SE 2A04 Fall 2002

Lab Exercise 3

Instructor: William M. Farmer

Assigned:	11 October 2002
Demonstration due:	18 October 2002
Lab report due:	25 October 2002

The purpose of this lab exercise is to implement an abstract data type (ADT) of vectors as an array of pointers to records.

Step 1

Write an Oberon-2 module named `TestVectors` that "black box" tests any module named `Vectors` implementing the module interface specification (MIS) for a Vectors ADT given below.

Step 2

Write an Oberon-2 module named `Vectors` that implements the MIS for a Vectors ADT given below. In addition, your implementation is required to:

(1) Represent a vector by a pointer to a record.

(2) Store the pointers in an array of size 1000. This means that your Vectors ADT module can store at most 1000 vectors.

(3) For all $x, y \in$ `REAL`, store in the array at most one pointer that represents the vector (x, y).

Step 3

Construct an Oberon-2 program named `TestMine` that uses your `TestVectors` module to test your `Vectors` module.

Step 4

During the lab session on October 18, demonstrate the `TestMine` program.

Step 5

Before or during the lab session on October 18, send a copy of your `Vectors` module to your receiver partner, and get a copy of your sender partner's `Vectors` module. Construct an Oberon-2 program named `TestPartners` using your `TestVectors` module to test your sender partner's `Vectors` module.

Step 6

Write a lab report that includes the following:

(1) A copy of the Lab Exercise 3 Marking Scheme (which is available on the course Web site) stapled to the front of your report.

(2) A copy of your `TestVectors` module and a brief explanation of its design.

(3) A copy of your `Vectors` module and a brief explanation of its design.

(4) The results of the test of your `Vectors` module.

(5) The results of the test of your sender partner's `Vectors` module.

(6) A discussion of the test results and what you learned doing the lab exercise.

(7) A discussion of any problems you found with the MIS.

(8) A copy of the part of your log book relevant to this lab exercise.

The lab report is due no later than the beginning of the tutorial session on October 25.

MIS for Vectors ADT

- Imported modules: none required
- Interface:

```
INTERFACE Vectors;
  TYPE Vector;
  CONST Zero: Vector;
  PROCEDURE GetVec(x,y: REAL): Vector;
  PROCEDURE XVal(v: Vector): REAL;
  PROCEDURE YVal(v: Vector): REAL;
  PROCEDURE Add(u,v: Vector): Vector;
  PROCEDURE Mul(r: REAL; v: Vector): Vector;
END Vectors.
```

- Exceptions: none
- Axiomatic input/output specification:

  (1) $\texttt{XVal}(\texttt{Zero}) = 0.$

  (2) $\texttt{YVal}(\texttt{Zero}) = 0.$

  (3) $\forall\, x, y : \texttt{REAL}\ .\ \texttt{XVal}(\texttt{GetVec}(x, y)) = x$

  (4) $\forall\, x, y : \texttt{REAL}\ .\ \texttt{YVal}(\texttt{GetVec}(x, y)) = y.$

  (5) $\forall\, u, v : \texttt{Vector}\ .\ \texttt{XVal}(\texttt{Add}(u, v)) = \texttt{XVal}(u) + \texttt{XVal}(v).$

  (6) $\forall\, u, v : \texttt{Vector}\ .\ \texttt{YVal}(\texttt{Add}(u, v)) = \texttt{YVal}(u) + \texttt{YVal}(v).$

  (7) $\forall\, r : \texttt{REAL}\ .\ \forall\, v : \texttt{Vector}\ .\ \texttt{XVal}(\texttt{Mul}(r, v)) = r * \texttt{XVal}(v).$

  (8) $\forall\, r : \texttt{REAL}\ .\ \forall\, v : \texttt{Vector}\ .\ \texttt{YVal}(\texttt{Mul}(r, v)) = r * \texttt{YVal}(v).$