We have created a shell based on the conditions assigned in Codio to execute commands from the command line. Sanjaya Subedi and Ujjwal Adhikari collaboratively worked on this assignment to achieve the following goals for the given tasks.

Task 1 - Print the Shell Prompt and Adding Built-in Commands

a. cd: changes the current working directory

   It takes the first string and compares it with "cd" and using the inbuilt chdir function, it changes the current working directory to the given next string.

```
if (strcmp(arguments[0],"cd")==0){
        chdir(arguments[1]);
```

b. pwd: prints the current working directory

   It takes the first string and compares it with "pwd" and using the inbuilt getcwd function, it prints the current working directory.

```
else if (strcmp(arguments[0],"pwd")==0){
        printf("%s\n",getcwd(wd,sizeof(wd)));
 }
```

c. echo: prints **a** message and the values of environment variables

   There are two conditions for this command. If the variable is defined and the string is stored, it needs to find that through the "$" sign. Otherwise it prints what is inputted after echo. For printing the information stored in variable, getenv inbuilt function is used, otherwise it prints the information written after echo.

```
else if (strcmp(arguments[0],"echo")==0){
        i = 1;
        while(arguments[i] != NULL){
          if (arguments[i][0] == '$'){
            printf("%s ", getenv(arguments[i]+1));
          }
          else{
            printf("%s ", arguments[i]);
          }
          i++;
        }
      }
```

d. setenv: sets an environment variable

   It creates an environment variable to store the values in it.

```
else if (strcmp(arguments[0],"setenv")==0) {
     char* temp_val[2];
     temp_val[0] = strtok(arguments[1], "=");
     i=0;
     while(temp_val[i] != NULL || i == 2) {
       i++;
       temp_val[i] = strtok(NULL, "=");
     }
     setenv(temp_val[0], temp_val[1], 1);
    }
```

e. exit: terminates the shell

   It uses an inbuilt exit to terminate the shell.

```
else if (strcmp(arguments[0],"exit")==0){
     exit(0);
    }
```

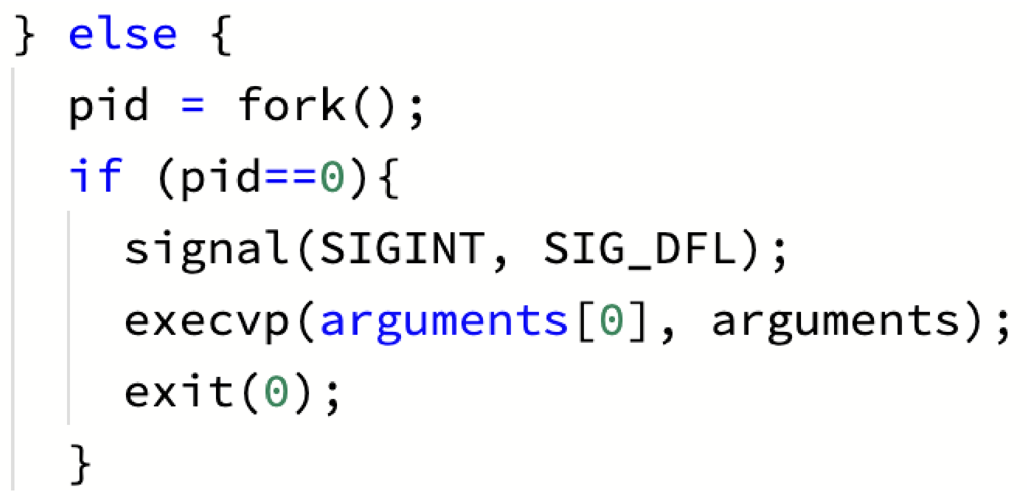
f. env: prints the current values of the environment variables

   It displays the predefined environment if any exists or otherwise displays the built in environment variable like pwd, etc. It searches for the variable using the getenv inbuilt function of the argument is not Null.

```
else if (strcmp(arguments[0],"env")==0){
     if (arguments[1] != NULL){
       printf("%s\n",getenv(arguments[1]));
     } else {
       char** env= environ;
       for (; *env; env++)
       printf("%s\n", *env);
     }
    }
```

