PY2105 - Exam 1
Deadline: 15:50, 7 October 2025

The programming test is "open book" in the sense that you can use your PY2105 notes as well as the example files and other information on the PY 2105 Canvas pages. It is not allowed to use any additional resources from the internet.

The programming test is to be solved according to the UCC code of honour (= no breach of UCC rules and regulations); copying may result in zero marks.

Remember to add comments to your code, especially in case when you are not sure how to solve a specific problem. The comments can guide our way to give you (in case) some partial points!

Problem 1 (**3 marks**): Explain in one to two sentences each the meanings of:

- What is a program?

- What is a compiler?

- What is a variable and its value?

Problem 2 (**4 marks**): Draw a flow diagram and also write the corresponding program (in c++ or python) fulfilling the following task: the user enters two "double" numbers and then the program prints the larger of these two numbers on the screen. Do not use the predefined "max" function.

Problem 3 (**5 marks**): Make a flow diagram and write a programme (in c++ or python) fulfilling the following task: the users enters a positive integer n (n $\geq$ 0) and then the program calculates and prints the factorial of that number, defined as $n! = 1 \cdot 2 \cdot \ldots \cdot n$ and keep in mind that $0! = 1$.

Problem 4 (**8 marks**):

a) Plot the following function (either via gnuplot or python) in the intervall [-5:5]:

$$f(x) = x^3 - 3x^2 + 3 .$$

b) Write a program that uses the central differentiation method to find the derivative at x, where x can be specified by the user. Do not use a predefined function in c++ or python to do so. Use a fixed step size of 0.1.

c) Adapt your program to also calculate the true error of your approximation and print the error.

d) Further adapt your program to calculate the true error, if you use the forward and backward differentiation method instead and compare the errors of all 3 methods.

e) How much smaller does the step size for the forward differentiation method need to be in order to get the same error as the central differentiation method?

Please submit all solutions electronically via Canvas (scan or take a photo of the hand-written parts and submit the source code (.cxx or .py files or similar) of all programs)! **Submitting the codes not as source codes will result in zero marks for the corresponding problem!**

In the unlikely case of the Canvas upload not working, for whatever reason, please tell one of the tutors immediately and email me your answers (same format as specified above) before the deadline at 15H50 to bbitsch@ucc.ie.