

## CSE / IT 324 Assignment #2

### Exercise 1:(10 pts)

Consider the following ALGOL program:

```
begin integer i, j; integer array A[1:3];
      procedure P(x,y); integer x,y;
        begin
          y := 2;
          Print(x);
          i := 3;
          Print(x);
          i := 3;
          Print(x);
          Print(y);
        end;
      A[1] := 7; A[2] := 11; A[3] := 13;
      i := 1;
      P (A[i], i);
      P (i, A[i]);
end
```

For each case below, show the changes to the values of all involved variables (i.e., array A and i, in the caller block; and x and y in the callee P) as you step executing in the code.

What values are printed by the above Algol program if

- x and y are both passed by value?
- x is passed by value and y is passed by name?
- x is passed by name and y is passed by value?
- x and y are both passed by name?
- x and y are both passed by value-result?

## Exercise 2: (10 pts)

**Hint:** Any text between (\* and \*) is a comment.

**Note:** Labeling the blocks (i.e., blk1, blk2, blk3, etc.) is not part of the program, nor is it part of Algol syntax. These labels are used only for referencing blocks in the problem statement below.

Consider the following ALGOL code:

```
main: begin (* main program block definition *)
    integer a, b; real c;
    procedure P1 (x); value x; integer x;
blk1:   begin integer f;
        procedure P11(y); value y; real y;
blk2:   begin real r; r := y + b; PrintInteger(r); end;
        procedure P12 (z); value z; integer z;
blk3:   begin integer b; b := z + 25; P11(b) end;
        (* blk1 code *)
        f := x + b; P12(f);
        end (* blk1 code *)
    begin (* the main program (block) code *)
        a:=15; b:=20; c:=1.7; P1(a)
    end (* end of main program (block) code *)
end (* end of main program (block) definition *)
```

(a) What would be the printed value of "r", in **blk2** above, in each of the following *scoping* mechanisms: i) **static**? ii) **dynamic**? You **must** show the picture of the system stack upon the execution of the "PrintInteger (r)". (30)

- (b) Draw the contour diagram of the above ALGOL program and answer the following questions, based on that diagram: (11)
- i. Can we call **P11** ( ) in the main block **main**?
  - ii. Can we call **P1** ( ) in **blk3**?
  - iii. Can we call "**blk1**" in **P12** ( ) ?
- (c) If we just imagine that we had created a sibling procedure to P1 ( ) that is immediately declared after P1 ( ) , call it Q1 ( ) , and it had the exact structure of P1 ( ) , with the renaming of the internal procedures P11 ( ) to be Q11 ( ) , and P12 ( ) to be Q12 ( ) . Remember, both P1 ( ) and Q1 ( ) are siblings in the "main" block (program). Now, answer the following questions:
- i. List the names of all procedures that are visible to be called from within the code of: Q1 ( ) , Q12 ( ) , P11 ( ) , and P1 ( ) ; assuming static scoping. (12)
  - ii. If we assume dynamic scoping, can we still use the contour diagram to answer part "i" above? **Justify** your yes/no answer. (7)
  - iii. In case of dynamic scoping, is there a scenario that allows the calling of procedure P11 ( ) from within Q12 ( ) ? **ONLY** when you answer **YES**, show such scenario. (10)

**Exercise 3: EXTRA CREDIT:** (4 pts)

Would you consider the *dynamic scoping* mechanism a violation of the *abstraction* that is introduced via the static nesting of scopes? Justify your 'yes or no' answer.

**Assignment Submission:**

Your assignment must be submitted before class on the due date to the moodle website as a single **PDF** file. You may choose to draw the contour diagram by hand for Question 2 Part B and turn it in as a separate sheet of paper at the beginning of class with your name on it. The assignment's PDF file **MUST** conform to the following naming convention "lastname\_assignment2.pdf"

Example: John Ashcroft would use the file name: "ashcroft\_assignment2.pdf"

***All work is to be done individually. You must provide reasoning and complete work for full credit. The questions must be typed out as above with work and solutions below.***

**Note:** Spelling & Grammar will influence your grade.