

**Exercises-Wildcards****Description**

This exercise is about shell wildcards. Wildcards (which may also be called shell metacharacters, or, more accurately, *globbing characters*) are special characters used in filename patterns. When the shell encounters a wildcard pattern on a command-line, it replaces it, if possible, with a list of paths that match the wildcard pattern. There are three things you should learn from this exercise:

- the globbing functions in the C library expand wildcards. The use of these functions is limited to a few programs - shells and the **find** command in particular. Almost no other commands will expand wildcards, For more information, check out **glob(7)** (use the command **man 7 glob**)
- the wildcard operators [globbing characters], what they mean and how to use them.
- ways to suppress the interpretation of wildcard operators by quoting them.

**The Wildcard Operators**

The following sequences of characters are interpreted as wildcards by the shell. Enclosing characters in any type of quotes (single- or double-) hides them from the shell.

<b>Operator</b>	<b>Meaning</b>	<b>Example</b>	<b>matches objects whose names are</b>
<b>*</b>	anything, including nothing	<b>A*</b>	capital <b>A</b> followed by any number (including zero) of any combination of characters
<b>?</b>	a single character	<b>???</b>	exactly three characters long
a string of characters enclosed in <b>[ ]</b>	a single character that is one of the characters enclosed in the brackets.	<b>[ abc ]</b>	a single character that is either <b>a</b> or <b>b</b> or <b>c</b>
two characters separated by a dash enclosed in <b>[ ]</b>	one character whose value is greater than or equal to the first character and less than or equal to the second character	<b>[ a-z ]</b>	a single character whose value is greater than or equal to 'a' and less than or equal to 'z'. (i.e., a lowercase character) Note: uppercase characters have consecutive values, as do lowercase characters, as do digits. However, <b>[ a-Z ]</b> does not do what you want. Use <b>[ a-zA-Z ]</b> instead.
a character class enclosed in <b>[ ]</b>	a single character that is a member of that character class	<b>[:alpha:]</b>	the character class is alpha. It is indicated by <b>[:alpha:]</b> The inner brackets indicate the character class. The outer brackets indicate the character set (that it is a single character) Both sets of brackets are needed.  Classes include: alpha, upper, lower, digit, alnum, blank, space(whitespace), punct, print, ascii, cntrl, ascii
if the first character inside of the <b>[ ]</b> is <b>!</b> or <b>^</b>	<b>!</b> negates the character set. a single character that is not a member of the set.	<b>[^:lower:]</b>	a single character that is not a member of the character class <b>[:lower:]</b> Thus, any character that is not lowercase.

**Note:** **\*** and **?** will not match a leading **.** in a name (indicating a hidden file)

**Note2:** **!** is the traditional negation operator in character sets. **^** is also recognized by bash for this function to make it consistent with regular expressions, which we will cover later. We will use them interchangeably, but **^** is more important to know.

*bash* also offers brace expansion, which uses braces to enclose a comma-separated list of alternatives. Brace expansion is not a wildcard, as this sequence is expanded whether or not each possibility exists, rather it is a pattern generator.

`{xyz,abc}` expands to the list `xyz abc`

`abc{xyz,abc}` expands to the list `abcxyz abcabc`

`*.{doc,html}` expands to `*.doc *.html` which are then expanded as wildcards

### Exercises

First, interpret the following wildcards:

1. `[[:alpha:]]*`
2. `[^012]?`
3. `z*a?`
4. `[0-9!a-z]*`
5. `*a*z`
6. `[[:alpha:]]`
7. `*[^[:digit:][:punct:]]*`

Now, connect to the directory **wildcards** beneath the class public directory on hills to do the remainder of the exercises.

