OPERATING SYSTEM: UNIX/LINUX

Course 3

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Shell Programming: a basic script

- Write shell program
  - scripts containing a series of shell commands
- The first line of the script should start with
  - #!/bin/bash (She Bang: #!)
  - which indicates to the kernel the interpreter

```
#!/bin/sh
# fichier : bonjour.sh
# Display Bonjour for the user
echo "Bonjour $USER"
```

- bash$ **chmod +x bonjour.sh**
- bash$ **./bonjour.sh** (./ is used to start a program)
  - Bonjour dany
- She Bang: #! Must be the first line
- Comments
  - Every lines that start with **#** Unless the first line

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A Basic Script

-
  ```
  pwd
  ls -C
  date
  ```
- To make a file executable, use the `chmod` program
  ```
  chmod +x myscript
  ```
- To run the file as a program, simply type:
  ```
  ./myscript
  ```
- If the directory that contains the script is in your `PATH`, this can be abbreviated further to:
  ```
  myscript
  ```

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A Basic Script

- *Any* UNIX command may be added to a script
  - ./`myscript`
  - *export PATH=$PATH:. ; echo $PATH*
  - `Myscript`
- *Create bin directory in your home*
  - *mkdir bin*
  - *mv bonjour.sh bin*
  - *bonjour.sh*

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The `echo` Command

- `echo` is a shell built-in command
- Its function is simple: to write its command-line parameters to Standard Output. If no parameters are given, a blank line (carriage-return) is output
- It is primarily used to display messages to the users of the script
- For example:

```
$ echo My name is Mark
My Name is Mark
$
```

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The `read` Command

- `read` is a shell built-in command for reading from Standard Input (usually the keyboard) and storing the information in shell *variables*
- It is mostly used to receive the answers to questions and prompts issued by the script
- For example:

```
$ read name
Mark Virtue
$
```

- The shell variable `name` now contains the value `Mark Virtue` and can be examined by typing

```
$ echo $name
```

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The `read` Command

- `read` can break the line of input into several variables, as follows:

```
$ read firstname surname
  Mark Virtue
  $
```

- The shell variable `firstname` contains the value `Mark` and `surname` contains the value `Virtue`
- Input is separated by spaces and tabs
- If more words are provided than there are variables, the extra words are added to the last variable
- If not enough words are provided, the extra variables will contain nothing

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Read command

- Options

read –s	(silent)
read –n N	(takes only N character)
read –p "message"	(prompt message)
read –t T	(timeout T seconds)

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command Substitution

- Substitution
  - $() or ` `
- Example :
  - echo "`whoami`, we are the `date` "
  - echo "$(whoami), we are the $(date)"
- Compare :
  - pwd
  - echo pwd
  - echo `pwd`
  - echo "there is `ls | wc -l` file(s) in `pwd` "
  - NOW=`date`
  - MYDIR=`pwd`

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command Substitution

```
#!/bin/bash
# This script displays some information about your environment
        echo "Bonjour. Nous sommes le $(date)"
        echo "Votre répertoire du travail est: $(pwd)"
        echo 'Votre répertoire du travail est: $(pwd)'
```

- single quotation: prevents the shell interpretation of commands

```
$ echo $person
   max
$ echo "$person"
   max
echo "$LOGNAME needs $1000 in `date +%B`" (utiliser \$)
   xyz needs 000 in October
$ echo '$person'
   $person
$ echo \$person
   $person
```

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Variables

- Nom des variables
  - May contains

    `a-z, A-Z, 0-9` et "_"
  - Must begin with a letter
  - Case sensitive
  - No space before and after afecting a value (=)
  - Use double quotation in case the string contains a space
  - Example:
    - `month=Janvier`
    - `street="Rue Saint Pères"`
    - `echo $street`
    - `unset street`
    - `echo $street`

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Variables

- `PREF=counter`
- `WAY=${PREF}clockwise`
- `FAKE=${PREF}feit`
- `echo $WAY $FAKE`
- `person=`
- `echo $person`
- `unset person`

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Variables

- Variables are used to store a value
  - files="notes.txt report.txt"
  - echo $files
  - A=10; echo $A; unset A; echo $A
- Environment variables
  - env: displays whole environment variables
  - export files="notes.txt report.txt"
  - Or files="notes.txt report.txt" ; export files
- PATH
  - echo $PATH
  - echo $USER
  - echo $PWD; echo $HOSTNAME; echo $PS1;
  - export PS1="[\u:\w]\$"

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Shell Variables (cont.)

