CSE 390a
Lecture 6
bash scripting continued; remote X windows; unix tidbits

slides created by Marty Stepp, modified by Jessica Miller
http://www.cs.washington.edu/390a/
Lecture summary

- more shell scripting
  - if/else
  - while/until
  - select/case
  - advanced: arrays and functions
- Remote editing/GUI
- various new Unix/Linux commands
  - file archiving and compression
  - shell history
  - newlines in Unix vs Windows
if/else

if [ \textit{test} ]; then
  \textit{commands}
fi

if [ \textit{test} ]; then  # if / else if / else
  \textit{commands1}
elseif [ \textit{test} ]; then
  \textit{commands2}
else
  \textit{commands3}
fi

- there \textbf{MUST} be a space between \texttt{if} and [ and between [ and \texttt{test}:
  - [ is actually a shell command, not just a character
  - also be careful to include the semi-colon between ] and then
# Testing operators

<table>
<thead>
<tr>
<th>comparison operator</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>=, !=, &lt;, &gt;</td>
<td>compares two string variables</td>
</tr>
<tr>
<td>-z, -n</td>
<td>tests whether a string is or is not empty (null)</td>
</tr>
<tr>
<td>-lt, -le, -eq, -gt, -ge, -ne</td>
<td>compares numbers; equivalent to Java's <code>&lt;</code>, <code>&lt;=</code>, <code>==</code>, <code>&gt;</code>, <code>&gt;=</code>, <code>!=</code></td>
</tr>
<tr>
<td>-e, -d</td>
<td>tests whether a given file or directory exists</td>
</tr>
<tr>
<td>-r, -w</td>
<td>tests whether a file exists and is read/writable</td>
</tr>
</tbody>
</table>

```bash
if [ $USER = "daisy" ]; then
  echo ‘Hello there, beautiful!’
fi

LOGINS=`w | wc -l`
if [ $LOGINS -gt 10 ]; then
  echo ‘attu is very busy right now!’
fi
```
More if testing

<table>
<thead>
<tr>
<th>compound comparison operators</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>if [ expr1 -a expr2 ]; then ...</td>
<td>and</td>
</tr>
<tr>
<td>if [ test1 ] &amp;&amp; [ test2 ]; then ...</td>
<td></td>
</tr>
<tr>
<td>if [ expr1 -o expr2 ]; then ...</td>
<td>or</td>
</tr>
<tr>
<td>if [ test1 ]</td>
<td></td>
</tr>
<tr>
<td>if [ ! expr ]; then ...</td>
<td>not</td>
</tr>
</tbody>
</table>

# alert user if running >= 10 processes when 
# attu is busy (>= 5 users logged in)
LOGINS=`w | wc -l`
PROCESSES=`ps -u $USER | wc -l`
if [ $LOGINS -gt 5 -a $PROCESSES -gt 10 ]; then
  echo "Quit hogging the server!"
fi
Exercise

• Write a program that computes the user's body mass index (BMI) to the nearest integer, as well as the user's weight class:

\[ BMI = \frac{weight}{height^2} \times 703 \]

<table>
<thead>
<tr>
<th>BMI</th>
<th>Weight class</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \leq 18 )</td>
<td>underweight</td>
</tr>
<tr>
<td>18 - 24</td>
<td>normal</td>
</tr>
<tr>
<td>25 - 29</td>
<td>overweight</td>
</tr>
<tr>
<td>( \geq 30 )</td>
<td>obese</td>
</tr>
</tbody>
</table>

$ ./bmi
Usage: ./bmi weight height

$ ./bmi 112 72
Your Body Mass Index (BMI) is 15
Here is a sandwich; please eat.

$ ./bmi 208 67
Your Body Mass Index (BMI) is 32
There is more of you to love.
#!/bin/bash
# Body Mass Index (BMI) calculator
if [ $# -lt 2 ]; then
  echo "Usage: $0 weight height"
  exit 1
fi

let H2="$2 * $2"
let BMI="703 * $1 / $H2"

echo "Your Body Mass Index (BMI) is $BMI"
if [ $BMI -le 18 ]; then
  echo "Here is a sandwich; please eat."
elif [ $BMI -le 24 ]; then
  echo "You're in normal weight range."
elif [ $BMI -le 29 ]; then
  echo "You could stand to lose a few."
else
  echo "There is more of you to love."i
Common errors

• [: -eq: unary operator expected
  ▪ you used an undefined variable in an if test

• [: too many arguments
  ▪ you tried to use a variable with a large, complex value (such as multi-line output from a program) as though it were a simple int or string

