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CMPUT 415 — Fall 2000-2001
Compiler Design
Final Examination
December 11, 2000

Name:
Id:

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CMPUT 415
RUDNICKI, P.
DEC 00 FINAL
PAGES: 9

Instructions

- Write your name and student id number in the box above.
- This is an open book exam. Time allowed: 60 minutes.
- Place all answers in the spaces provided on the question pages. **JUSTIFY** each answer appropriately.
- This exam counts 10% toward your final grade in this course. This exam is worth 20 points. The weight of each question is indicated in square brackets by the question number.
- This exam is not impossible, but the questions do not necessarily have obvious answers. Think about each question for couple of minutes before answering it.
- There should be 6 questions and 9 numbered pages in this exam booklet. You are responsible for checking that your exam booklet is complete.

Question	Mark	Out Of
1		2
2		2
3		6
4		2
5		2
6		6
TOTAL		20

Question 1 [2 marks]:

1. Who were the members of your group?

2. In your group, how was the work distributed among the team members in the last stage of the project?

3. Do all the team members contributed roughly equally to the project? If your answer is *No*, please give details.

Question 2 [2 total marks]: You are given the following pseudo-code:

```
 0   L1: a := b + c;
 1:      b := a + c;
 2:      c := b + c;
 3:      if a = b then goto L1;
 4:      d := d - 1;
 5:  L2: a := s + c;
 6:      if c = d then goto L3;
 7:      return;
 8:  L3: a := b + x;
 9:      callProcedureP(a, b, c);
10:      a := b + x;
```

What are the basic blocks in the code fragment? Use the line numbers to identify the basic blocks. The code includes a procedure call. Should the call form a basic block on its own? Explain your reasoning.

Question 3 [6 total marks]: Convince me that you know how your compiler generates code for the following program. Sketch the code in ASC with sufficient comments such that I am able to follow it.

```
program a(input, output);
const
   s = -10;
   t =  2;
type
   A_record = record
                 f1 : integer;
                 f2 : real;
              end;
var
   x : integer;
   A : array[s..t] of A_record;

begin
   x := s;
   while x <= t do
   begin
      A[x].f1 := abs(x);
      A[x].f2 := sqrt(A[x].f1);
      x := x+1;
   end;
end.
```

Question 3 (continued)

Question 4 [2 total marks]: Some programming languages allow subroutines to be called with a variable number of parameters (in PAL this was permitted only for I/O procedures). What are the implications of extending PAL to allow user defined procedures to be called with variable number of parameters? Some of the aspects you might want to consider are: changes to the language, symbol table, semantics, code generation, and runtime.

Question 5 [2 total marks]: Assume that you have accepted the rewarding job of TA-ing the CMPUT 415 course next year. The course instructor insists on having the same PAL compiler as the course project but is willing to reorganize the stages in which the project is submitted.

What suggestions would you have to the course instructor?

What pieces of advice would you give the students in order to help them with their project?

Question 6 [6 total marks]: To *some* of you this question may look familiar. Consider the following grammar G over terminal alphabet $\{a, b, c, d\}$:

1. $S' \rightarrow S\$$
2. $S \rightarrow Aa$
3. $S \rightarrow bAc$
4. $S \rightarrow Bc$
5. $S \rightarrow bBa$
6. $A \rightarrow d$
7. $B \rightarrow d$

Part 6a [1 mark]: Is G an LL(1) grammar? Why or why not?

Part 6b [1 mark]: Is G an LR(0) grammar? Why or why not? Find the collection of LR(0) items for G. You do not have to find all of them, find only these that are required to answer the question above and make a comment about the remaining ones.

Part 6c [1 mark]: Is G an SLR(1) grammar? Why or why not?

Part 6d [2 marks]: Here is G again:

1. $S' \rightarrow S\$$

2. $S \rightarrow Aa$ 3. $S \rightarrow bAc$ 4. $S \rightarrow Bc$ 5. $S \rightarrow bBa$

6. $A \rightarrow d$ 7. $B \rightarrow d$

Is G an LR(1) grammar? Why or why not? Find the collection of LR(1) items for G. You do not have to find all of them, find only these that are required to answer the question above and make a comment about the remaining ones.

Part 6e [1 mark]: Is G an $LALR(1)$ grammar? Why or why not?