COSC 2P90 MIDTERM TEST
23RD OCTOBER, 2003

Time: 6:00 p.m. – 7:00 p.m. Total marks: 30 Total pages: 2
This is a *closed-book* exam No calculators are permitted
Answer all questions *in your exam booklet*.

Answer any **3** of the following **4** questions. Be sure to answer all parts of the questions you choose. Each question is worth a total of 10 marks.

1. Explain each of the following parameter passing mechanisms (3x2 marks): call by value, call by value-result and call by reference. How does call by value-result differ in Algol-W from call by value-result in other languages (1 mark)? Determine the value of the variable `x` after executing the following program segment if the parameter is passed using *each* of call by value, call by value-result (*not* the Algol-W version) or call by reference (3x1 marks):

```
var x, z : Integer;

procedure f (y : Integer);
begin
    x := 0;
    if (z mod y = 0) then y := 0 else y := 1;
end;
…
begin
   z := 5;
   x := 2;
   f(x);
end.
```

2. Consider the following Ada loop where `c` and `d` are arbitrary sequences of statements. Give an alternative implementation using a regular while-loop without any exit or break statement (4 marks).

```
loop
   c;
   exit when x < 0;
   d;
end loop;
```

Consider the following loop written in Pascal-like syntax. Explain 3 different possibilities for the calculation of the final value and increment of the loop index `i` (6 marks). Note: it is not necessary to give the final value and increment, just explain how they are calculated.

```
j := 2;
for i := 1 to 10*j step 7-j do
   j := j + 1;
end;
```

3. Discuss the relative advantages and disadvantages of static typing vs. dynamic typing (4 marks). Explain the differences between static scope and dynamic scope (2 marks). Consider the following program written Pascal syntax. Determine the value of `y` after executing with static scope (2 marks) and with dynamic scope (2 marks). In each case, you must explain how that value is obtained.

```
program p;
var x, y : Integer;

procedure p;
begin
   x := x + 1;
end;

function f : Integer;
var x : Integer;
begin
   x := 1;
   q;
   f := x;
end;

begin
   x := 3;
   y := f;
end.
```

4. Explain the concept of information hiding (2 marks). Why is it important in constructing large systems (2 marks)? Discuss the notion of side-effects in functions (2 marks). Explain 2 language features that enable programmers to avoid relying on side-effects in functions (4 marks).