- (For experienced programmers: All shell variables are *strings*)
- Values may be assigned to a variable by use of the "=" sign, for example:

```
sport=basketball
```

- There must be no **spaces** on either side of the "="
- If you need to assign a value that contains spaces to a variable, use the " character. For example:

```
street="Smith Avenue"
```

- To retrieve the contents of a variable, use the "$" sign before the variable name:

```
echo You live on $street
```

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Special Characters

- These special characters should be avoided when naming files
  - Note that it is *never* possible to give a file a name that includes the `/` character (although this character is not special to the shell)
- If it ever becomes necessary to pass one of these characters as a parameter to another program, one of three actions is required:
  - Prefix the character with a `\` (for example, `\$`)
  - Surround the character with a pair of " characters (for example `"#"`) Note, this doesn't work for all characters
  - Surround the character with a pair of ' characters (for example `'$'`) This works for all characters except `'`

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Comments

- A *comment* is a piece of human-readable text added to a script to make the code more understandable
- A comment is any part of a line of a script that follows the `#` character
- For example:

```
 #  Count the number of users on the system
who | wc -l    # wc means "word count"
```

- Comments are an important part of software development – their use dramatically cuts down on maintenance time and costs
- You are strongly encouraged to comment *all* your code

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Environment Variables

- Many shell variables are "inherited" from the login shell *environment*. In other words, they are preset variables
- For example, when running a script the following variables will be available (amongst others):
  - `HOME`
  - `PATH`
  - `LOGNAME`
  - `TERM`
- Such variables may be changed by the script, but the changes will not be seen by the login shell unless the script was run using the "." operator.

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Predefined Shell Variables

Shell Variable	Description
PWD	The most recent current working directory.
OLDPWD	The previous working directory.
BASH	The full path name used of the bash shell.
RANDOM	Generates a random integer between 0 and 32,767
HOSTNAME	The current hostname of the system.
PATH	A list of directories to search of commands.
HOME	The home directory of the current user.
PS1	The primary prompt (also PS2, PS3, PS4).

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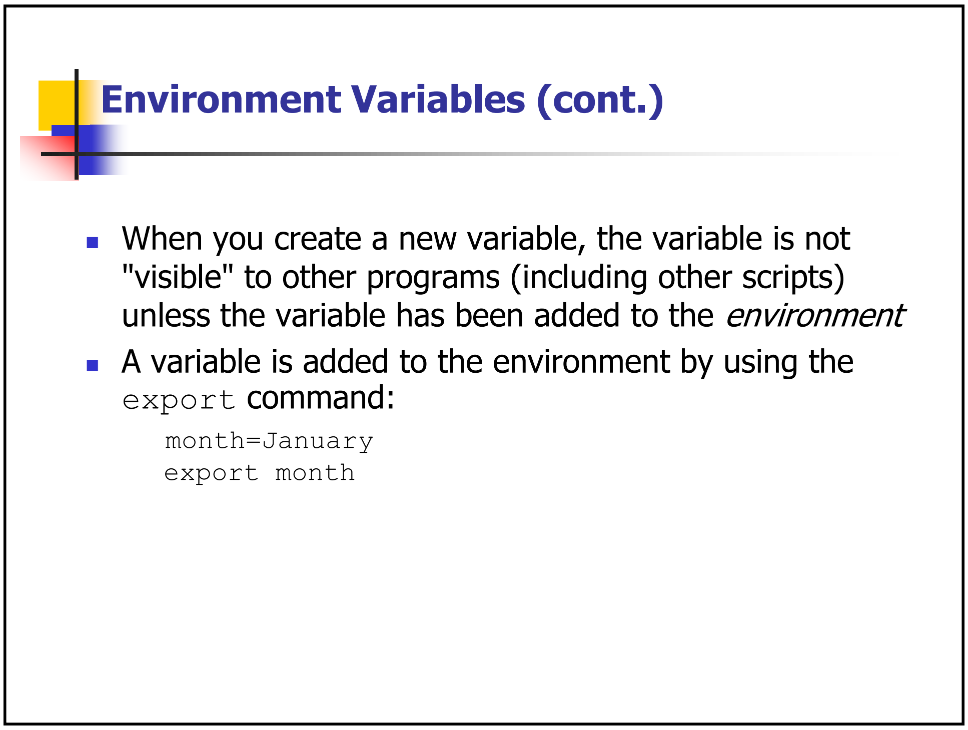

