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CSCE 3613: Operating Systems

Assignment 3 Documentation

Date: 10/27/14

**Goals**

The goal of this assignment is to create a program which mimics the basic behavior of the Bash Shell used on Linux/UNIX operating systems. The main functionalities which are reproduced in this simple shell are: the execution of commands and programs, the execution of two commands joined by a pipe, input redirection, and output redirection in both overwrite and append mode. In addition, to these operations the simple shell also creates a log file which is used to record the operations performed by the simple shell.

**Structure**

The simple shell is composed of five source files: “main.c”, “parse.c”, “execute.c”, “redirections.c”, and “log.c”. The portion of the program which parses user input to determine which commands, redirections, and options should be executed is contained in “parse.c”. The largest file, “execute.c,” contains the portion of the program responsible for the execution of the commands detected by the parsing of user input. Everything is held together by the code in “main.c” which coordinates the gathering, parsing, and execution of user input. Helper functions in “redirections.c” and “log.c” are used to ease the implementation of input/output redirections and the use of the log file, respectively.

**Testing**

Below is a terminal session which shows the simple shell executing single commands with input and output redirections. After quitting the program, the log file is printed to the terminal using the “cat” command.

Script started on Mon 27 Oct 2014 01:19:04 PM CDT

ava001@turing:~/csce3613/assignment3$ touch \*.cava001@turing:~/csce3613/assignment3$ makegcc -Wall -c parse.cgcc -Wall main.c parse.oava001@turing:~/csce3613/assignment3$ ./a.outmyshell-% lsa.out execute.c foo.txt log.c main.c makefile out.txt parse.c parse.o redirections.c typescriptmyshell-% ls > out.txtmyshell-% cat out.txta.outexecute.cfoo.txtlog.cmain.cmakefileout.txtparse.cparse.oredirections.ctypescriptmyshell-% ls >> out.txtmyshell-% cat out.txta.outexecute.cfoo.txtlog.cmain.cmakefileout.txtparse.cparse.oredirections.ctypescripta.outexecute.cfoo.txtlog.cmain.cmakefileout.txtparse.cparse.oredirections.ctypescriptmyshell-% wc < out.txt > file.txtmyshell-% cat file.txt 22 22 192myshell-% wc < out.txt 22 22 192myshell-% wc < out.txt >> file.txtmyshell-% cat file.txt 22 22 192 22 22 192myshell-% quitava001@turing:~/csce3613/assignment3$ cat foo.txtMain process PID=4817Waiting for user input... lsAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=4960Child is attempting to execute "ls" with execvp()Parent process has finished waitingWaiting for user input... ls > out.txtAttempting to execute single command with > and possibly <Attempting fork()Parent process is waiting. Child's PID=5207Child is applying output redirection (overwrite) to out.txtChild is attempting to execute "ls" with execvp()Parent has finished waiting.Waiting for user input... cat out.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=5539Child is attempting to execute "cat" with execvp()Parent process has finished waitingWaiting for user input... ls >> out.txtAttempting to execute single command with >> and possibly <Attempting fork()Parent process is waiting. Child's PID=6250Child is applying output redirection (append) to out.txtChild is attempting to execute "ls" with execvp()Parent process has finished waitingWaiting for user input... cat out.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=6471Child is attempting to execute "cat" with execvp()Parent process has finished waitingWaiting for user input... wc < out.txt > file.txtAttempting to execute single command with > and possibly <Attempting fork()Parent process is waiting. Child's PID=8522Child is applying input redirection from out.txtChild is applying output redirection (overwrite) to file.txtChild is attempting to execute "wc" with execvp()Parent has finished waiting.Waiting for user input... cat file.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=9112Child is attempting to execute "cat" with execvp()Parent process has finished waitingWaiting for user input... wc < out.txtAttempting to execute single command with <Attempting fork()Parent process is waiting. Child's PID=9543Child is applying input redirection from out.txtChild is attempting to execute "wc" with execvp()Parent process has finished waitingWaiting for user input... wc < out.txt >> file.txtAttempting to execute single command with >> and possibly <Attempting fork()Parent process is waiting. Child's PID=10349

