Lab 3

# Linking Files and Directories

* The 'ln' command creates links to files. A link may simply be considered an additional name for a file. The link may be in the same directory or a different directory than the original filename.

## Hard Links

* A file called 'cars' has been created in your current directory to demonstrate linking.
* ***View the contents of this file:***
  + Answer: cat cars
* The 'ln' command creates links to files. A link may simply be considered an additional name for a file. The link may be in the same directory or a different directory than the original filename.
* ***Create a link to the 'cars' file called 'cars2':***
  + Answer: ln cars cars2
* ***Look at detailed information about the 'cars' and the 'cars2'files in the current directory:***
  + Answer: ls –l
* The statistics for 'cars' and 'cars2' are identical. In fact, 'cars' and 'cars2' are two names for the same physical file.
* The 'number of links' shown after the permissions was 2 for both filenames. This means that the file has two links to it, one with the name 'cars' and one with the name 'cars2'.
* Note that creating an additional link to a file, even if in a different directory, is not a method of backing up the file. If the hard drive fails, then the physical file can still be
* corrupted or destroyed regardless of the number of links.
* ***Try the '-i' option of the ls command:***
  + Answer: ls –i
* The '-i' option of ls gives the 'inode' number of filenames. 'inode' stands for information node, and contains all the information about a file, including permissions, owner, group, create date-time, last modified date-time, and other pieces of information.
* Each file requires a unique inode. As you saw, the inodes for 'cars' and 'cars2' were the same, since they are different names for the same file.
* ***Now delete the file 'cars':***
  + Answer: rm cars
* ***Now take a look at the remaining files:***
  + Answer: ls –l
* You saw that 'cars2' is still there. A file is not considered deleted until ALL hard links are removed.
* Note that files are not actually physically deleted from a hard drive, and may be recovered, until their specific inodes are overwritten with new data.
* ***To see that the file is still there, display the contents:***
  + Answer: cat cars2
* ***Now rename the 'cars2' file to 'cars', and we're back where we started:***
  + Answer: mv cars2 cars

## Symbolic Links

* Symbolic links give another name to a file, in a way similar to hard links. But a file can be deleted even if there are remaining symbolic links.
* Symbolic links are also called soft links. In order to give a file a symbolic link, the 'ln' command is used with the '-s' option.
* ***Give 'cars' the symbolic link 'cars3':***
  + Answer: ln –s cars cars3
* ***Have a look at the file:***
  + Answer: ls –l
* Notice that the first character (file-type) for 'cars3' was 'l', which means it's a symbolic link. And in the name field, you saw 'cars3 -> cars'.
* The symbolic link 'cars3' DOES NOT point to the inode that 'cars' is pointing to. Instead, 'cars3' points at the name 'cars'.
* ***Let's display the file pointed to by 'cars3':***
  + Answer: cat cars3
* 'cars3' will continue to point to the name 'cars', even if 'cars' is deleted.
* ***Let's delete 'cars' and see what happens:***
  + Answer: rm cars
* ***Now take a look at the remaining files:***
  + Answer: ls –l
* As you saw, the file cars has been removed, but 'cars3' is still pointing to the name 'cars'.
* If we now create a file called 'cars', 'cars3' will automatically point to the new file.
* ***To see how this works, rename the file 'new' to 'cars':***
  + Answer: mv new cars
* ***Now display the contents of cars:***
  + Answer: cat cars
* ***Now display the contents of cars3***
  + Answer: cat cars

## Linking To Directories

* Directories can be linked only symbolically, except by the system administrator.
* ***To demonstrate, start by displaying the contents of the directory '~uli101/2015c/sample\_dir3/linked\_directories/sample\_files':***
  + Answer: ls –l “above link”
* These are the same 'cars' and 'new' files that we've already seen earlier in this Assignment.
* It's very cumbersome to type a long pathname such as ~uli101/2015c/sample\_dir3/linked\_directories/sample\_files. If we were often accessing the files in this directory, we could create a link.
* ***Let's create a symbolic link to the directory, and call it 'linkdir':***
  + Answer: ln –s ~uli101/2016b/sample\_dir3/linked\_directories/sample\_files linkdir
* Now we can refer to 'linkdir' instead of ~uli101/2015c/sample\_dir3/linked\_directories/sample\_files.
* ***Copy the file 'cars' from 'linkdir' to the current directory:***
  + Answer: cp linkdir/cars .
* ***Now take a look at the files in the current directory:***
  + Answer: ls -l

