Chapter 9
Pipes, Filters, and Redirection

LEARNING OBJECTIVES

1. List the standard input and output devices.
2. Explain redirection.
3. Explain what filters are and when they are used.
4. Formulate and explain the syntax of the filter commands SORT, FIND, and MORE.
5. Explain when and how to use the SORT, FIND, and MORE commands.
6. Explain what shell extensions are and how you may use them.
7. Explain what pipes are and how they are used.

STUDENT OUTCOMES

1. Use > and >> to redirect standard output.
2. Use < to redirect standard input.
3. Use filter commands to manipulate information.
4. Enable shell extensions and use extended features.
5. Combine commands using pipes, filters, and redirection.

CHAPTER SUMMARY

1. The redirection symbols are >, <, and >>.
2. The >> appends output to the end of a file.
3. Redirection, pipes, and filters have to do with standard input and standard output.
4. Any command that expects its input from the keyboard has standard input.
5. Any command that normally displays its output on the screen has standard output.
6. Standard error means that the operating system writes error messages to the screen.
7. You can redirect standard input and output to and from devices or files.
8. The pipe symbol is |.
9. The pipe takes standard output from one command and uses it as standard input for the next command.
10. You can pipe many programs together.
11. Filters take data, change it in some fashion, and send the output to the screen.
12. The three filters are SORT, FIND, and MORE.
13. Two of the SORT command parameters are /R for reverse order and /+n for column number.

14.   FIND has four parameters: /V for everything except the specified item, /C for the number of occurrences of the item, /N for the line number where the item appears in the file, and the /I for results regardless of case.
15.   MORE lets you look at text files one screenful at a time. The parameter /C clears the screen before the display begins.
16.   You may enable shell extensions (extended features) in a command prompt window. However they are enabled by default. Extensions give you more options with commands.
17.   You must have a command on both ends of the pipe.
18.   Redirection is the last action you can take. You write either to the screen or to a file, not to both. You either accept input from the keyboard or from a file.
19.   You can string together pipes and filters to create your own commands.
20.   Each part of a command must be able to stand alone on the command line.
21.   Redirection performs an "instead of" action.

KEY TERMS

ASCII sort sequence case-sensitive character string extension	filters input/output (I/O) pipe redirection	standard error standard input standard output

LECTURE NOTES

CHAPTER OUTLINE

Chapter Overview

- Will use redirection to redirect standard input and standard output.
- Learn how pipes can be used to connect programs.
- How filters can be used to manipulate data will be explained.
- What shell extensions are and how they may be used will be discussed.
- Learn how to combine commands using pipes, filters, and redirection.

REDIRECTION OF STANDARD I/O (INPUT/OUTPUT)
- Redirection of Standard I/O (Input/Output)
  - What is keyed in is input.
  - What is written to screen is output.
  - Input/output called I/O.

- OS recognizes three standards:
  - Standard input: Keyboard.
  - Standard output: Screen.
  - Standard error: place from which OS writes error messages to the screen.
- Not all commands deal with standard input and standard output.
  - **See PowerPoint slide #10 –** Results of Copy Command
- I/O redirection allows standard I/O to be changed.
  - Read from file, not keyboard.
  - Write to printer, not screen.
- Three redirection operators.
  - The > redirects output of command to device or file.
  - The < asks for input from source other than the keyboard.
  - The >> redirects standard output and appends but does not overwrite a file.

ACTIVITY—USING > TO REDIRECT STANDARD OUTPUT

- Using > to Redirect Standard Output
  - DATA disk in Drive A, A: \> displayed.
  - Activity steps.
    - Key in:
      - **DIR C:\WUGXP*.TXT**
      - **DIR C:\WUGXP*.TXT > TXTFILES.TXT**
      - **TYPE TXTFILES.TXT**
  - Activity completed.

ACTIVITY—USING < TO REDIRECT STANDARD INPUT

- Using < to Redirect Standard Input
  - DATA disk in Drive A, A: \> displayed.
  - Activity steps.
    - Key in:
      - **MD TEST**
      - **COPY C:\WUGXP*.NEW TEST**
      - **DEL TEST*.***
      - **N** <u>then</u> **DIR TEST**
      - **TYPE Y.FIL**
      - **DEL TEST*.* < Y.FIL**
      - **DIR TEST**
  - Activity completed.

ACTIVITY—USING >> TO ADD REDIRECTED OUTPUT TO A FILE

- Using >> to Add Redirected Output to a File
  - DATA disk in Drive A, A: \> displayed.
  - Activity steps.
    - Key in:
      - **COPY C:\WUGXP*.TXT**
      - **TYPE JUPITER.TXT**
      - **TYPE MERCURY.TXT**
      - **TYPE MERCURY.TXT >> JUPITER.TXT**
      - **TYPE JUPITER.TXT**
  - Activity completed.