8. Take the wildcard pattern from #2 and issue the following commands:
  - precede the wildcard with **ls**. It looks like **ls** understands wildcards.
  - precede the wildcard with **echo**. This shows that the shell expands wildcards.
  - precede the wildcard with **echo ls**. This shows that the shell expands the wildcard before it passes it to **ls**.
  - precede the wildcard with **ls** and put single quotes around the wildcard. This suppresses the shell's wildcard expansion and shows you that **ls** doesn't know anything about wildcards.
9. Take the wildcard pattern from #3 and issue the following commands:
  - precede the wildcard with **ls**. Do the paths output seem to make sense?
  - precede the wildcard with **echo**. Can you reconcile the output with that using **ls**?
  - precede the wildcard with **echo ls**. This shows the command as it is executed.
  - Can you put the above together and come up with an explanation? Test your theory by using the command **ls -dF** followed by the wildcard. What do these options do?

From this point on we will be practicing using wildcards with the **ls** command. As you just learned, it will be less confusing if you use the options **-dF** when using **ls** in the remainder of this exercise.

Write commands to list objects in the current directory whose names

10. are three characters long
11. start with a letter, either upper- or lower-case
12. contain a digit anywhere in the name
13. end with a character that is not a digit
14. contain a blank
15. start with a `.`
16. start with a `.` and are a total of three characters long
17. contain at least one character that is neither a letter nor a digit
18. contains a left or right square bracket `[` or `]`

19. contain at least one instance of each of **a** and **q** in the name, in either order (you need two wildcards to do this!)

Next, write commands to list objects whose paths are

20. in a subdirectory of the current directory. The name of the object can be anything.

21. in a subdirectory of the current directory whose name starts with a digit. The name of the object must be five characters long and start with a letter.

Last, to show you that this really has nothing at all to do with **ls**:

22. output the contents of all objects in the current directory whose name starts with **a**

### Answers

The set of wildcards match anything in the current directory whose name

1. begins with a lower-case letter
2. is a total of two characters long. The first character may not be **0 1** or **2**
3. begins with a **z** and ends with an **a** followed by any single character
4. starts with a digit, lowercase letter or the **!** character (the **!** must come at the beginning of the character set to negate it)
5. contains an **a** and ends with a **z**
6. is a single alphabetic character
7. contains a character that is neither a digit nor a punctuation character
8. Here's the commands that you should have used and some interpretation:
  - **ls [^012]? - ls** seems to understand wildcards (but it doesn't)
  - **echo [^012]? - echo** outputs the list of names that match the pattern!
  - **echo ls [^012]? - echo** outputs what an ls command looks like after the shell has expanded the wildcard. Are there any wildcards left for **ls** to worry about?
9. Here are the commands that you should have used and some interpretation:
  - **ls z\*a? - ls** outputs names, but they don't appear to match the pattern!
  - **echo z\*a? - echo** outputs the list of names that match the pattern!
  - **echo ls z\*a? - echo** outputs what an ls command looks like after the shell has expanded the wildcard. If this is the command as it is executed, why does **ls** put out strange names?
  - adding the options **-dF** shows that the object that matches the wildcard is a directory. Remember that **ls** outputs the contents of the directory by default. The **-d** suppresses this behavior and the **-F** puts the **/** at the end to indicate the directory.
10. `ls -dF ???`
11. `ls -dF [a-zA-Z]*` # or `[[[:alpha:]]*`
12. `ls -dF *[0-9]*` # or `*[[:digit:]]*`
13. `ls -dF *[^0-9]` # or `*[^[:digit:]]`
14. `ls -dF *' '*` # Note you must use quotes to 'hide' the blank OR  
`ls -dF *\  
ls -dF *[[[:blank:]]]* # :blank: class. Careful, *[' '* or *[\  
- 15. ls -dF .*
- 16. ls -dF .?? # Why did this file not appear in the output of #8?
- 17. ls -dF *[^a-zA-Z0-9]* # can you do this using character classes?
- 18. ls -dF *[[[]]* # a character set containing the characters [ and ]`

19. `ls -dF *a*q* *q*a*`
20. `ls -dF */*`
21. `ls -dF [0-9]*/[a-zA-Z]???? # or [[:digit:]]*/[[:alpha:]]????`
22. `cat a*`