COP 3402 Systems Software
Fall 2016
Instructor: Dr. Pawel Wocjan

Final Exam
Wednesday 12/07/2016

First Name: _____

Last Name: _____

NID: _____

First Name: _____

Last Name: _____

NID: _____

Problem: Points:

1 _____ **(out of 10)**

2 _____ **(out of 5)**

3 _____ **(out of 5)**

Total _____ **(out of 20)**

Problem 1 – PM/0 machine

Name four registers of the PM/0 machine (no abbreviations).

_____

_____

_____

_____

What is stored in an activation record? Name four entries (no abbreviations.)

_____

_____

_____

_____

Name two entries (besides name and kind) that are stored for a variable in the symbol table.

_____

_____

Problem 2 – Code generation

a) Generate PM/0 code for the fragment that is printed *like this*. Use the assembler instructions such as `INC, LIT, LOD, STO, IN, OUT, HLT, JPC, JMP, CAL, RET, ADD, SUB, MUL, DIV.`

Your PM/0 code:

```
var a, b;

procedure B;

begin

  write a;

end;

procedure A;

  const f = 42;

  begin

    read b;

    a := b * f;

    call B;

  end;

begin

  call A;

end.
```

PM/0 code for `procedure A` (the italic fragment):

```
A:  INC   4        ; allocate activation record
    IN              ; read input
    STO  1, b       ; b := input
    LOD  1, b       ; load b
    LIT  42         ; f = 42
    MUL             ; b * f
    STO  1, a       ; a := b * f
    CAL  B          ; call procedure B
    RET             ; return from A
```

If you have to use `CAL / JMP / JPC` use meaningful symbolic names for the addresses (if you wanted to know the exact numeric values, you would have to generate the code for the entire program, which is not required).

Problem 3 – Syntax diagram

You are given below the EBNF specification of procedure declaration in **extended** PL/0. This specification shows that procedures can have parameters.

```
<procs>  ::= { "procedure" <ident> "(" <params> ")" ";" <block> ";" }
<params> ::= [ <ident> { "," <ident> } ]
```

Draw neatly the syntax diagrams for `<procs>` and `<params>`.