

Programming exam in C: Shell

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1 Brief description

This file describes in a very objective manner what was implemented for the shell implementation exercise. Further details regarding the expected behaviour of the Shell can be found in `case_tests.csv`, in which the first column describes the user's input and the second explains how the program should behave. The shell was developed to work accordingly to the description provided in the document at the discipline's Google Classroom.

2 Brief description

The folder contains 3 main files: `func.h`, which stores the function signatures of `func.c`. This file stores a large number of functions utilized by `shell.c`, which is the main program. The folder also contains `redir_file.c`, a program developed to test redirections using "<", 3 command files to test batchfile behaviour and lastly, there is `case_tests.csv`.

3 Requirements

3.1 Interactive sequential execution and exit

The execution was implemented using `execvp()` and passing an `arg_data` struct to a function, that is responsible for creating a child process to execute the command. This way, the shell does not terminate after executing the command. Exit is handled by a custom shell handler in the main program. The maximum characters of a line of command is defined by `MAX_LINE`. If a line is longer than `MAX_LINE - 1`, the commands will be executed in the next interaction.

3.2 Batch, exit and interactive sequential execution

The batch execution executes differently from the interactive, as it stores an array of lines of command, which is limited to 40 lines. When all the lines are finished or the file passes an exit command, the program terminates. Lines of command are separated by line breaks, and the commands are separated by ";".

3.3 Batch and interactive execution, exit, and style parallel

For style parallel, a new thread is created for every process. The order in which they finish execution is random, but generally faster processes finish earlier. Every thread also has a process of its own to execute `execvp()`.

3.4 Batch and interactive execution, exit, style sequential and PIPE

Style sequential offers support for pipes, and the data for every pipe is stored in `pipe_arg_data`. This decision was taken having parallel execution in mind. The shell offers support for one pipe at a time, which means that chains of pipes are ignored and only the two first commands are executed.

3.5 Batch and interactive execution, exit, style parallel and PIPE

Just as style parallel, those pipes are stored in `pipe_arg_data`. In this case, the threads call the pipe execution function in `pthread_create()` method and pass the `pipe_arg_data` struct.

3.6 Batch and interactive execution, exit, style sequential and redirections

The output of commands can be written to another file using `>`. Redirection to commands using `<` reutilizes the logic of batchfiles to read the lines of a file line by line, but does not separate by `;`. Redirections utilizing `>>` append to a file's content. In order to execute any redirection, an executable must be called using `./example`, the redirection and the file's name. If multiple spaces are passed rather than a file's name, an error message is displayed.

3.7 Batch and interactive execution, exit, style parallel and redirections

Utilizes a thread for every execution.

3.8 Batch and interactive execution, exit, style sequential or parallel and history

History stores the last executed command in a runtime variable. Its initial value returns a `"No command"` output, but after execution of a last command different than `!!`, the history is updated for the next line of command. It supports up to 40 characters, and values longer than that are ignored.

3.9 Batch and interactive execution, exit, style sequential or parallel and history

This functionality is incomplete, and its execution causes the output of the shell to behave badly. The usage of `&` executes a process but does not wait for

it to terminate. However, the shell behaves badly after this. It also does not support the command `fg` nor does it print the specified format established by the document when sent to background.

4 Error handling

Empty lines of command or lines made of only spaces are ignored by the shell. Spaces before and after `;` are also allowed. `CTRL-D` terminates the shell and even if a batchfile does not have an exit command, the shell exits. If more than one file is passed to the shell executable, it prints an error message then terminates.

5 Additional note

Lastly, a `Makefile` is used to compile all the C files in the directory, and their objects and executables should be removed using `make clean`. The `make` command uses `-pthread`, which allows a Linux Ubuntu 20.04 LTS WSL distro to support pthread methods.