

# Operating Systems Coursework - C Shell

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## 1 Features

- Load \$HOME and \$PATH from profile file
- \$HOME and \$PATH variable assignment
- Execute any commands located in \$PATH

## 2 Implementation

### 2.1 definition.h

Holds the struct definition of the Shell struct.

```
typedef struct Shell {  
    char cwd[4097]; //Max path length in Linux is 4096  
  
    char **path; //Array of directories  
    char *home;  
} Shell;
```

Stores the state of the shell, i.e. the current working directory, current \$PATH and \$HOME.

### 2.1.1 main.c

The `main()` function initialises the shell by calling `load_profile()` which reads the `profile` file and initialises the `$HOME` and `$PATH` variables.

It then calls the `command_loop()` function which calls subroutines to:

1. Print the current working directory to the output
2. `read_line()` - Wait for input from the user and read it
3. `parse_args()` - Split the input into args
4. Exit the terminal if `exit` is entered
5. `execute_cmd()` - Execute any other commands with their respective arguments

## 2.2 executeCmd.c

Inside the file `executeCmd.c` we have the function `int execute_cmd(Shell *shell, char **args)` which executes the given command. A pointer to the state of the shell is passed in as a parameter.

First it checks if the command is a builtin. These are:

- `cd` - Changes the current working directory of the shell.
- `$VAR=` - Environment variable assignments

The code to handle builtins is defined in `builtin.c`.

If the command is not a builtin:

- Spawn a new child process using `fork()`
- If we're in the child process:
  - Look for the program in the current `$PATH` within `shell->path` with the function `find_program()`.
  - If the return value of `find_program()` is `NULL`, then the program could not be found within the `$PATH` and an error is returned to the shell.
  - Else, we use the path of the found executable and call `execv()` to run the program in the child process. Any output from the program is printed to the terminal.
- If we're in the parent process:
  - Wait until the child process terminates

## 2.3 builtin.c

### 2.3.1 cd

The `cd` builtin function takes the state of the shell and the path to change to as a string as its parameters.

We try to change the directory using `chdir(path)`. It return `-1` if it fails.

If it does not fail we get the new current working directory using `getcwd()` and update the state of the shell `shell->cwd` to the new path.

### 2.3.2 \$VAR=

Within `set_shell_variable()` we simply call `set_variable()` from `loadProfile.c`.

## 2.4 inputHandler.c

This file contains all the logic for reading input to the shell, allocating memory and parsing the input correctly.

### 2.4.1 read\_line()

This function reads a line from the shell input and returns a pointer to a string.

We use a buffer that gets dynamically reallocated when it needs more memory.

### 2.4.2 parse\_args(char \*line)

This splits the input line into an array of arguments when there is a space or other delimiting token.

We use `strtok()` to do most of the work.

## 2.5 loadProfile.c

This file includes logic for reading and parsing the `profile` file.

### 2.6 load\_profile()

Loads the `profile` file using `fopen()` and reads it line by line using `getline()`.

We parse and set the `$HOME` and `$PATH` variables and store it in the shell state.

If no `$HOME` or `$PATH` is set, an error is thrown and the shell exits.

### 2.7 set\_variable()

Sets the shell state for the `$PATH` and `$HOME` variable assignments.