

Introduction to Fortran: Problem Sheet

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1 Compilation

- Obtain the code examples for this session
 - Download from github: <https://github.com/coolernato/Intro-to-Fortran.git>
- Find the Compilation directory
- Source.f90 should be compiled as a single file
- Source1.f90 and Source2.f90 should be compiled together
- Compile and run the files by either:
 - Compile it on your own computer and run it
 - Copy and paste it into <https://www.onlinegdb.com> , select Fortran in the top right and click Run

2 My First Code

- Find the My First Code directory
- Compile and "run my_first_code.f90"
- Experiment with:
 - Changing the words in quotation marks following the print statement
 - Adding more print statements
- You will need to recompile between making a change and running your program

3 Variables

3.1 Mathematical Operators

There are 5 identical cubes, each with a side length of 3.2m. Calculate and print:

- The volume of one cube
- The area of all faces of one cube
- The volume of all cubes
- The area of all cubes
- The surface area to volume ratio of the cubes

100m³ of water is added to these cubes. One cube will be fully filled, before the next is filled and so on. Eventually there will be a number of completely filled cubes and a partially filled cube.

- How many cubes are completely or partially filled?
- What volume of the partially filled cube is unfilled?

3.2 Order of Operations

- Find the Variables directory
- Compile the order_of_operations file
- Write down what you expect the value of the different cases to be
- Run the file
- Check the results are what you expect

3.3 Arrays

A location in 3d Cartesian space may be represented by (x,y,z) coordinates. This may be represented by a dimension 1 array with size 3.

- Create a 1d array with three elements to represent Position A, which is at (1,2,1)
- Calculate the location of Position B, which has a displacement of (3,-4,1) from Position A
- Calculate the location of Position C, which is twice as far from the origin as Position B
- Calculate the location of position D, which is found by rotating position C 45° around the z axis (clockwise when viewed from above). To rotate a location around the z axis in this manner by an angle θ , it may be multiplied by the matrix:

$$\begin{pmatrix} \cos(\theta) & -\sin(\theta) & 0 \\ \sin(\theta) & \cos(\theta) & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad (1)$$

- Calculate the straight line distance between Positions A and D

Extension:

- Repeat the above, but with three points, all contained in a single two-dimensional array
- Initial points to use are (1,2,1), (-1,0,1) and (-3, -2, -2.5)

4 Conditionals

- In the Conditionals directory open the exercise_conditionals.f90 file
- Write down what you think will be printed for each case
- Compile and run the file and check the results are what you expected

5 Loops

For each of the following tasks, write a piece of code using "do" or "do while" loops to achieve the following effects:

- Print the numbers 1-20.
 - If a number is a multiple of 3, print "Fizz" instead
 - If a number is a multiple of 5, print "Buzz" instead
 - If a number is a multiple of 3 and 5, print "FizzBuzz" instead
- Calculate the value of the expression $\sum_{n=1}^{\infty} 0.5^n = 0.5 + 0.25 + 0.125 + 0.0625 + \dots$
 - Use a variable to keep track of the increasing sum
 - Each iteration of your loop should add a new value to the increasing sum
 - When the difference between the increasing sum in one iteration of your loop and the previous is less than 0.0001, the loop should stop
 - Print the final value