Environment Variables (cont.)

- When you create a new variable, the variable is not "visible" to other programs (including other scripts) unless the variable has been added to the *environment*
- A variable is added to the environment by using the `export` command:

```
month=January
export month
```

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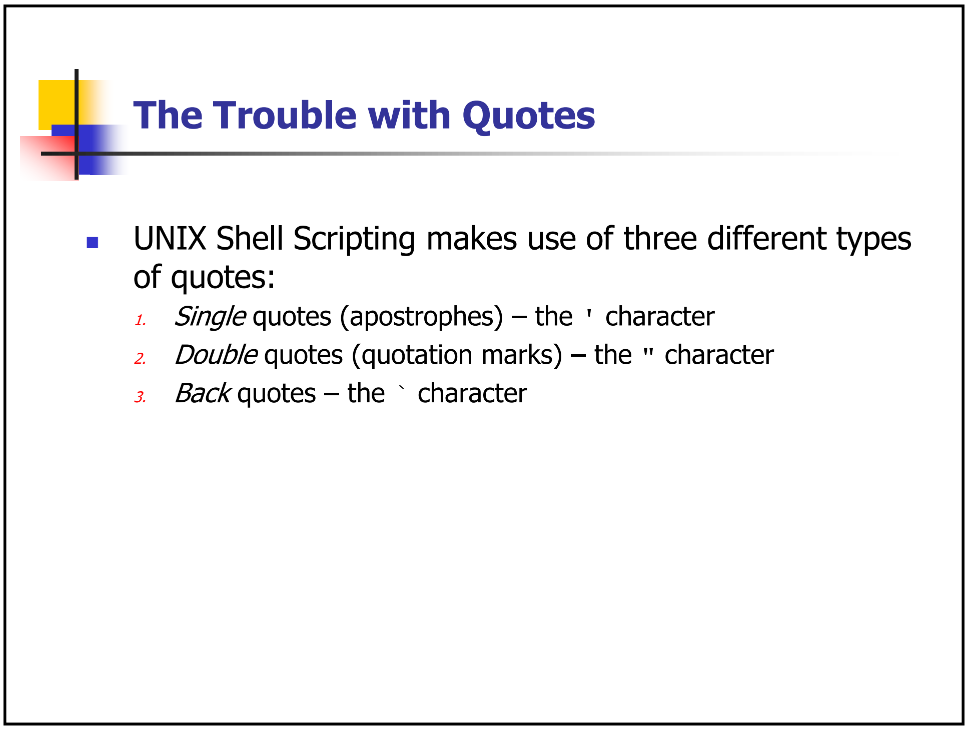

The Trouble with Quotes

- UNIX Shell Scripting makes use of three different types of quotes:
  1. *Single* quotes (apostrophes) – the `'` character
  2. *Double* quotes (quotation marks) – the `"` character
  3. *Back* quotes – the `` ` `` character

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Single Quotes

- For example, the shell command:

```
$ echo 'The total is nearly $750'
```

will cause the following output to appear on the screen:

```
The total is nearly $750
```

