Statements and expressions in Fortran

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Basics

Program structure

```
Program foo
  < declarations >
  < statements >
End Program foo
```

Statements

- One line, one statement

```
x = 1
y = 2
```

- semicolon to separate multiple statements per line

```
x = 1; y = 2
```

- Continuation of a line

```
x = very &
  long &
  expression
```

Comments

- Ignore to end of line

```
x = 1 ! set x to one
```

- comment after continuation

```
x = f(a) & ! term1
  + g(b)   ! term2
```

Variable declarations

- Variable declarations at the top of the problem
- Variables are implicitly defined. Dangerous, so use:

  `implicit none`
- declaration

  `type, attributes :: name1, name2, ....`

  where
  - *type* is most commonly `integer`, `real(4)`, `real(8)`, `logical`
  - *attributes* can be `dimension`, `allocatable`, `intent`, `parameters` et cetera.

Floating point types

Indicate number of bytes:

```
integer(2) :: i2
integer(4) :: i4
integer(8) :: i8

real(4) :: r4
real(8) :: r8
real(16) :: r16

complex(8) :: c8
complex(16) :: c16
complex*32 :: c32
```

Arithmetic expressions

- Pretty much as in C++
- Exception: `r**2` for power.
- Modulus is a function: `MOD(7,3)`.

Boolean expressions

- Long form `.and.` `.not.` `.or.` `.lt.` `.eq.` `.ge.` `.true.` `.false.`
- Short form: `<` `<=` `==` `/=` `>` `>=`

Statements

I/O routines

- Input:

  ```
  READ *,n
  ```

- Output:

  ```
  PRINT *,n
  ```

There is also `WRITE`.

Other syntax for read/write with files and formats.

Exercise 1

Write a program that

- Displays the message `Type a number`,
- accepts an integer number from you (use `cin`),
- and then prints out three times that number plus one.

Optional exercise 2

Write two programs, one that reads a temperature in Centigrade and converts to Fahrenheit, and one that does the opposite conversion.

$$C = (F - 32) \cdot 5/9, \qquad F = 9/5\, C + 32$$

Check your program for the freezing and boiling point of water. (Do you know the temperature where Celsius and Fahrenheit are the same?)

Can you use Unix pipes to make one accept the output of the other?