Computer Science – Lecture 11
Pascal Programming III

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Blackboard IFP

Objectives

- To understand variables & types
- To understand assignment statements
- We will cover more jargon & buzzwords as we go along
- Tomorrow's practical:
  - More Pascal Programming!

Pascal Variable Names

- Variables are places to keep information
- Last week we looked at giving variables a name
  - Start with a letter, followed by letters, numbers and '_'
  - Cannot be a "reserved word" (program, var, while…)
  - Cannot contain blanks
- It is always best to use meaningful names
  - `BankBalance` is better than `bb`
  - Because most programs have to be changed!
    - Often by someone else!

Pascal Variable Types - 1

- Pascal has four "built-in" types
  - (A "built-in" type is one that comes with Pascal – later on we will see to how construct or own types)

- Integer
  - A whole number, positive or negative, e.g. 543
  - Do not use ',' to separate thousands
  - The range is usually quite large, but NOT infinite
    - Typically roughly +/- 2 billion (2,000,000,000)
  - Integers are stored exactly

Pascal Variable Types - 2

- **Real**
  - Any number, positive or negative, including decimals
  - E.g. 3.141592, 7.0, 3.1E6
  - Range is very, very large (but still NOT infinite)
    - At least 10E-25 to 10E38
  - Reals may NOT be stored exactly
    - Very large numbers may lose least significant digits
    - Very small numbers may lose least significant digits
    - All decimal numbers are subject to errors
    - Be VERY careful comparing real numbers
  - It is best to avoid real numbers if you can

Real Number Errors

- All numbers are subject to rounding errors
- Some numbers cannot be represented exactly in binary – consider 0.3 (decimal)

0	.	0	1	0	0	1	1
1.0		0.5	0.25	0.125	0.0625	0.03125	0.015625

```
 0.25000
+0.03125
 0.28125
```

```
 0.250000
+0.031250
+0.015625
 0.296875
```

Pascal Variable Types - 3

- **Char**
  - Can be any single character '+', 'a', 'A'
- **Boolean**
  - Can be either 'true' or 'false'
  - Named after a British mathematician, George Boole
- **We "Declare" variables like this:**
  - `Var variable-name [, variable-name…] : variable-type;`

This is the keyword 'var'

These are one or more variable names (note the comma)

This one of the types, real, char…

  - E.g. `var BankBalance : integer;`

Don't forget the ';'!

Assigning Values to Variables

- We use the "assignment operator"
- An "operator" is like a mathematical operation
  - '+', '-' etc.
- The assignment operator assigns a value to a variable e.g.
  - `Start := 0;`
  - `Gross := 102 * 1.175;`
  - `TotalSoFar := TotalSoFar + 1;`
  - `ThisOne := LastOne;`
- A common error is to use '=' instead
  - Say to yourself ':=' means "becomes" or "is set to"

Assigning Types

- You can only assign values of the same type as the variable
  - E.g. cannot assign the value ‘T’ to an Integer variable
- The only exception is an integer assigned to a real variable
  - It will be automatically converted
- We will look later at how to convert between types

Arithmetic Operators

- + addition
- - subtraction
- * multiplication
- / division

- + addition
- - subtraction
- * multiplication
- div division
- mod remainder

Operator Precedence

- * / div mod are done first
- + - are done next
- Equal precedence operators are calculated from left to right
- It is better to always use brackets to show what you want to happen

Tomorrow's Practical

- Three programs using various operators
  - See work sheet
- Worksheets available today if required
- Karl will be available to help between 13:00 and 15:00 in the IT Degree Lab