FILTERS

- Filters
  - Manipulate information.
    - Read information from keyboard.
    - Change input in specified way.
    - Write results to the screen.
  - Three OS filters - external commands.
    - SORT - arranges lines in ascending or descending order.
    - FIND - searches for particular group of characters, called a character string.
    - MORE - temporarily halts screen display after each screenful.
  - OS creates temporary files while it "filters" data.
    - Important that there be access to the disk and the filters.
    - If a disk is write-protected, the OS will not be able to execute filter commands.

THE SORT COMMAND

- The SORT Command
  - Sorts/arranges lines of text.
  - Sends output to screen unless redirected.
  - Default sorts in ascending order.
  - SORT syntax: **See PowerPoint slide #22.**
    - **/R** - reverses sort order- sorts Z to A, 9 to 0.
    - **/+n** - sorts file according to characters in column n.
    - **M kilobytes** – amount of main memory to use for sort
    - **/T** – (Temporary) – path of directory to hold sort's working storage in case does not fit into main memory.
    - **/O** – Output – if not specified data written to standard output. Specifying output file faster than redirecting standard output to same file.
    - **[drive1:] [path1] filename1** - specifies file (s) to be sorted.
    - **[drive2:] [path2] filename2** - specifies a file where the sorted input is to be stored.

ACTIVITY—USING SORT

- Using SORT
  - DATA disk in Drive A, A: \> displayed.
  - <F6> means to press the <F6> key.

- Activity steps.
  - Key in the following commands. Each command followed by <Enter>
    - **SORT** then **MECURY** then **VENUS** then **EARTH** then **3** then **MARS**
    - **JUPITER** then < **F6**> then **SORT** then **333** then **3** then **22** then **124** then **<F6>**
  - **Discuss results of this sort– sorting by units not numerically.**
  - Key in the following commands. Each command followed by <Enter>
    - **SORT** then **333** <**Spacebar**> <**Spacebar** > **3** then <**Spacebar**> **23** then **124** then **<F6>**
  - **Discuss result of this sort – using spaces forces lines to be same length – placing number digits in proper position.**
  - Activity completed.

FILTERS AND REDIRECTION

- Filters and Redirection
  - Standard output of filters is screen display.
  - Can redirect both the output and the input of the filter commands.
  - Filter commands not usually used with actual keyboard input.
  - Filter commands used with input redirected from a file, a device, or another command.

ACTIVITY—USING THE SORT COMMAND WITH REDIRECTION

- Using the SORT Command with Redirection
  - DATA disk in Drive A, A: \> displayed.
  - Activity steps.
    - Key in:
      - **COPY C:\WUGXP\STATE.CAP**
      - **SORT < STATE.CAP**
      - **SORT STATE.CAP**
      - **SORT /R < STATE.CAP**
      - **SORT /+17 STATE.CAP**
      - **SORT /+17 STATE.CAP > SORTED.CAP**
      - **TYPE SORTED.CAP**
      - **SORT/ +17 STATE.CAP /O BYCITY.CAP**
      - **TYPE SORTED.CAP**
      - **TYPE BYCITY.CAP**
  - Activity completed.

The FIND Filter

- The FIND Filter.
  - Searches for specific character string by enclosing it in quotation marks.
  - Command is looking for exact match, therefore, **is case sensitive** unless use /I parameter.
  - FIND syntax:
    FIND [/V] [/C] [/N] [/I] "string" [[drive:] [path] filename […]]
    - **/V** - displays all lines not containing specified string
    - **/C** - displays only the count of lines containing a string.

- **/N** - displays line numbers with displayed lines.
- **/I** - ignores the case of characters when searching for the string.
- **/OFF [LINE]** - Do not skip files with offline attribute set
- **"string"** - specifies the text string to find.
- **[drive:] [path] filename** - specifies a file or files to search.
- If pathname is not specified, FIND searches the text types at the prompt or piped from another command.
- FIND command at command line can help find a file based on content.

ACTIVITY—USING THE FIND FILTER
- Using the FIND Filter
    - DATA disk in Drive A, A: \> displayed.
    - PERSONAL.FIL on DATA disk.
    - Must use double quotes.
    - Activity steps.
        - Key in:
            - **FIND "Smith" PERSONAL.FIL**
            - **FIND /V "Smith" PERSONAL.FIL**
            - **FND /N "Smith" PERSONAL.FIL**
            - **FIND /C "Smith" PERSONAL.FIL**
            - **FIND /I "Jones" PERSONAL.FIL**
            - **FIND "Jones" PERSONAL.FIL /I\I**
    - Activity completed.