Child is applying input redirection from out.txt

Child is applying output redirection (append) to file.txt

Child is attempting to execute "wc" with execvp()

Parent process has finished waiting

Waiting for user input... cat file.txt

Attempting to execute single command

Attempting fork()

Parent process is waiting. Child's PID=11101

Child is attempting to execute "cat" with execvp()

Parent process has finished waiting

Waiting for user input... quit

ava001@turing:~/csce3613/assignment3$ exit

exit

Script done on Mon 27 Oct 2014 01:21:48 PM CDT

Below is a terminal session which shows the simple shell executing two commands connected with a pipe using input and output redirections. After quitting the program, the log file is printed to the terminal using the “cat” command.

Script started on Mon 27 Oct 2014 01:23:54 PM CDT

ava001@turing:~/csce3613/assignment3$ touch \*.cava001@turing:~/csce3613/assignment3$ makegcc -Wall -c parse.cgcc -Wall main.c parse.oava001@turing:~/csce3613/assignment3$ ./a.outmyshell-% ls | wc 10 10 88myshell-% ls | wc > out.txtmyshell-% cat out.txt 11 11 96myshell-% ls | wc >> out.txtmyshell-% cat out.txt 11 11 96 11 11 96myshell-% wc < out.txt | cat 2 6 48myshell-% wc < out.txt | cat > file.txtmyshell-% wc < out.txt | cat >> file.txtmyshell-% cat file.txt 2 6 48 2 6 48myshell-% wc < out.txt | cat > file.txtmyshell-% cat file.txt 2 6 48myshell-% rm file.txtmyshell-% lsa.out execute.c foo.txt log.c main.c makefile out.txt parse.c parse.o redirections.c typescriptmyshell-% wc < out.txt | cat >> file.txtmyshell-% cat file.txt 2 6 48myshell-% quitava001@turing:~/csce3613/assignment3$ cat foo.txtMain process PID=19366Waiting for user input... ls | wcAttempting to execute two piped commandsAttempting fork()Parent process is waiting. Child's PID=19898Child is saving stdin and stdout descriptors and creating pipeChild created pipecmd2(PID=19898): Attempting to connect to read end of pipecmd1(PID=19899): Attempting to connect to write end of pipecmd2: "wc" connected to the read end of the pipecmd1: "ls" connected to the write end of the pipecmd2: Attempting to execute "wc" with execvp()cmd1: Attempting to execute "ls" with execvp()Parent has finished waiting.Waiting for user input... ls | wc > out.txtAttempting to executed two piped commands with > and possibly <Attempting fork()Parent process is waiting. Child's PID=20495Child is saving stdin and stdout descriptors and creating pipeChild created pipecmd2(PID=20495): Attempting to connect to read end of pipecmd1(PID=20496): Attempting to connect to write end of pipecmd2: "wc" connected to the read end of the pipecmd1: "ls" connected to the write end of the pipecmd2: Applying output redirection (overwrite) to out.txtcmd1: Attempting to execute "ls" with execvp()cmd2: Attempting to execute "wc" with execvp()Parent is finished waitingWaiting for user input... cat out.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=20703Child is attempting to execute "cat" with execvp()Parent process has finished waitingWaiting for user input... ls | wc >> out.txtAttempting to execute two pipe commands with >> and possibly <Attempting fork()Parent process is waiting. Child's PID=21082Child is saving stdin and stdout descriptors and creating pipeChild created pipecmd2(PID=21082): Attempting to connect to read end of pipecmd1(PID=21083): Attempting to connect to write end of pipecmd2: "wc" connected to the read end of the pipecmd1: "ls" connected to the write end of the pipecmd2: Applying output redirection (append) to out.txtcmd1: Attempting to execute "ls" with execvp()cmd2: Attempting to execute "wc" with execvp()Parent is finished waitingWaiting for user input... cat out.