

University of Cape Town
Department of Computer Science
CSC3003S Class Test
2007

Marks : 20

Time : 45 minutes

Instructions:

- Answer all questions from Section A and 3 questions from Section B.
 - Show all calculations where applicable.
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Section A [Answer Question ONE – this is compulsory]

Question 1

- a) What is the purpose of the context-sensitive analysis phase of semantic analysis? [1]
- b) Besides context-sensitive analysis, what is the other task carried out by the semantic routines of a compiler? [1]
- c) Discuss 1 advantage and 1 disadvantage in using intermediate representations in compilers. [2]
- d) During the process of generating machine code, when should registers be used instead of memory? [1]

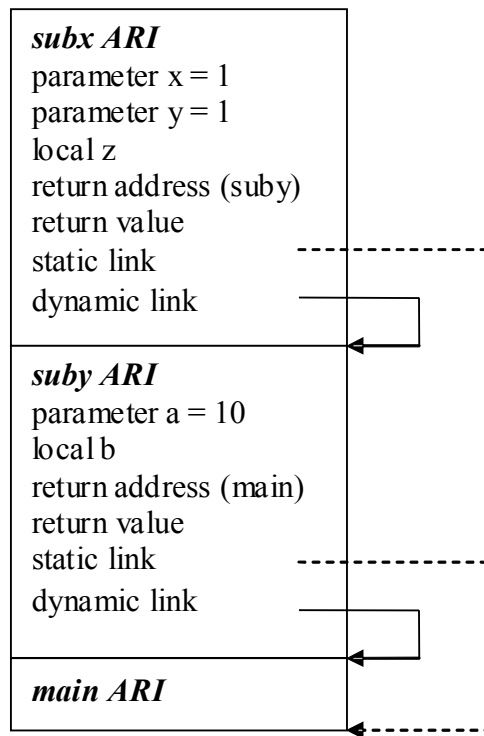
Section B [Answer 3 questions ONLY]

Question 1: Symbols and Types

- a) What is scope and why is it desirable to have multiple scopes? [2]
- b) What is the difference between name and structural type equivalence? Discuss with an example. [3]

Question 2: Activation Records

- a) What is an activation record? [1]
- b) Write a skeletal program that will result in the following activation record. [4]



Question 3: Code Generation

- a) Using the attached IR language, convert the following C-like expression to an unoptimised IR tree. Assume **a** and **b** are stack variables at offsets k_a and k_b respectively from the frame pointer TEMP(FP). Provide the final tree and do not use the Nx/Cx/Ex expression types/objects. You may use the binary operator shorthand instead of the BINOP nodes. [3]

$a = (b + 5) * 10$

- b) State the formula used to calculate memory offsets for element $A[i, j]$ of a 2-dimensional array. Assume either row-major or column-major order. [2]

$A : \text{array } [L1..U1, L2..U2] \text{ of type } T$

Question 4: Basic Blocks and Traces

- a) What is a basic block? [2]
- b) What benefit is there in rearranging basic blocks into traces? [1]
- c) In preparation for instruction selection, what modifications do we need to make to code where a CJUMP is followed by a label other than its true and false labels? Illustrate with an example. [2]