• let: syntax error: operand expected (error token is " ")
  ▪ you used an undefined variable in a let mathematical expression
while and until loops

while [ test ]; do
    commands
done

until [ test ]; do
    commands
done

while [ "$ACTION" = "open the pod bay doors" ]; do
    echo "I’m sorry Dave, I’m afraid I can’t do that."
    read -p "What would you like me to do?" ACTION
done
select and case

• Bash Select

```bash
PS3=\textit{prompt} \quad \# \text{Special variable for the select prompt}
select \textit{choice} in \textit{choices}; \textbf{do}
  \begin{itemize}
  \item \textbf{commands}
  \begin{itemize}
  \item \# Break, otherwise endless loop
  \item break
  \end{itemize}
  \end{itemize}
\textbf{done}
```

• Bash Case

```bash
case \textit{EXPRESSION} in
  \begin{itemize}
  \item \textbf{CASE1)} \textit{COMMAND-LIST};;
  \item \textbf{CASE2)} \textit{COMMAND-LIST};;
  \item \ldots
  \item \textbf{CASEN)} \textit{COMMAND-LIST};;
  \end{itemize}
esac
```
Exercise

• Have the user select their favorite kind of music, and output a message based on their choice
Exercise Solution

PS3="What is your favorite kind of music? "
select CHOICE in "rock" "pop" "dance" "raggae"; do
case "$CHOICE" in
   "rock") echo "Rock on, dude." ;;
   "pop") echo "Top 100 is called that for a reason." ;;
   "dance") echo "Let's lay down the Persian!" ;;
   "raggae") echo "Takin' it easy..." ;;
   * ) echo "come on...you gotta like something!" ;;
esac
break
done
Arrays

\[ name = (element1 \ element2 \ldots \ elementN) \]

\[ name[index] = value \] \# set an element

\$name \] \# get first element

\${name[index]} \] \# get an element

\${name[*]} \] \# elements sep.by spaces

\${#name[*]} \] \# array's length

- arrays don't have a fixed length; they can grow as necessary
- if you go out of bounds, shell will silently give you an empty string
  - you don't need to use arrays in assignments in this course
Functions

function name() {
  # declaration
  commands
  # ()'s are optional
}

name
  # call

- functions are called simply by writing their name (no parens)
- parameters can be passed and accessed as $1, $2, etc. (icky)
  - you don't need to use functions in assignments in this course
Remote editing

- Gnome's file browser and *gedit* text editor are capable of opening files on a remote server and editing them from your computer
  - press Ctrl-L to type in a network location to open
Remote X display

- normally, you cannot run graphical programs on a remote server
- however, if you connect your SSH with the -X parameter, you can!
  - the X-Windows protocol is capable of displaying programs remotely

```
ssh -X attu.cs.washington.edu
```

- Other options (-Y for “Trusted” mode, -C for compressed, see online)
Compressed files

<table>
<thead>
<tr>
<th>command</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>zip, unzip</td>
<td>create or extract .zip compressed archives</td>
</tr>
<tr>
<td>tar</td>
<td>create or extract .tar archives (combine multiple files)</td>
</tr>
<tr>
<td>gzip, gunzip</td>
<td>GNU free compression programs (single-file)</td>
</tr>
<tr>
<td>bzip2, bunzip2</td>
<td>slower, optimized compression program (single-file)</td>
</tr>
</tbody>
</table>

- **many Linux programs** are distributed as .tar.gz archives
  - first, multiple files are grouped into a .tar file (not compressed)
  - next, the .tar is compressed via gzip into a .tar.gz or .tgz

- to decompress a .tar.gz archive:
  ```bash
  $ tar -xzf filename.tar.gz
  ```
Other useful tidbits

• Single quotes vs double quotes
  ▪ Quotes tell the shell to treat the enclosed characters as a string
  ▪ Variable names are not expanded in single quotes
    • STAR=*  
      ▪ echo $STAR  
      ▪ echo "$STAR"  
      ▪ echo ‘$STAR’

• Shell History
  ▪ The shell remembers all the commands you’ve entered
  ▪ Can access them with the history command
  ▪ Can execute the most recent matching command with !
    • Ex: !less will search backwards until it finds a command that starts with less, and re-execute the entire command line
Newlines in Windows/Unix

• Early printers had two different command characters:
  ▪ Carriage return (\r) – move the print head back to the left margin
  ▪ Line feed (\n) – move the paper to the next line
  ▪ Both occurred when you wanted a “newline”

• As time went on, both (\r\n) and just (\n) were used to signify a “newline”

• Windows typically uses the (\r\n) version, while Unix uses (\n)
  ▪ Can cause problems when displaying text files created on one system on another system
  ▪ Most modern text editors recognize both and do the right thing
  ▪ Can convert if needed:
    • dos2unix and unix2dos commands