

School of Computing, University of Leeds, 21/22

# XJCO2211

## Operating Systems

### Coursework C3: Programming a Shell

**Deadline: 22<sup>nd</sup> Nov 2021 at 12pm (Beijing time)**

This assignment is worth 25% of the final module grade (total 30 marks available). It is composed of **2 parts**. Your submission should include the final version of your code.

### Introduction

This coursework is a programming project with a short report. You will be creating a simplified shell.

The key learning objectives are to:

- Improve programming skills and understand how to use system calls
- Understand the creation and management of processes
- Understand inter-process communication and resource management

### Assessment & Submission

There will be **TWO** assignments on Minerva for the **TWO** parts of your coursework. You will be required to submit both your code and the associated report to the corresponding assignments. You will also be required to demonstrate the shell you have produced.

**Code Submission:** Upload your code to the assignment (*Programming a Shell (Code)*) either as a single C file named “StudentID\_USERNAME\_C3.c” or if you use multiple source files, as a .ZIP named “StudentID\_USERNAME\_C3.zip”.

**Report Submission:** Upload the report as a PDF named “StudentID\_USERNAME\_C3\_report.pdf” to the Turnitin assignment (*Programming a Shell (Report)*) on the module VLE.

### Disclaimer

**This is intended as an individual piece of work and, while discussion of the work is encouraged, plagiarism in any form is strictly prohibited. The answers you hand in should be your own work. Standard late penalties apply for work submitted after the deadline.**

## The Task

You are required to write a simple shell in C. The features of this shell are described below. The features described below can be implemented in any order. The marks for demonstrating each feature are shown below.

### Task 1: Programming (Shell)

1. Your shell should support the following *built-in* commands: [2 marks]
  - a. **info**: Print the following to the standard output where *USERNAME* is replaced with your own – “COMP2211 Simplified Shell by USERNAME”.
  - b. **exit**: Close the shell.
  - c. **pwd**: Print the current working directory of the shell to the standard output.
  - d. **cd PATH**: change the current working directory of the shell to the directory given by the parameter *PATH*.
2. Run another program from your shell. [1 mark]  
**ex PATH ARGS**: execute the program specified in the *PATH* parameter and pass it the remaining arguments.
3. Implement simple grep feature. The command **mygrep “match\_pattern” file** should output all lines that satisfied the pattern match. [2 marks]
4. Allow the commands to be pipelined between processes using the standard ‘|’ character. The command **cat file | ex ProgB** should redirect the standard output of **file** to the standard input of **ProgB**. (The function of program B: input the text of file, and output the text plus your student ID.) [2 marks]
5. Allow the output of programs to be redirected to files using the standard ‘>>’ character. The command **ex ProgA >> a.txt** should append the standard output of **ProgA** to the file **a.txt**. (ProgA outputs some characters. If the file does not exist, automatically creates a new one.) [2 marks]
6. Implement an additional feature of your own design to the shell. Possible examples could be: customisable prompts, new built-in commands or colour styling of output. [1 mark]

**Submit your code for the completed solution on Minerva.**

**[Total: 10 marks]**

### Task 2: Report

Write a report on your implementation of the shell with a **maximum length of 5 sides of A4**. You should reference any additional materials that you have used, including any tutorials or documentation. Your report should be formatted with the main text body in **Arial point size 11, 1.5 line spacing, your name in the header and page number in the footer**.

In your report you should discuss:

- How you achieved each of the above features and your design decisions.
- Your reason for implementing your additional feature.
- The execution snapshot for each subtask in Task 1 to show the running effectiveness of your implementation.
- The differences between your approach and other possible approaches for certain features.
- Some differences that would occur if you implemented this shell for a different operating system.
- Reflect on what you’ve learned.

**Submit your report on Minerva as a PDF.**

The report will be marked as follows:

Coverage	2
Understanding	3
Depth (completeness, detail, comparison)	8
Referencing	3
Report structure	2
Writing quality	2

**[Total: 20 marks]**