Assignment 2

Writing a Basic Command Shell

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This project must be done in a group of two

Github Setup

The first part of assignment to is to take the **epic** that you wrote in assignment 1 and to break it down into user stories; the epic was written as a note in your github 'Projects', specifically the 'Assn 2 -- Basic Command Shell' project. You want to take this epic and break it down into manageable sized **user stories**. Each of these user stories should be logged as an **issue** on github, labeled as an **enhancement.** They should still be in the 'Backlog' column. You then want to assign the first 2 or 3 user stories to each of the group members. *Note: you can assign issues to contributors*. The first issue each member decides to work on should be moved to the 'In Progress' column. Each user will want to track their work through the 'Projects' Kanban board and resolve the issue when they complete it. After completing all their assigned user stories they can assign themselves new ones and begin working on them.

Coding Requirements

Write a command shell called rshell in C++. Your shell will perform the following steps:

1. Print a command prompt (e.g. `$`)
2. Read in a command on one line. Commands will have the form:

```
cmd          = executable [ argumentList ] [ connector cmd ]
connector    = || or && or ;
```

where executable is an executable program in the PATH and argumentList is a list of zero or more arguments separated by spaces. The connector is an optional way you can run multiple commands at once. If a command is followed by ;, then the next command is always executed; if a command is followed by &&, then the next command is executed only if the first one succeeds; if a command is followed by ||, then the next command is executed only if the first one fails. For example:

```
$ ls -a
$ echo hello
$ mkdir test
```

is equivalent to:

```
$ ls -a; echo hello; mkdir test
```

There should be no limit to the number of commands that can be chained together using these operators, and your program must be able to handle any combination of operators. For example, you should be able to handle the command:

```
$ ls -a; echo hello && mkdir test || echo world; git status
```

1. Execute the command. This will require using the C++ syscalls `fork`, `execvp`, and `waitpid`. Previous cs100 students created two video tutorials (a fun cartoon tutorial ; more serious explanation). You should also refer to the man pages for detailed instructions. **DO NOT USE THE `system()` CALL!**
2. You must have a special built-in command of exit which exits your shell.
3. Anything that appears after a # character should be considered a comment. For example, in the command ls -lR /, you would execute the program /bin/ls passing into it the parameters -lR and /. But in the command ls # -lR /, you would execute /bin/ls, but you would not pass any parameters because they appear in the comment section. You should also note that the # may or may not be followed by a space before the comment begins

IMPORTANT: Most bash commands are actually executables located in /bin, /usr/bin/ (e.g. ls). But some commands are built-in to bash (e.g. cd). So while the ls command should "just work" in your shell, the cd command won't. You are only required to be able to run commands that are in the use/bin/ directory for this assignment, in addition to your own exit function.

IMPORTANT: You can expect that all symbols mentioned above will be separated by spaces *EXCEPT* the semicolon (;), which will come directly after a command with no space preceding it.

HINT: Pay careful attention to how you parse the command string the user enters. There are many ways to mess this up and introduce bugs into your program. You will be adding more parsing features in future assignments, so it will make your life much easier if you do it right the first time! I recommend using either the strtok function from the C standard libraries or the Tokenizer class provided in the boost library. Students often don't do this section of the assignment well and end up having to redo all of this assignment in order to complete the future assignments.

Submission

Create a branch called exec off your main project repo. Do all of your work under this branch. When finished, merge the exec branch into the master branch, and create a tag called assn2. **Remember that tags and branches in git are case sensitive!**

NOTE: git push will not automatically push tags to your repository. Use git push origin assn2 to update your repository to include the assn2 tag.

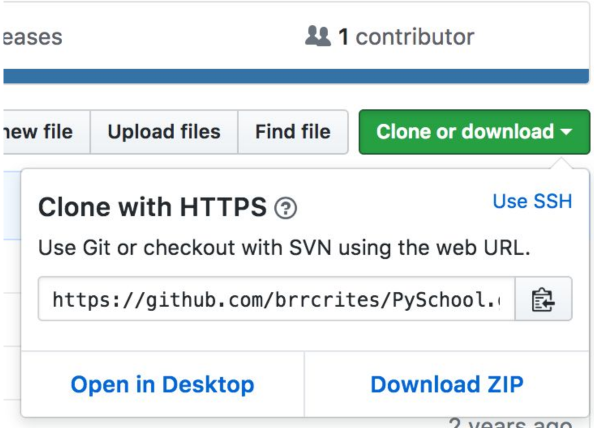
To download and grade your homework, the TA will run the following commands from the hammer server:

```
$ git clone  https://github.com/yourusername/rshell.git
$ cd rshell
$ git checkout assn2
$ make
$ bin/rshell
```

IMPORTANT: You should verify these commands work for your repository on hammer.cs.ucr.edu to verify that you've submitted your code successfully. If you forget how to use git, two students from previous cs100 courses (Rashid Goshtasbi and Kyler Rynear) made video tutorials on the git commands needed to submit your assignments via Github.