PIPES
- Pipes
    - Pipes - output from one program becomes input to next program.
    - <u>Not limited</u> to two programs.
    - Pipes used with filter commands.
        - Used to further refine data.
    - Symbol is broken bar |
    - Location of pipe not standard
    - Filter commands.
        - Commands read and write temporary files to the disk.
        - Filters are external commands.
        - OS must be able to access the commands.
    - All files (even temporary ones) must be named.
        - Temporary files "hold" data until the next command can process it.
        - Temporary files are deleted when pipes are done filtering.
    - Filter commands will not work if a disk is write-protected.

THE MORE FILTER
- The MORE Filter
    - MORE displays one screenful of data at a time.
    - Useful when want to read long text file.

- Pauses after screen is full.
  - Press any key - next screen is displayed.
- No more data in file – returns to system prompt.
- MORE syntax: **See PowerPoint slide #43.**
  - **[drive:] [path] filename** - specifies file (s) to display one screen at a time.
  - **command-name** - specifies a command whose output will be displayed.
  - **/E** – enable extended features.
  - **/C** – clear screen before displaying page.
  - **/P** – expand FormFeed character.
  - **/S** – squeeze multiple blank lines into a single line.
  - **Tn** – expand tabs to n space (default 8).
  - Switches can be present in MORE environment.
  - +n – Start displaying the first file at line n.
  - files – List of files to be displayed. Files in the list are separated by blanks.
- If extended features are enabled – following commands accepted at –More—prompt
  - **See PowerPoint slide #44.**
  - **Right column describes features**

ACTIVITY—USING THE MORE FILTER
- Using the MORE Filter
  - DATA disk in Drive A, A: \> displayed.
  - Activity steps.
    - Key in all **bold** commands.
      - **DIR | MORE** then <u>Return to System Prompt</u>
      - **DIR | MORE** then <u>Return to System Prompt</u>
      - **DIR | MORE** then <u>Return to System Prompt</u>
      - **DIR | SORT / +39 | MORE** then <u>Return to System Prompt</u>
      - **MORE PERSONAL.FIL** then <u>Return to System Prompt</u>
      - **TYPE PERSONAL.FIL | MORE** then <u>Return to System Prompt</u>
      - **MORE PERSONAL.FIL /C +20**
      - **MORE SORTED.CAP BYCITY.CAP /C**
      - Press **<SPACEBAR>**
      - **MORE SORTED.CAP BYCITY.CAP**
      - Press **<SPACEBAR>**
      - Close all open windows and return to desktop environment (GUI).
  - Activity completed.

OTHER FEATURES OF MORE
- Other Features of MORE
  - If extended features are enabled – have more choices available to you with MORE command.
    - **See PowerPoint slide # 45**.
      - Command Prompt by default enables shell extensions
      - CMD /X - Enables shell extensions
      - CMD /Y -Disables shell extensions.

- Open Command Prompt window are running a shell.
- Shell is command interpreter used to pass commands to operating system.

ACTIVITY—USING THE EXTENDED FEATURES OF MORE
- Using the Extended Features of MORE
  - DATA disk in Drive A, A: \\> displayed.
  - Activity steps.
    - Click **Start/Run.**
    - Key in: **CMD.EXE /X**
    - Click **OK**.
    - Key in: **A:** then **MORE PERSONAL.FIL**.
    - Press **<Enter>** twice then **Q**.
    - Key in: **MORE PERSONAL.FIL**
    - Key in: **P** then 5
    - Press **<Enter>** then = sign then **S**
    - Key in: **3** then press **<Enter>**
    - Close **all open windows**.
  - Activity completed.

COMBINING COMMANDS WITH PIPES AND FILTERS
- Combining Commands with Pipes and Filters
  - Use pipes so standard output from one command is standard input to next command (filters).
  - Use pipes to connect two or more programs and create a flow of data.
  - Redirecting output from a command is an "instead of" process.
  - When combine use of pipes and > - redirection becomes end of pipeline.
    - Last step in process.

ACTIVITY—COMBINING COMMANDS
- Combining Commands
  - Open Command Prompt window.
  - DATA disk in Drive A, A: \\> displayed.
  - Activity steps.
    - Key in:
      - **FIND "Teacher" PERSONAL.FIL | FIND "CA"**
      - **FIND "Teacher" PERSONAL.FIL | FIND "CA" > TEACHER.FIL**
      - **TYPE TEACHER.FIL**
      - **FIND "PrOfeSSor" PERSONAL.FIL | FIND "AZ" | SORT**
    - **Press up arrow once**
    - **Use left arrow key until cursor in under P in PERSONAL.FIL**
    - Key in /|**<SpaceBar>**
    - Press **<End> key** then **<Enter>**
    - Key in:

- **DIR | SORT /+39 | MORE**
- Return to system prompt.
- Key in:
  - **DIR | FIND "<DIR>" SORT +39**
  - **<u>Quotation marks around <DIR> so command line would not use < and > as redirection.</u>**
- Activity completed.