AV530 Year 2000 Exam
Closed book exam
Answer all questions
Total marks: 36
This exam contributes to 50% of the subject’s marks.
Q1  a) 2 marks   b) 2 marks   c) 2 marks

Write code fragments that can output the following patterns of numbers. It should only use IIO.Put, and Ada.Text_IO.New_Line to accomplish this. It should not have statements such as “IIO.Put (4);”.

a)

1
22
333
4444

b)

1
12
123
1234

c)

4
34
234
1234

Q2  a) 3 marks   b) 3 marks

Given the following definition
Max : constant := 100;
type Found is array (1..Max) of Boolean;

a) Write a function

function Count_True (Item : List) return Natural;

that counts the number of cells in the array that are set to true.

b) Write a procedure

procedure Negate (Item : in out List);

that changes the value of each cell in the array.
Q3 9 marks

In a file called "data.dat" is a list of end points for a series of straight road segments, as stored by a local council. These are in the form...

```
x1 y1 x2 y2 Name of road
```

where x1, y1 are the start point of the road, and x2,y2 are the end points, measured in meters based on some geographical grid.

For example you may have

```
10 20 100 200 Main Rd
123 234 75 67 Lesser Street
456 234 123 456 Ada Boulevard
```

Write a complete program that determines the longest stretch of road using Pythagoras’ theorem, and then displays the name of the road.

Pythagoras’ theorem is

```
length = sqrt ( (x1 – x2)^2 + (y1 – y2)^2)
```

You should use the function `Sqrt` from the package `Ada.Numerics.Elementary_Functions`

Q4 3 marks

The following program suffers from a problem that if a user enters non numeric input, the program terminates with a Data_Error exception.

Modify the program so that this does not occur by handling the exception that is generated. The program should continue to prompt the user even if they enter incorrect data.

```
with Ada.Text_IO; use Ada.Text_IO;

procedure Add_Numbers is

procedure Read_Number (X : out Natural) is
begin
 loop
  Put_Line (“Enter a number in 1..100 :”);
  Get (X);
  exit when X in 1..100;
  Put_Line (“Error: number not in 1..100”);
 end loop;
end;

A, B : Integer;
```
begin
  Read_Number (A);
  Read_Number (B);
  Put ("The product is ");
  Put (A * B);
  New_Line;
end;

Q5 3 marks

We can declare a type in a package to be private. What is the purpose of this?

Q6 3 marks

Write a function that, given a date record consisting of the fields day, month and year, determines the day of the year. E.g. December 31\textsuperscript{st}, 1999 is the 365\textsuperscript{th} day of the year.

You can assume the existence of the functions

\begin{verbatim}
function Leap (Year : Year_Range) return Boolean;
function Days_In_Month (Month : Month_Range;
                          Year  : Year_Range) return Positive;
\end{verbatim}

Q7 6 marks

Write a procedure that has four parameters…

\begin{verbatim}
Search_String type String
Search_Char   type Character
Replace_Char  type Character
Position      type Natural
\end{verbatim}

that searches through Search_String for the first occurrence of the character ‘Search_Char’. If it finds it it replaces it with the character “Replace_Char”, and returns with Position set to the location of the replaced character within the array. Otherwise it returns with Position set to 0.