University of Cape Town

Department of Computer Science

CSC3003S Class Test Rewrite

2007

Marks : 20

Time : 45 minutes

Instructions:

- Answer all questions from Section A and 3 questions from Section B.
- Show all calculations where applicable.

Section A [Answer Question ONE – this is compulsory]

Question 1

a) Before any code can be generated, context-sensitive analysis is applied to check for errors. Discuss 3 types of errors that can be detected. [3]

b) Although intermediate representations are widely accepted, there are still disadvantages. Discuss 2 disadvantages in using intermediate representations in compilers. [2]

Section B [Answer 3 questions ONLY]

Question 1: Activation Records

a) For what types of programs do we NOT need to store activation records on a stack? [1]

b) Assuming stack-based activation records, draw the full activation record stack corresponding to the function **not_main** at the position marked "%%%", as called by the function **main** in the following program: [4]

```
function main
start
   call output not_main (1, 2)
stop
function integer not_main (x, y)
start %%%
   return x + y
stop
```

Question 2: Basic Blocks and Traces

a) Why must traces not overlap? [1]

b) Why must traces cover all nodes of the IR tree? [1]

c) Separate the following program into basic blocks, generate a set of traces and then optimise the resulting code. Show each step of the process. [3]

```
label a:
  statement 1
  jump c
label b:
  statement 2
label c:
  jump b
```

Question 3: Optimisations

a) What is the difference between peephole optimisation and global optimisation? [1]

b) Briefly discuss 2 types of peephole optimisations and provide code examples to indicate the effect of each. [4]

Question 4: Instruction Selection

a) Describe the steps of the maximal munch algorithm. [3]

b) Maximal munch is an optimal algorithm. What is the difference between an optimal algorithm and an optimum algorithm? [2]