(Attempt 2 questions out of 3)

Question 1.

(a) Explain the differences between the *top-down* and *bottom-up* approaches to program design and discuss their relative merits.

[8 marks]

(b) Define a set type *nums* which can contain all the natural numbers between 1 and 100. What are the limitations on the types which can be used as base types for sets in Delphi/Pascal ?

[3 marks]

(c) Write procedures or functions which :-

 – given two values of type *nums* called *alpha* and *beta* will write out all the numbers which are members of both sets. **[5 marks]**

 – given the same two values will write out all members of alpha which are not members of beta. **[5 marks]**

(d) Define a suitable enumerated type to represent the months of the year. What are the advantages of enumerated types. **[4 marks]**

Question 2.

(a) Give the syntax for the three main loop structures in Delphi and explain briefly how they operate. Show, using examples, how a for loop can be simulated by a while loop. **[8 marks]**

(b) Consider the following code fragment...

```
type
studentPtr = ^student;
student = record
   name : string;
   age : integer;
   next : studentPtr;
end;
```

and assume you have been given complete code for the following procedure which places a record in a linked list... **[PTO]**

```
procedure insertStudent(var head : studentPtr; thisStudent : studentPtr);
```

write a procedure which asks the user for a filename, opens the file for reading, reads in all data in the file and inserts the data into a linked list using the above procedure. **[12 marks]**

(c) Explain, using examples of each, the difference between *compiler* errors and *run-time* errors.

[5 marks]

Question 3.

(a) If the Pascal or Delphi compiler you were using did not provide a built-in debugger explain what statements you could use to provide the equivalent of breakpoints and watches. How could you arrange for these to be switched on and off without extensively modifying your code **[8 marks]**

(b) What is the difference between a variable parameter and a value parameter in a procedure or function? Explain how you would choose which to use. **[5 marks]**

(c) Explain the difference between a *constant* declaration and a *variable* declaration. Use examples to show when and why each would be used. **[7 marks]**

(d) Given the following constant and type declarations write a procedure which will initialise all the entries in the array to 1.

```
const
    maxEntries = 25;
type
    index = 1..maxEntries;
    arrayType = array[index] of integer;
```

[5 marks]