**CS2106 Introduction to Operating Systems**

**Lab 2 - Shell Scripting and Process Programming**

**Answer Book**

Please read the instructions in the main lab sheet before completing this document. Submission deadline is **Sunday 16 March 2025, 11.59 pm**. The folder will stay open slightly after this, but once the folder closes, **absolutely no submissions will be allowed.**

**Submission checklist:** A ZIP file called AxxxxxxY.zip, where AxxxxxxY is the student ID of the student submitting. The ZIP file should contain:

* This file, appropriately renamed to the submitter’s student ID.
* grade.sh
* lab2p2f.c

|  |  |
| --- | --- |
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**Part 1 – Bash Scripting**

**Question 1.1 (1 mark)**

It is a special construct called Shebang that is the character sequence #! used at the beginning of a script. It indicates to the system what program (specifically command-line shell) is to be used to interpret the script, /bin/bash in this case.

**Question 1.2 (1 mark)**

I changed the line z=$x\*$y to z=$((x\*y)) to make the value of z an arithmetic expansion of x \* y instead of the string “15\*20”.

**Question 1.3 (1 mark)**

#!/bin/bash

echo "Hello $(whoami) from the future. \

Today is $(date --date="+3 days" +%A), \

$(date --date="+3 days" +%d) $(date --date="+3 days" +%B) $(date --date="+3 days" +%Y), \

and the time is $(date +%T)." # No need \"+3 days\" for time as same time

**Question 1.4 (1 mark)**

$# 🡺 Number of arguments (that are passed to the function in this case)

$1 🡺 Value of first function parameter

$2 🡺 Value of second function parameter

$@ 🡺 All function parameters as separate words

$? 🡺 Exit status of last executed command (the return value of func in this case)

**Question 1.5 (1 mark)**

I see the final value of i being printed on the screen. When exit(i) is called, the final value of i is the exit status returned to the operating system. Since $? gives the exit status of the last executed command as mentioned in Question 1.4, calling echo $? will send the final value of i as output to the screen (stdout).

**Question 1.6 (1 mark)**

Running “./slow 5 ; ./slow 10” gives the output equivalent to running “./slow 5” then “./slow 10”, one after the other.

Running “./slow 5 & ./slow 10” gives the following output (<> stands for a val):

[1st line] [<job-number>] <PID>

[Subsequent lines] *“./slow 5” and “./slow 10” concurrently executing in an interleaving fashion*

[Last line] [<job-number>]+ Exit 11 ./slow 5

“;” denotes sequential execution (or more specifically synchronous execution) while “&” denotes parallel execution (virtual parallelism with 1 foreground job and 1 background job).

(For grader only) Part 1 total: \_\_\_\_\_\_\_\_\_\_\_ / 6

**Part 2 – Playing with POSIX Calls**

**Question 2.1 (1 mark)**

Yes, the parent and child processes are executing concurrently (virtual parallelism). This can be seen from the interleaved output produced by the parent and child processes.

**Question 2.2 (1 mark)**

The parent’s parent is bash (the shell).

**Question 2.3 (1 mark)**

“ac” – contains the number of command-line arguments

“av” – contains the command-line arguments themselves stored in an array of char\* strings (1st is the program name followed by other arguments passed through the command line)

“vp” – contains the environment variables available to the program stored in an array of char\* strings (all elements have the format of VARIABLE=<value> except for the last element which is NULL)

**Question 2.4 (1 mark)**

int main() {

if(fork() == 0) {

char\* const argv[] = {"cat", "file.txt", NULL};

execvp("cat", argv);

}

else

wait(NULL);

}

/\* Explanation

To use execvp instead of execlp, just have to ensure that arguments are passed in a way that matches the calling convention of execvp instead of execlp (switched from a variadic argument list to a char\* const array in this case).

//\*/

**Question 2.5 (1 mark)**

**Question 2.6 (1 mark)**

**Question 2.7 (1 mark)**

(For grader only)

Part 2 total: \_\_\_\_\_\_\_\_\_\_\_ / 7

**REPORT TOTAL: \_\_\_\_\_\_\_\_\_\_\_\_ / 13**

**Demo: \_\_\_\_\_\_\_\_\_\_\_\_\_ /4**

**Total: \_\_\_\_\_\_\_\_\_\_\_\_\_/17**