Scientific Computing II - Exercise 1

Professor: Antti Kuronen
Student: Caike Crepaldi

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This exercise was done using a ssh remote login through my pangolin (pangolin.it.helsinki.fi) university linux account while using my macbook pro with OS X.

To do such a thing, the following command was run in the OS X Yosemite terminal.

```
Macbook-Pro:~ crepaldi$ ssh username@pangolin.it.helsinki.fi
```

1   First Problem

Using the shell, the following commands were used.

```
username@tktl-pangolin:~$ ls
Desktop Documents Downloads Tools-for-HPC Z-drive
username@tktl-pangolin:~$ mkdir Sci-Comp2
username@tktl-pangolin:~$ cd Sci-Comp2
username@tktl-pangolin:~/Sci-Comp2$ mkdir Exercise1
username@tktl-pangolin:~/Sci-Comp2$ cd Exercise1
username@tktl-pangolin:~/Sci-Comp2/Exercise1$
```

2   Second Problem

Using the shell, the following commands were used.

```
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ wget "http://www.courses.physics.helsinki.fi/fys/tilaII/files/hello.f90"
2015-09-09 21:31:25 (16.8 MB/s) - 'hello.f90' saved [175/175]
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ ls
hello.f90
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ gfortran -o hello.exe hello.f90
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ ./hello.exe
Thank you for compiling and executing
this program!
username@tktl-pangolin:~/Sci-Comp2/Exercise1$
```

3   Third Problem

Using the shell, the following commands were used.

```
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ wget "http://www.courses.physics.helsinki.fi/fys/tilaII/files/numbers.f90"
2015-09-09 21:43:53 (31.8 MB/s) - 'numbers.f90' saved [194/194]
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ gfortran -o numbers.exe numbers.f90
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ ./numbers.exe
2.6666666666666666666666666666666666654
2
1.89999998
1.89999998
username@tktl-pangolin:~/Sci-Comp2/Exercise1$
```

To understand the program and the output lets see the source.

numbers.f90

```fortran
program numbers
  implicit none
  integer :: a=5, b=3
  real :: x=2.2, y=3.5

  write(6,*) (a+b)/3.0_16
  write(6,*) (a+b)/3
```

```
 8│   write(6,*) (x+y)/3.0
 9│   write(6,*) (x+y)/3
10│
11│ end program numbers
```

The result shown by the program output is due the implicit conversions that happen when we use Fortran language.

In short, when different kinds of data types are used in a mathematical operation, the value of the lower ranking type is converted to the higher ranking type. Therefore, the result of this operation has the same type as the higher ranking type variables or constants.

- In the line 6 we have an operation between integers and reals (kind=16), therefore the result is shown as a real (kind=16) number.

- In the line 7 we have an operation between integers, therefore the result is shown as an integer number.

- In the line 8 we have an operation between reals, therefore the result is shown as a real number.

- In the line 9 we have an operation between reals and integers, therefore the result is a real number.

4 Fourth Problem

Using the shell, the following commands were used.

```
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ wget "http://www.courses.physics.helsinki.fi/fys/tilaII/files/testintkind.f90"
2015-09-09 22:18:47 (12.4 MB/s) - 'testintkind.f90' saved [150/150]
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ gfortran -o testintkind.exe testintkind.f90
username@tktl-pangolin:~/Sci-Comp2/Exercise1$ ./testintkind.exe
```

The text bellow was printed in the terminal as result of the execution of the **testintkind.exe** program.

1	1
2	1
3	2
4	2
5	4
6	4
7	4
8	4
9	4
10	8
11	8
12	8
13	8
14	8
15	8
16	8
17	8
18	8
19	16
20	16
21	16
22	16
23	16
24	16
25	16
26	16
27	16
28	16
29	16
30	16
31	16
32	16
33	16
34	16
35	16
36	16
37	16
38	16
39	−1
40	−1
41	−1
42	−1
43	−1
44	−1
45	−1
46	−1
47	−1
48	−1
49	−1
50	−1

As told in the assignment, if there is no large enough integer supported by the compiler to present *n*, a value of -1 is returned.

Comparing this information with the program's output, we can conclude that the biggest integer value supported by my system is 10^{38}.

5 Fifth Problem

<div align="center">bolt.f90</div>

```fortran
program bolt
  implicit none
  real :: velocity, meters=100, time=9.58

  velocity=meters/time

  write(6,*) "Mr. Bolt's average speed was", velocity*3.6,"km/h!"

end program bolt
```

To compile and run this program use the commands bellow.

```
username@tktl-pangolin:~$ gfortran -o bolt bolt.f90
username@tktl-pangolin:~$ ./bolt
```

The output should be like the following.

```
Mr.  Bolt's average speed was 37.5782890 km/h!
```

This program's source code can be found together with this PDF documentation in the zip archive. In that archive, this program is named ex1p5.f90.

6 Sixth Problem

<div align="center">speed.f90</div>

```fortran
program speed
  implicit none
  real :: velocity, meters, time

  write(6,*) "Give a distance (in meters)"
  read(5,*) meters
  write(6,*) "Give the elapsed time (in seconds)"
  read(5,*) time

  velocity=meters/time

  write(6,*) "The average speed was", velocity*3.6,"km/h."

end program speed
```

To compile and run this program use the commands bellow.

```
username@tktl-pangolin:~$ gfortran -o speed speed.f90
username@tktl-pangolin:~$ ./speed
```

This program's source code can be found together with this PDF documentation in the zip archive. In that archive, this program is named ex1p6.f90.