CSCU9V4 Systems: Assignment 2(Compulsory)

Submission due: Friday 8th April 2022 17:00

Brief

In this assignment you need to write a short summary about one topic in Operating Systems, and to develop algorithms in C, building on top of the theory in the lectures and your experience with C in the lab. You should demonstrate to be able to

1) develop simple programs in C;

2) explain foundational concepts of computer organisation and operating systems; and

3) discuss and explain developed solutions to programming problems and evaluate those solutions.

Partial, incomplete or non-optimal solutions will be accepted. In general, when you have to return a text, strive for clarity and correctness, and avoid not-so-relevant details. Respect word-limits where indicated, but don’t take them as a goal: if you have a shorter clear and complete description, well done! Code should be correct and commented (remember: comments are not there to explain how the language works, e.g. “this is an assignment”, but to help the reader interpreting the program logic, e.g. “checking the array boundary”), and where possible optimised, e.g. use the most suitable data structures or commands (you may add a short comment explaining relevant choices or alternatives where relevant).

This is an **individual** assignment.

**Add your student number here**:

Task 1: Operating systems [50]

Your task is to write a short report on **one** of the two topics below about elements of an operating system, following the proposed outline. Your work should start from the course teaching material, which can be expanded with further research. You have a word limit, so try to focus on the relevant aspects and present them clearly but concisely. You will get points for the technical content as well as presentation.

1. Virtual Memory and Memory Management.

Describe what a virtual memory is, what it is useful for, and possible criticalities. Describe one algorithm for the management of virtual memory. You may want to use a picture to support your explanation (adding a picture of a clear handwritten figure will be ok).

2. Processes and their life-cycle.

Explain what the role of processes in a computer is. Explain the life cycle of the processes, i.e. which states they may undergo through. Describe one scheduling algorithm. You may want to use a picture to support your explanation (adding a picture of a clear handwritten figure will be ok).

Please use section heading to structure the text. e.g. you could have (for an imaginary topic) 1. Context, 2. The Banker’s algorithm, 3. Correctness, 4. Conclusions. The report **must not** exceed 500 words (excluding title, headers, references, figures and figure captions, if any). Please note that if you use a diagram/chart that is already available, you must reference its source rather than claim it as your own.

**Max 500 words**

Task 2: Numbers [20]

a) Write a C program in a file minmax.c that

- reads an integer n using a scanf() function,

- reads n double numbers and computes (Hint: remember to use %lf to read a double) their minimum (min), maximum (max) and average (avg),

- prints min, max and avg with a precision of three decimals.

Ideally, you should write a memory-optimised program that uses the minimum possible number of variables (a non-optimised solution will also be accepted for less marks).

Report your program and an output example here:

b) Describe in detail as if you were explaining it to a CSCU9V4 student how the scanf() function works, including the rules for the matching of the *format string*, and the use of &.

Provide examples to support your explanations. For instance, you may use significant code fragments and their outputs demonstrating one correct use of & in the scanf() call, and one example where things do not work as expected.

**Max 200 words** excluding examples (if any)

Task 3: Reading the code [10]

Describe in detail each of the many operations and definitions that are present in the following code.

for (int i = 0; i < (int) (sizeof(a) / sizeof(a[0])); i++)

a[i] = 0;

A good approach is to assume you are the executor of (the compiled/executable version of) the code: which operations are presents and how they will be executed? You need to decompose the line of code and describe what each component is, what is its aim and how it works. E.g.

“This is a for-loop. The conditions within the parentheses … The body of the for loop …”

Explain here …

Task 4: Functions and array [20]

In a file maxArray.c, write a function (Hint: you may what to use pointer arithmetics)

int \*maxptr(int a[])

that

- takes an array of positive integers as a parameter,

- finds the maximum element of the array,

- returns a pointer to the maximum element of the array, and

- replaces the maximum element in the array with -1 (using the pointer).

Use maxptr() in a program that defines an array of 10 positive integers, prints the array, calls maxptr() passing the array as a parameter and prints the returned pointer and the array after the execution of maxptr().

Report your program and its output here:

Explain in detail the line of code that calls the function maxptr() and outline how the working of the function develops from there:

Submission instructions

This is an **individual** assignment: you are not allowed to share ideas with others. You can use teaching materials from the course. This assignment is worth **50%** of the overall grade for CSCU9V4 and is **compulsory**. You should submit this sheet with your work as a PDF and the programs you developed as separate .c files by the deadline mentioned in the beginning, using the CSCU9V4 Assignment page on Canvas. Please, check the pdf with turnit-in.

**Grading will be anonymous and therefore you are requested NOT to include your name in the submission. However, you must mention the student number in all files (.pdf and .c).**

Referencing

You must follow the IEEE referencing style details of which can be found here:

<https://ieeeauthorcenter.ieee.org/wp-content/uploads/IEEE-Reference-Guide.pdf>

Plagiarism/Academic Misconduct

Work which is submitted for assessment **must be your own work**. Plagiarism means presenting the work of others as though it were your own. The University takes a very serious view of plagiarism, and the penalties can be severe (ranging from a reduced mark in the assessment, through a fail mark for the module, to expulsion from the University for more serious or repeated offences). Consequently, we check submissions carefully for evidence of plagiarism and pursue those cases we find. Further details about the university policy on academic misconduct can be found here:

https://www.stir.ac.uk/media/stirling/services/academic-registry/documents/policy-and-procedure- academic-integrity-misconduct.docx

Late submission

If you cannot meet the assignment hand-in deadline and have good cause, please see Dr Bhowmik / Dr Bracciali to explain your situation and ask for an extension. Coursework will be accepted up to seven darys after the hand-in deadline (or expiry of any agreed extension), but the mark will be lowered by three marks per day or part thereof. After seven days, the work will be deemed a non-submission.

Marking and feedback

Marks will be given for each of the components following the University of Stirling’s common marking scheme for undergraduate students. Please note that the marking scheme is not linear, which means achieving higher grades will be increasingly challenging and should meet the expectations of the common marking scheme.

Written feedback will be provided along with the marks on or before Friday 29th April 2022. (within three weeks of the submission deadline – or of any agreed extension). You are welcome and encouraged to discuss your results with Dr. Bracciali.

Note

A copy of coursework will be retained in Canvas and it may be used anonymously to create an exemplar answer for future students. If you do not wish your coursework to be used for this purpose, please inform the module co-ordinator upon submission using the Comments box.