A SHELL APPLICATION IN C

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DESIGN OF MENTIONED FEATURES

Commands are executed by forking and using execvp() system call. File redirections supported by using open() system call with appropriate mode. And then duplicating to appropriate file descriptor (STDIN or STDOUT) before executing the commands. Single Pipes '|' are nested using pipes and duplicating to appropriate file descriptor in a recursive call. Double '||' and Triple pipes '|||' are implemented by having intermediate processes that read from one pipe and write to multiple pipes (One for each command being piped to). This is extended to implement some of the additional features like allowing nesting of these operators and allowing larger pipe operators.

ADDITIONAL FEATURES:

Advanced Piping Operations: The Shell Supports any amount of piping and not limited to '||' and '|||'. Moreover they can be arbitrarily nested any number of times with any other pipe. Only restriction is that pipes and number of commands must be matched. Pipes are matched with the nearest comma separated commands. Arbitrary piping and nesting results in a tree of input and output dependencies. And results in several streams of output.
Ex: cat test.c |||| wc, head -n 5, tail -n 5 || grep include, cat, grep hello
*   cat test.c | head -n 10 || cat > first10lines.txt, wc*

Converging pipe '&': To combine/gather all the outputs resulting from arbitrary piping and arbitrary nesting use a converging pipe '&' . This is useful when you want to combine/gather all the outputs and pass it to another set of commands that are in turn arbitrarily piped and nested.
Ex: cat test.c || head -n 10, tail -n 10 & cat || grep return, wc
         ls || grep o, grep c & cat || head -n 5, tail -n 5 & sort

Shell Prompt: Shell prompt is prompted and indicates effective username, hostname and current working directory.

Shell Commands: Shell also supports few commands of its own. 'clear' to clear the screen. 'exit' to exit the terminal. 'history' lists previous commands. 'history index' executes a command from the history at specified index. 'dir' or 'cd' is used to change current working directory. 'cd ~' or 'cd' is used to go to home directory of current user. 'cd -' is used to go to previous working directory. 'cd path/to/directory' to change current working directory to specified path.

Additional features: TAB autocompletion and usage of arrow keys and more such features using readline library. Requires 'libreadline' package.

ARCHITECTURE

Shell is implemented as two major parts. One is the Parser which parses the input the string and generates a parse forest of commands (collection of parse trees). Other is Execution unit which executes each of the parse trees of commands. And Master Execution unit which gathers output resulting from execution of one parse tree and redirects them to execution unit executing the next parse tree of commands.

To compiler the code using the following options.
make shell   To compile without readline
make shell-readline   To compiler with readline