Programming Languages: Mid-Term Exam

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Problem 1.[5 pt] What are the values of `x`, `y` and `z` at the end of the following C program?

```
z = 0; x = 1; y = 2;
if (x = 1)
   if (y = 1) z = 1;
else z = 2;
```

☐ This is an erroneous C program.

☐ `x=1`, `y=2` and `z=0`.

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Problem 2.[5 pt] Consider the following FORTRAN program. What is the matrix `V` after the loop is executed?

```
   DO 14 I=1,N
   DO 14 J=1,N
   V(I,J) = (I/J) * (J/I)
14 CONTINUE
```

☐ An identity matrix.

☐ A matrix of all zeroes.

☐ A matrix of all ones.

☐ Complier flags an error.

Problem 3.[5 pt] Consider the following ADA program fragment.

```
type STRING_10_PTR is access STRING(1..10);

S: STRING_10_PTR := new STRING;
```

☐ Allocates a string to the pointer.

☐ Causes a CONSTRAINT-ERROR exception.

☐ Compiler detects it as an erroneous program.

☐ Hard to tell what happens.

Problem 4.[5 pt] We are given the following syntax:

```
<S> ::= <A>
<A> ::= <B> + <A> | <D> <C>
<B> ::= <D> | <D> * <B>
<D> ::= x | (<C>)
<C> ::= +x | -x
```

Which of the following strings are valid sentences of the grammar?

(*i*) <B> + <B> + <B> + x -x

(*ii*) x + x + x * x * x * (-x) + x + x -x

(*iii*) x * x * x * x * x * x * x

☐ All three: (i), (ii) and (iii).

☐ Only (ii) and (iii)

☐ Only (iii).

☐ Only (ii).

Problem 5.[5 pt] Consider the following program, where <BINDING> could be "call-by-value", "call-by-reference", "call-by-value/result" (copy-in-copy-out) or "call-by-name".

```
procedure SWAP( A, B: <BINDING> INTEGER) is
   T: INTEGER;
begin
   T := A;
   A := B;
   B := T;
end
```

The program works correctly for the following modes.

☐ "call-by-reference" and "call-by-value/result" only.

☐ "call-by-value" and "call-by-value/result" only.

☐ "call-by-reference" only.

☐ "call-by-reference", "call-by-value/result" and "call-by-name" only.

Problem 6.[15 pt] Assume that you have written a compiler that uses a run-time *display*, separate from the activation stack. Give a quick sketch of the stack and the display when control reaches the positions of the two comments in the following program. Assume that parameters are called by value.

```
program main;
   procedure P(a: integer);
      procedure Q(b: integer);
         begin { a) What are the stack and display now? }
         R(a+2, b+3)
```

```
      end;
   begin Q(a+1);
   end;
procedure R(c,d: integer):
   begin { b) What are the stack and display now? }
   end;
begin P(1)
end.
```