe within a program the location of a networked remote host. Explain the method of description of remote hosts for

      i. Java applets;
      ii. Java remote method invocations; and
      iii. Java Aglets. [*6 marks*]

   (c) Describe the event-driven programming model which underlies the Java 1.1 Abstract Windowing Toolkit (AWT) as used by Java applets. Identify the Java language constructs which are used to implement the defining concepts of the Java 1.1 AWT event model. [*8 marks*]

   (d) What are the security concerns which are raised by Java's AWT? How are these concerns alleviated in practice? [*2 marks*]