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=21245Child is attempting to execute "cat" with execvp()Parent process has finished waitingWaiting for user input... wc < out.txt | catAttempting to execute two piped commands with <Attempting fork()Parent process is waiting. Child's PID=23719Child is saving stdin and stdout descriptors and creating pipeChild created pipecmd2(PID=23719): Attempting to connect to read end of pipecmd1(PID=23720): Attempting to connect to write end of pipecmd2: "cat" connected to the read end of the pipecmd1: "wc" connected to the write end of the pipecmd2: Attempting to execute "cat" with execvp()cmd1: Applying input redirection from out.txtcmd1: Attempting to execute "wc" with execvp()Parent has finished waitingWaiting for user input... wc < out.txt | cat > file.txtAttempting to executed two piped commands with > and possibly <Attempting fork()Parent process is waiting. Child's PID=24521Child is saving stdin and stdout descriptors and creating pipeChild created pipecmd2(PID=24521): Attempting to connect to read end of pipecmd1(PID=24522): Attempting to connect to write end of pipecmd2: "cat" connected to the read end of the pipecmd1: "wc" connected to the write end of the pipecmd2: Applying output redirection (overwrite) to file.txtcmd1: Applying input redirection from out.txtcmd1: Attempting to execute "wc" with execvp()cmd2: Attempting to execute "cat" with execvp()Parent is finished waitingWaiting for user input... wc < out.txt | cat >> file.txtAttempting to execute two pipe commands with >> and possibly <Attempting fork()Parent process is waiting. Child's PID=25317Child is saving stdin and stdout descriptors and creating pipeChild created pipecmd2(PID=25317): Attempting to connect to read end of pipecmd1(PID=25318): Attempting to connect to write end of pipecmd2: "cat" connected to the read end of the pipecmd1: "wc" connected to the write end of the pipecmd2: Applying output redirection (append) to file.txtcmd1: Applying input redirection from out.txtcmd1: Attempting to execute "wc" with execvp()cmd2: Attempting to execute "cat" with execvp()Parent is finished waitingWaiting for user input... cat file.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=25797Child is attempting to execute "cat" with execvp()Parent process has finished waitingWaiting for user input... wc < out.txt | cat > file.txtAttempting to executed two piped commands with > and possibly <Attempting fork()Parent process is waiting. Child's PID=26462Child is saving stdin and stdout descriptors and creating pipeChild created pipecmd2(PID=26462): Attempting to connect to read end of pipecmd1(PID=26463): Attempting to connect to write end of pipecmd2: "cat" connected to the read end of the pipecmd1: "wc" connected to the write end of the pipecmd2: Applying output redirection (overwrite) to file.txtcmd1: Applying input redirection from out.txtcmd1: Attempting to execute "wc" with execvp()cmd2: Attempting to execute "cat" with execvp()Parent is finished waitingWaiting for user input... cat file.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=26709Child is attempting to execute "cat" with execvp()Parent process has finished waitingWaiting for user input... rm file.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=27700Child is attempting to execute "rm" with execvp()Parent process has finished waitingWaiting for user input... lsAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=27771Child is attempting to execute "ls" with execvp()Parent process has finished waitingWaiting for user input... wc < out.txt | cat >> file.txtAttempting to execute two pipe commands with >> and possibly <Attempting fork()Parent process is waiting. Child's PID=28571Child is saving stdin and stdout descriptors and creating pipeChild created pipecmd2(PID=28571): Attempting to connect to read end of pipecmd1(PID=28572): Attempting to connect to write end of pipecmd2: "cat" connected to the read end of the pipecmd1: "wc" connected to the write end of the pipecmd2: Applying output redirection (append) to file.txtcmd1: Applying input redirection from out.txtcmd2: Attempting to execute "cat" with execvp()Parent is finished waitingWaiting for user input... cat file.txtAttempting to execute single commandAttempting fork()Parent process is waiting. Child's PID=28977Child is attempting to execute "cat" with execvp()Parent process has finished waitingWaiting for user input... quitava001@turing:~/csce3613/assignment3$ exitexit

Script done on Mon 27 Oct 2014 01:28:05 PM CDT

**Conclusion**

The program successfully achieves the goals of this assignment. The main functionalities of the Bash Shell which are reproduced in this simple shell are: the execution of commands and programs, the execution of two commands joined by a pipe, and input/output redirection in both overwrite and append modes. In addition, to these operations the simple shell also creates a log file which is used to record the operations performed by the simple shell.