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Administrivia

- Reminder: Homework 1 due today.

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Basic Organization / Terminology

- Kernel — heart of operating system, manages processes and files and so forth.
- Shell — program that interprets what you enter, calls (“launches”) other programs.
This being UNIX, there are several, mostly offering similar functionality but maybe with different syntax.
Several ways to start a shell — next slide.
- Graphical environments, window managers, etc. Also several of these!

Starting a Shell

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- From the console, type `control-alt-Fn`, where n is 1, 2, ... 6, and log in. (To get back to the graphical virtual console, `control-alt-F7`.) (This may be different this year, with X session at `control-alt-F1`.)
- From a graphical environment, start a “terminal emulator” (`xterm`, `gterm`, etc.). If your desktop has a taskbar, might be good to put a “start a terminal” icon on it. (For GNOME, right click on taskbar, then “add to panel”, “launcher from menu”, etc.)
- From a Windows system, run `putty`.
- Other ways (log in remotely with `ssh`, ...)

A Little About Shells

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- Several choices; most commonly used are probably `bash` and `tcsh`. By default, you get the one in your entry in the password file.
- How to find out what that is? `echo $SHELL`. (This displays the environment variable `SHELL`. More about those later.)
- How to change? `chsh` command on some systems; on others, can only be changed by administrator.
Or start a different one by typing its name, like any other command.
- Following discussion is about `bash`, but many other shells offer similar functionality.

What Your Shell Does With What You Type

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- Shell provides in-place editing (arrow and other keys), command history, tab completion of filenames, etc. — until you press “return”.
- Shell then processes command line — expands wildcards and references to variables, “tokenizes” command into commandname and parameters.
- Shell then either processes command (if a builtin), or locates executable in “search path” (PATH environment variable) and forks off a new process.
- Command’s return code then available via shell variable.
- (Aside: Wonder what a simple shell program looks like? Look at first homework from CSCI 4320 . . .)

What `bash` Does With What You Type — In-Place Editing

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- Simple editing — left and right arrows; ctrl-a, ctrl-e, etc.
- Command history — move forward/back with up and down arrows, search with ctrl-r.
- Tab completion — for filenames, command names, etc.
- Read about `bash` and/or `readline` — `man` and `info` pages for more info.

What `bash` Does With What You Type — Processing Command Line

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- Shell takes completed line and expands filename wildcards, references to variables (more about both in next slides), “tokenizes” command into commandname and parameters, splitting (by default) at whitespace.
- If that’s not what you want — e.g., to include a space in a filename, inhibit expansion of filename wildcards, etc. — use escape character (backslash) or quotes. Single quotes inhibit all of this, double quotes all but variable substitution.

What `bash` Does With What You Type — Processing Command Line

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- Shell locates command. Two cases:
 - Builtin command — shell executes directly.
 - External command — shell finds an executable by looking in “search path” (`PATH` environment variable) and forks off a new process.
(Why the distinction? Some things can’t reasonably be done in a new (“child”) process!)
- Command’s return code then available via shell variable.
(Why would anyone care? Useful in writing scripts.)
(Where does the return code come from? whatever is returned by program — e.g., from C program’s `main`.)

What `bash` Does With What You Type — Miscellaneous

- Notice that some keys have meanings other than what Windows users are used to — `ctrl-C`, `ctrl-D`, `ctrl-Z`, possibly also `ctrl-S`, `ctrl-Q` (depending on environment — e.g., which terminal emulator).

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Environment Variables

- Associated with a process (e.g., a shell) there can be “environment variables”. Useful as another way (in addition to command-line arguments, input from file/keyboard, etc.) of giving process information.
- Some variables of interest — `PATH`, `SHELL`, `HOME`, `USER`.
- To display current value, `printenv FOO` or `echo $FOO`.
- To set value, `FOO=value` (no spaces) in `bash`.
- To make value available to other commands, `export FOO`.

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Filename Expansion

- You probably already know about using `*` as a wildcard for specifying one or more files. Other options too — “filename expansion” section in full `bash` manual or `info` pages.
- `echo` can be used to check what a particular expression expands to.

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Minute Essay

- How is the pace of the class so far? too fast (too much new-to-you info), too slow (too little new-to-you info), ...?

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