

MODULE SPECIFICATION

1 **Title of module:** CO647 Compiler Construction and Virtual Machines

2 **Department responsible for management:** Computing Laboratory

3 **Start date:** 2006/7

4 **Number of students:** 50

5 **Modules to be withdrawn:** none

6 **Level:** H

7 **Number of credits:** 15

8 **Terms during which module taught:** Autumn or Spring

9 **Prerequisites and co-requisites:**

CO524 Programming Language Technology is a prerequisite.

10 **Programmes of study:**

BSc Computer Science,

BSc Computer Science with Artificial Intelligence,

BSc Mathematics with Computer Science,

and their Year in Industry counterparts.

11 **Subject-specific learning outcomes and relationship to programme learning outcomes:**

This module is concerned with techniques for constructing compilers and programming language run-time systems; it has a particular focus on systems for managed code (Java, C# etc).

On successful completion of this module, students will:

- a) Be able to explain the structure of a modern optimising compiler [A3].
- b) Be able to compare and contrast the approaches taken by different virtual machines (e.g. the Java VM and Microsoft's CLR) [A3, A4, B3, B3, C2].
- c) Be able to describe and compare a variety of different dynamic memory management ('garbage collection') algorithms [A3, A4, A5, B3, B4, C1, C2].
- d) Be able implement simple GC algorithms [A2, A3, B2, B4, B5].
- e) Be able to select appropriate representations for data, symbol table and compiler intermediate forms [A3, A4, B1, B3, B4, C1, C2].
- f) Be able to translate between different program representations [A3, A4, B1, B5].
- g) Be able to apply theoretical analyses to optimise code [A3, A5, B1, B4, B5].

12 **Generic learning outcomes and relationship to programme learning outcomes:**

On successful completion of this module, students will:

- a) Be able to communicate technical issues clearly to specialist audiences [B2, D2].
- b) Be able to make effective use of IT facilities to support their private study [D3].
- c) Be able to manage own learning and development, including time management and organisational skills [D5].
- d) Understand and be able to explain the quantitative dimensions of a problem [D4].

13 **Synopsis of curriculum.**

The scope of the module is outlined below. Note that topics will not necessarily be delivered in this order.

- Compiler architecture.
- Virtual machines, byte code, implementation.
- Memory management: garbage collection.
- Intermediate representations.
- Symbol tables.
- Data representation.
- Instruction selection; peephole optimisation.
- Dataflow analysis: liveness, register allocation.
- Optimisation, loop-analysis.

14 Indicative reading list:

- Modern Compiler Implementation in Java , Andrew W. Appel, Jens Palsberg, CUP 2002
- Garbage Collection, Richard Jones, Wiley 1996.
- Inside the Java 2 Virtual Machine, Bill Venner, Osborne McGraw-Hill, 1999.
- Shared Source CLI Essentials, Stutz, Neward and Shilling, O'Reilly 2003.

15 Learning and teaching methods.

Learning outcomes will be achieved through a combination of lectures, classes and surgeries and private study, supported by reading guides and web-based materials, with further assistance provided electronically via newsgroups and/or the web. The achievement of learning outcomes will additionally be facilitated by formative coursework assignments, also supported by the same means. This module represents a total of 150 study hours, broken down approximately as follows:

- 30 contact hours (lectures, classes, surgeries)
- 70 hours of private study (including exam revision)
- 50 hours spent on coursework

16 Assessment methods.

Learning outcomes will be assessed through an unseen written examination and coursework. The weightings are as follows:

- 50% written examination (learning outcomes a-c)
- 50% coursework (learning outcomes d-g)

17 Implications for learning resources:

A Linux environment would be desirable but not essential.

18 A statement confirming that, as far as can be reasonably anticipated, the curriculum, learning and teaching methods and forms of assessment do not present any non-justifiable disadvantage to students with disabilities.

As far as can be reasonably anticipated, the curriculum, learning and teaching methods and forms of assessment do not present any non-justifiable disadvantage to students with disabilities.

Statement by the Director of Learning and Teaching: "I confirm I have been consulted on the above module proposal and have given advice on the correct procedures and required content of module proposals"

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Director of Learning and Teaching

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Date

Statement by the Head of Department: "I confirm that the Department has approved the introduction of the module and will be responsible for its resourcing"

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Head of Department

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Date