Do not wait to upload your assignment to Github until the project due date. You should be committing and uploading your assignment continuously. If you wait until the last day and can't figure out how to use git properly, then you will get a zero on the assignment. NO EXCEPTIONS.

You will also need to create a file for submitting your partner and github information. Create a JSON file with the following information: you and your partner’s name, email, and id as well as the github url of your assignment’s repository. Save the file as **assn2.json** and submit it to iLearn’s to Assignment 2 submission link.



Use Git or checkout with SVN using the web URL.

`https://github.com/brrcrites/PySchool.`

j

Here's an example file:

```
{
    "github_url": "https://www.github.com/busrac/rshell.git",
    "partners": [
        {
            "name": "Busra Celikkaya",
            "email": "bceli001@ucr.edu",
            "id": 861000000
        },
        {
            "name": "Lam Le",
            "email": "lle018@ucr.edu",
            "id": 861000000
        }
    ]
}
```

You **MUST** validate that your JSON is correct using a JSON linter (like this one) before you submit it. Invalid JSON will result in a zero for this assignment. Your repository should be public, however if you prefer to have a private repository please email the instructor for additional information on adding collaborators.

Project Structure

You must have a directory called `src` which contains all the source files for the project, additionally you may either have a folder `header` which contains your header files or you may keep them in the `src` directory.

You must have a Makefile in the root directory. In the Makefile you will have two targets. The first target is called all and the second target is called rshell. Both of these targets will compile your program using `g++` with the flags: `-Wall -Werror -ansi -pedantic`.

You must **NOT** have a directory called bin/ in the project; however, when the project is built using the make command, this directory must be created and the executable file placed there.

You must have a LICENSE file in your project. You may select any open source license. I recommend either GPL or BSD3.

You must have a README.md file. This file should briefly summarize your project. In particular, it must include a list of known bugs. These bugs should also be logged as issues on your github. If you do not have any known bugs, then you probably have not sufficiently tested your code! Read this short intro to writing README files to help you. You must use the Markdown formatting language when writing your README.

You must have a directory called tests. The directory should contain a bash script that fully tests each segment of the program mentioned in the rubric. This means that for a completed project, you should have the following files (with these exact names):

```
single_command.sh          #tests single commands
multi_command.sh                #tests commands with ;, &&, or
||
commented_command.sh       #tests commands with comments
exit.sh                    #tests exit and commands with exit
```

Each of these files should contain multiple commands in order to fully test each functionality. Proper testing is the most important part of developing software. It is not enough to simply show that your program works in some cases. You must show that it works in every possible edge case

IMPORTANT: The file/directory names above are a standard convention. You **must** use the exact same names in your project, including capitalization.

Coding Conventions

Your code must not generate any warnings on compilation.

You must follow the CalTech coding guidelines, as stated in the syllabus.

Your final executable must have no memory leaks. You can use a tool like Dr. Memory or Valgrind to verify this.

Every time you run a syscall, you must check for an error condition. If an error occurs, then call perror. For every syscall you use that is not error checked, you will receive an automatic -5 points. For examples on when, how, and why to use perror, see this video tutorial.

Collaboration Policy

You **MAY NOT** look at the source code of any other student.

You **MAY** discuss with other students in general terms how to use the unix functions.

You are **ENCOURAGED** to talk with other students about test cases. You are allowed to freely share ideas in this regard.

You are **ENCOURAGED** to look at bash's source code for inspiration.

Grading

Rubric

Points	**Description**
5	Code comments
5	Following the style guidelines
5	Proper github management
20	Sufficient test cases
15	Executing single commands
20	Executing commands with ;, &&, and ||
20	Executing commands with comments
10	Exit commands
100	**Total**

IMPORTANT: Your project structure is not explicitly listed in the grading schedule above, however not following the correct structure will result in a 20 point deduction.

IMPORTANT: Projects that do not correctly compile as described above will receive **0 points**.