## Review Exercise

1. ***Create a subdirectory called autos within the current directory:***

Answer: mkdir autos

1. ***Create an additional name (hard link) to the file 'cars'. The link should be called 'cars.link' and should be in the directory 'autos':***

Answer: ln cars autos/cars.link

1. ***Create a link to the directory '~uli101/2015c/sample\_dir3/linked\_directories/sample\_files'.***

***The link, called 'samples', should be in the current directory.***

Answer: ln –s ~uli101/2015c/sample\_dir3/linked\_directories/sample\_files samples

1. ***There is a command called 'showtree' in the directory you just linked to. Execute this command using the newly created 'samples' link***

Answer: samples/showtree

# Command Summary

## Command Summary – Part 1

1. ***sample\_dir2 is a subdirectory of your home directory. Move to stenton (make stenton your current directory), using a relative-to-home pathname:***

Answer: cd ~/sample\_dir2/sample\_dir/stenton

1. ***Your current directory is stenton. Display detailed information about the markham directory itself, not the files within it:***

Answer: ls –ld ../markham

1. ***Your current directory is stenton. Place a calendar listing for the month of December 2015 into a file called Holidays within the gen\_ed directory:***

Answer: cal 12 2015 > gen\_ed/Holidays

1. ***Your current directory is stenton. Append (add) the current date and time to the Holidays file:***

Answer: date >> gen\_ed/Holidays

1. ***Display your userid:***

Answer: whoami

1. ***Display all the users logged into the system:***

Answer: who

1. ***Your current directory is stenton. Create a new directory called payroll within a new directory called accounting, which should be in admin:***

Answer: mkdir –p ../admim/accounting/payroll

1. ***Your current directory is stenton. Move the admin directory under stenton:***

Answer: mv ../admin .

1. ***Your current directory is stenton. Remove the accounting directory:***

Answer: rm –r admin/accounting

1. **Your current directory is stenton. Move admin back to sample\_dir:**

Answer: mv admin ..

## Command Summary – Part 2

1. ***Your current directory is stenton. Copy the file ~uli101/2015c/cars to gen\_ed, but calling the new file cars2:***

Answer: cp ~uli101/2015c/cars gen\_ed/cars2

1. ***Your current directory is stenton. Display the entire cars2 file:***

Answer: cat gen\_ed/cars2

1. ***Your current directory is stenton. Copy the first 300 lines of file ~uli101/2015c/phonebook to a new file called phone\_directory in stenton. This file contains phone number and location information, already sorted by last name, which is the first field in each record.***

Answer: head -300 ~uli101/2015c/phonebook > phone\_directory

1. ***Your current directory is stenton. Display phone\_directory one screen at a time, until you find the record for 'Bruce Byce'. Make a note of his 4-digit telephone extension (you'll need it for the next question), then quit the command:***

Answer: more phone\_directory (2215)

1. ***Enter the 4-digit telephone extension for “Bruce Byce”:***

Answer: 2215

1. ***Your current directory is stenton. Create empty files called f1, f2, and f12 (in that order), within stenton:***

Answer: touch f1 f2 f12

1. ***Your current directory is stenton, move to sample\_dir***

Answr: cd ..

1. ***Your current directory is sample\_dir. Display all the files within sample\_dir (and it's subdirectories) that are larger than 10k bytes:***

Answer: find . –size +10k

1. ***Your current directory is sample\_dir. Edit the file cars2 using vi, and delete a line or make any other changes you wish, and save the file:***

Answer: vi stenton/gen\_ed/cars2

1. ***Your current directory is sample\_dir. Display the differences between the files ~uli101/2015c/cars and cars2:***

Answer: diff ~uli101/2015c/cars stenton/gen\_ed/cars2

## Command Summary – Part 3

1. ***Display the contents of the file '.bashrc' within the home directory of your instructor (userid hans.heim):***

Answer: cat ~hans.heim/.bashrc

1. ***Your current directory is sample\_dir. Display the 2nd line of the file cars2, translated to uppercase (hint: start with a 'head' command):***

Answer: head -2 stenton/gen\_ed/cars2 | tail -1 | tr “[a-z]” “[A-Z]”

1. ***Your current directory is sample\_dir. Display cars2 sorted numerically by the 4th field:***

Answer: sort –nk 4 stenton/gen\_ed/cars2

1. ***Your current directory is sample\_dir. Display only the 1st field (last name) of each record in phone\_directory. Note that the field delimiter is a space:***

