TDDB 44 Compiler construction TDDB 29 Compilers and interpreters Exam 030820

Exam in courses

TDDB 44 Compiler construction TDDB 29 Compilers and interpreters 2003-08-20, 14.00 - 18.00

Aids: None.

Max = 34 points, 17 points to pass.

Teacher on duty: Jonas Wallgren, only by phone: 282682

Problem 1 (4p) Formal languages and automata theory

NB! Only TDDB 29 (Compilers and Interpreters) students should solve this problem!

Give a DFA and a regular expression for the language over $\{0,1\}$ such that if a string contains 11 (two ones in succession) it must immediately be followed by 00 (two zeros in succession).

Problem 2 (4p) Phases of the compiler

a) Which phases does a compiler normally consist of? What is the purpose of each phase - what is the input and output of the phase? How are the phases connected?

b) What are the pros and cons of a multi-pass compiler?

Problem 3 (4p) Top-down parsing

A context-free grammar that should be used for top-down parsing could have some problems. Describe the problems and show haw they are removed.

Problem 4 (4p) LR parsing

If the grammar

A ::= $xAyAz | xBzAx | \epsilon$ B ::= $yBzBx | yBxBz | \epsilon$,

where X is the start symbol, is SLR(1) or even LR(0) then show, using tables and stack, how the string xyz is parsed. If the grammar is not then explain why.

Problem 5 (4p): Intermediate code generation

Translate the following code segment to quadruples, postfix code, and abstract syntax tree:

repeat
 x:=x-17;
 y:=y+1;
until x<100 or y>100;

Problem 6 (3p) Code optimization

a) What is a basic block? What is a loop?

b) Describe the loop optimization methods presented in the course, Use code examples.

Problem 7 (6p) Syntax directed translation

An Algol-like languagte is augmented with a cond3 statement in the following way:

The cond3 statement works like the following nesting of if statements:

```
if <expression_1>
    then <statement_1>
    else if <expression_2>
        then <statement_2>
        else <statement_3>
```

Write the semantic rules - a syntax directed translation scheme - for translating the cond3 statement to quadruples. Assume that the translation scheme is to be used in a bottom-up parsing environment using a semantic stack. Use the grammar rule above as a starting point, but maybe it has to be changed.

You are not allowed to define and use symbolic labels, i.e. all jumps should have absolute quadruple addresses as their destinations. Explain all the attributes, functions, and instructions that you introduce. State all your assumptions.

Problem 8 (3p) Memory management

What is done ata) compilationb) executionof a subprogram call in a language with static memory management?

Problem 9 (2p) Boot strapping

Explain the concepts of rehosting and retargeting. Use T diagrams.

Problem 10 (4p) Code generation for RISC

<u>NB! Only TDDB 44 (Compiler Construction) students should solve this problem!</u> a) What is branch prediction and when is it used? Give an example! Why is it important for pipelined processors?

b) Shortly explain software pipelining. Give a simple example.