

2002 Paper 7 Question 4

Optimising Compilers

- (a) Explain how the *register interference graph* (sometimes known as the *clash graph*) is constructed and briefly explain its relevance to register allocation. [5 marks]
- (b) Determine the register interference graph for the following flowgraph program expressed in an assembly language notation. Only lines 3 and 10 have labels; the remaining lines are numbered for your convenience. The compare and branch instructions are written on a single line to reflect the flowgraph view of them. Give the interference graph in diagrammatic form, and annotate each edge in it with the line or lines in the program which produce it.

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                Length:
L0              MOV    p, r0
L1              MOV    i, #0
L2              CMP    p, #0;   BEQ    L10
                L3:    MOV    t3, i
L4              ADD    t4, t3, #1
L5              MOV    i, t4
L6              MOV    t5, p
L7              LDR    t6, [t5, #4]
L8              MOV    p, t6
L9              CMP    t6, #0;   BNE    L3
                L10:   MOV    r0, i
L11             RET
```

[Hint: you may wish to construct a table showing which locations have which variables live at that point.] [10 marks]

- (c) Suppose a given flowgraph program uses k registers when a given compiler colours its variables with registers. Now suppose the program is converted to *static single assignment* (SSA) form and the latter coloured by the same compiler, this time using l registers. How would you expect k and l to compare? Discuss, giving reasons, whether there might be some program which disagreed with your expectation. [5 marks]