Answer: cut –d “ ” –f1 stenton/phone\_directory

1. ***Your current directory is sample\_dir. Find the records in cars2 that contain the string "ford", and display the number of characters in the result:***

Answer: grep ford stenton/gen\_ed/cars2 | wc –m

1. ***Your current directory is sample\_dir. Change the permissions (using octal) for cars2 so that an 'ls -l' listing would show rwxr-x--x:***

Answer: chmod 751 stenton/gen\_ed/cars2

1. ***Your current directory is sample\_dir. Add the permission (using symbolic) for gen\_ed so that all users can access the file cars2:***

Answer: chmod a+x stenton/gen\_ed

1. ***Your current directory is sample\_dir. Create a hard link to cars2, called cars3 within sample\_dir:***

Answer: ln stenton/gen\_ed/cars2 cars3

# Linux Processes

## Review Exercise

1. ***Enter the command that is used to display currently running processes, including an option to display PPID's (parent process id's):***

Answer: ps –f

1. ***Enter the command that is used to display the background jobs that are currently running:***

Answer: jobs

1. ***Enter the command to bring job #2 to the foreground:***

Answer: fg %2

1. ***Enter the command to terminate job #3:***

Answer: kill %3

1. ***Enter the command to terminate job #3, assuming “kill %3” didn’t work:***

Answer: kill -9 %3

# Regular Expressions Using grep

* The data file for the review questions, named "inventory", looks like this:
  + Strawberry Jam,300,4
  + Raspberry Jam,1216,7
  + Blueberry Jam,96,195
  + Strawberry Compote,49,621
  + Raspberry Compote,1937,624
  + Blueberry compote,200,625
  + Frozen Strawberries,130,1941
  + Straw Hats,16,2047
* The first field is the product name, the second field is the quantity on hand, and the third field is the product code. The fields are separated by commas.
* In each of the following questions, write a command using "grep" and a regular expression. The data file in all cases is named "inventory".

1. ***Display all of the lines in the file that contain the characters "Jam".***

Answer: grep “Jam” inventory

1. ***Display all of the lines in the file that contain the word "Straw" right before a space.***

Answer: grep “Straw ” inventory

1. ***Display all of the lines in the file that contain "Compote" or "compote". (Use a character class, do not use the -i option).***

Answer: grep “[Cc]ompote” inventory

1. ***Display all off the lines in the file that contain “Straw” at the beginning of the line.***

Answer: grep “^Straw” inventory

1. ***Display all of the lines in the file where the last field is one digit long.***

***Search for ',' before the field, then use a character class to make sure it's one digit, and anchor it to the end of the line to make sure it's the last field.***

Answer: grep “,[0-9]$” inventory

1. ***Display all of the lines that contain "Straw" followed later in the line by "Hat".***

Answer: grep “Straw.\*Hat” inventory

# Interactive Shell Environment

## Environment Variable

Remember:

**To create a variable:** variablename="value" To

**export a variable:** export variablename To access

**a variable:** $variablename (in a command) To remove

**a variable:** unset variablename To see environment

**variables:** env To see ALL variables: set

And to have an environment variable created every time you login, place the appropriate commands in ~/.bash\_profile (bash) or ~/.profile (ksh).

## Review Exercise

1. ***The following command has been executed:***

***set 10 20 30 40 50***

***Enter the value of the variable $3:***

Answer: 30

1. ***The following command has been executed:***

***set 10 20 30 40 50***

***Enter the value of the variable $#:***

Answer: 5

1. ***The following commands have been executed:***

***set 10 20 30 40 50***

***shift***

***shift***

***Enter the value of the variable $3***:

Answer: 50

1. ***The following commands have been executed:***

***set 10 20 30 40 50***

***shift***

***shift***

***Enter the value of the variable $#:***

Answer: 3

1. ***The following commands have been executed:***

***set 10 20 30 40 50***

***shift***

***shift***

***Enter the value of the variable $5:***

Answer: enter

1. ***The following commands have been executed:***

***set 10 20 30 40 50***

***shift***

***shift***

***Enter the value of the variable $\*:***

Answer: 30 40 50

1. ***Enter the command to display a line that looks like the following:***

***My process id is ####***

***where '####' is the process id of this Assignment (Hint: use a variable, not a command substitution):***

Answer: echo “My process id is $$:

1. ***What command would you use to add the directory '/usr/share/bin' to the end of your current PATH?***

Answer: PATH=$PATH:/usr/share/bin

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