Exercise 12
Fortran

Review

1. Which name of a variable is not an implicit valid name for floats? (1 P)
   □ MASS
   □ RADIUS
   □ XLum
   □ an ampersand & in column 6
   □ character C, *, ! in column 1

2. How can you mark a comment in Fortran 90 (fixed form)? (1 P)
   □ leading !
   □ an ampersand & in column 6
   □ character C, *, ! in column 1

3. What is not a valid data type in Fortran? (If not sure, just try it.) (1 P)
   □ INTEGER
   □ FLOAT
   □ DOUBLEPRECISION

1. Task A flawless Fortran program (2 P)
   Write and compile the shortest possible Fortran(77) program.
   Use, e.g., the gfortran compiler. You may also use the ifort compiler. To use the latter one, login on the student’s cluster (e.g., bell.stud.physik.uni-potsdam.de) and execute the following commands in the Bash:

   source ~htodt/intel/composerxe-2011/bin/compilervars.sh intel64

   or if you have the C-shell (tcsh):

   source ~htodt/intel/composerxe-2011/bin/compilervars.csh intel64

Which shell you are using, can be checked via: echo $0

   a) What size has the created binary? Does this size depend on the invoked compiler? (1 P)
   b) Inspect the binary with help of the Unix tools ldd and nm. Which libraries are invoked, what is the difference between the compilations of different compilers? (1 P)

2. Task Hello world! (3 P)
   Write a Fortran(77) program that prints out “Hello world!” in the terminal.

   a) with help of WRITE(*,*); (0.5 P)
   b) with help of WRITE and the correct format. (0.5 P)
   c) Which alternative to WRITE exists? (0.5 P)
   d) Which differences are between Fortran 90 and FORTRAN 77 regarding the structure of the source code? Write your program for both Fortran versions (two different source files!). Which compiler flags are required? (0.5 P)
e) Moreover, the program “Hello world!” should also print out the number 0.75E-3 exactly in this format: Hello world!0.75E-3. The format should be done with help of a FORMAT instruction. Where, within the source code, is a good position to put it? (1 P)

3. Task Root finding 3 P

Write a Fortran program to find the negative root of

\[ f(x) = 2.129628075 - 3.39845305 \times x - 1.680866 \times x^2 + 2 \times x^3 \]  

with help of the Newton-Raphson method, start with \( x = -4 \). Iterate until \( |f(x_n)| < 10^{-10} \). How many iterations are needed?

4. Task Boolean satisfiability problem (SAT) (4 P)

Which of the following boolean formulas are satisfiable (=true)? By which assignment is this done? Write an according program in Fortran.

a) \((x_1 \lor x_2 \lor x_3) \land (\neg x_1 \lor x_2 \lor \neg x_3 \lor x_4) \land (x_2 \lor x_3 \lor x_4)\)

b) \((x_1 \lor x_2) \land (\neg x_2 \lor x_1) \land (\neg x_1 \lor x_3) \land (\neg x_3 \lor \neg x_1)\)

Hint: You may use nested loops that change the assignment LOGICALs \( x_1 \ldots x_4 \) (truth table) or you are very clever and use a special function in Fortran (IBITS).