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Double Quotes

- Single quotes remove *all* of the shell's special-character features. Sometimes this is excessive – we may prefer *some* of the special characters to work, specifically:
  - `$` (for variable substitution, e.g. `$PATH`)
  - `` ` `` (see the next section)
  - Also, we may want the use of certain constructs, like `\"` or `\$`
- In these situations we can surround the text with *double* quotes. Other characters are still treated as special
- For example:

```
echo "$LOGNAME made \$1000 in `date +%B`"
```

produces

```
peter made $1000 in November
```

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Back Quotes

- Unlike single and double quotes, the back quotes have nothing to do with special characters
- Any text enclosed in back quotes is treated as a UNIX command, and is executed in its own shell. Any output from the command is substituted into the script line, replacing the quoted text
- For example

```
list=`who | sort`
echo $list
```

produces

```
fred tty02 Aug 21 11:01 peter tty01 Aug 22
09:58 tony tty05 Aug 22 10:32
```

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Line control

- It is possible to run two or more UNIX commands on the same line in a shell script, by separating the commands with the *;* (semicolon) character
- For example:

```
echo Please enter your Name:; read name
```

- For aesthetic reasons, you may wish to split a command line over more than one line of text. This is achieved by quoting the newline character, using either single quotes, double quotes or the backslash character
- For example:

```
echo This command is split \
over several lines
```

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Exercises

- Which of the following are valid variable names?
  - A. `month`
  - B. `echo`
  - C. `$year`
  - D. `24_hours`
  - E. `hours-24`
  - F. `fifty%`
  - G. `First Name`
  - H. `a`
  - I. `_First_Name`
  - J. `winner!`

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Exercise Solutions

- Which of the following are valid variable names?

A. `month`	Valid
B. `echo`	Valid
C. `$year`	The `$` causes the *contents* of the variable to be displayed
D. `24_hours`	Variable names cannot start with a digit
E. `hours-24`	Variable names cannot contain a –
F. `fifty%`	Variable names cannot contain a `%`
G. `First Name`	Variable names cannot contain a space
H. `a`	Valid
I. `_First_Name`	Valid
J. `winner!`	Variable names cannot contain a `!`

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User-defined Shell Variables

- Syntax:

  `varname=value`

<u>Example:</u>

```
rate=7.65
echo “Rate today is: $rate”
```

- use double quotes if the value of a variable contains white spaces

<u>Example:</u>

```
name=“Thomas William Flowers”
```

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Use Variables: Work with Variables

- Shell variables

```
tux@da10:~> VARIABLE1="Good morning"
tux@da10:~> echo $VARIABLE1
Good morning
tux@da10:~> bash
tux@da10:~> echo $VARIABLE1

tux@da10:~>
```

- Environment variables

```
tux@da10:~> export VARIABLE2="Good afternoon"
tux@da10:~> bash
tux@da10:~> echo $VARIABLE2
Good afternoon
tux@da10:~>
```

- To see which variables have been set for your shell, use **export**, **set** and **env**

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Use Variables: Work with Variables (continued)

- Use ***variable=value command*** to execute commands in a modified environment
- Use the command **unset *variable*** to delete a variable

```
tux@da10:~> a=10
tux@da10:~> echo $a
10
tux@da10:~> unset a
tux@da10:~> echo $a

tux@da10:~>
```

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Conditional Command Execution

- It is possible to specify that a command in a script will only run if particular condition is met
- Such conditions are *always* expressed in terms of the exit status of another program, as follows:

```
command1 && command2
```

means that `command2` will only run if `command1` completes with an exit status of `0`

```
command3 || command4
```

means that `command4` will only run if `command3` completes with an exit status that is *not* `0`

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Conditional Command Execution

- For example:

```
ls file1 && cp file1 /tmp
cp abc xyz && echo The file was copied okay
diff fileA fileB || echo The files are different
ls file2 || exit
```

- The only problem with these constructs is that they are very limited:
  - You can only perform *one* command if the condition is met (however, it *is* possible to group commands)
  - You cannot specify a second command to be run if the condition is *not* met

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