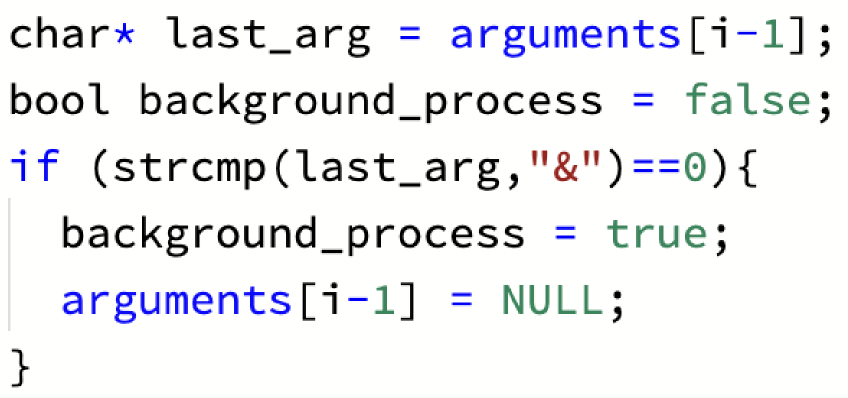
Task 2: Adding Processes

We executed the given arguments using execvp which will run the input argument as the built in commands. For example if the inputted argument is ls -l it will execute it as if it was the built in command.



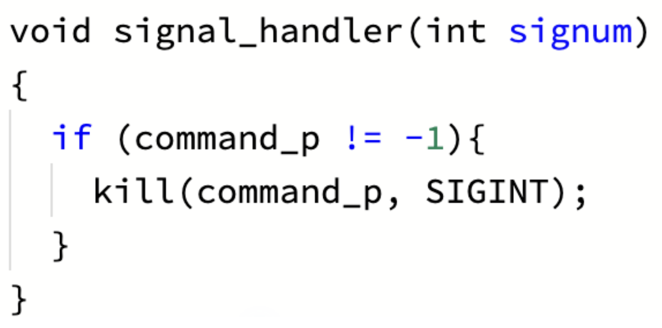
```
} else {
  pid = fork();
  if (pid==0){
    signal(SIGINT, SIG_DFL);
    execvp(arguments[0], arguments);
    exit(0);
  }
```

Task 3: Adding Background Processes
We created a boolean variable to keep track of adding background processes. If there is & at the end of the command line we set the boolean variable to true.



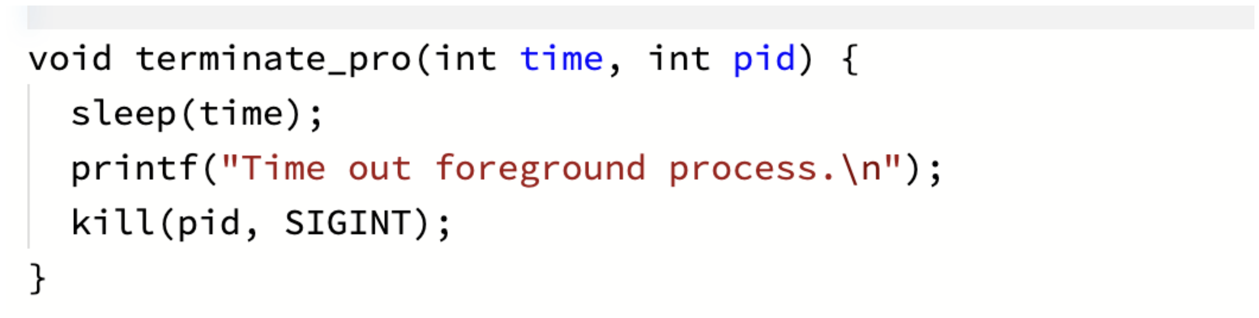
```
char* last_arg = arguments[i-1];
bool background_process = false;
if (strcmp(last_arg,"&")==0){
  background_process = true;
  arguments[i-1] = NULL;
}
```

Task 4: Signal Handling
We also created a function named signal_handler to handle the signal call of Ctrl C to terminate a foreground process. It is useful as it prevent the shell from quitting,



```
void signal_handler(int signum)
{
  if (command_p != -1){
    kill(command_p, SIGINT);
  }
}
```

Task 5: Killing off long running processes
We created a function named terminate_pro whose abbreviation is to terminate the process. This terminates the foreground process after 10 seconds have elapsed and the process has not completed.



```
void terminate_pro(int time, int pid) {
  sleep(time);
  printf("Time out foreground process.\n");
  kill(pid, SIGINT);
}
```