The PowerShell Language

• The designers of PowerShell drew extensively on existing scripting and programming languages to ensure that PowerShell incorporated the most useful features of many different languages.

• PowerShell is very similar to many of the programming languages that you are already familiar with in the areas of expressions, operators, control statements, and functional capabilities. We’ll look only briefly at these concepts in PowerShell, more to illustrate syntax than any other purpose.

• We’ll focus in this section of notes more heavily on the new and unique features of PowerShell that are not found in many other programming or scripting languages.
Expressions And Operators In PowerShell

Expressions

• An expression in PowerShell can be understood as a calculation that evaluates an equation and returns a result.

• An operator in PowerShell is the element of an expression that actually performs the calculation (such as addition or subtraction).

• PowerShell has three general categories of expressions:

  – Arithmetic expressions – expressions that return a numerical result.

  – Assignment expressions – used to set, display, and modify variables.

  – Comparison expressions – use Boolean logic to compare two values and return a true or false result.

• The following page illustrates an example of each type of expression.
# PS-Part6-p3

# PowerShell Notes - Part 6 Page 3 - Expressions

# Script Body

write-host " " -ForegroundColor Green
write-host "Arithmetic Expression" -ForegroundColor Green
write-host "1 + 1 = " -ForegroundColor Red -NoNewLine
write-host "1 + 1 = " -ForegroundColor Red -NoNewLine
write-host "$myString1 = " This is an example test string -ForegroundColor Green
write-host "$myString1 = " $myString1 -ForegroundColor Red
write-host "Comparison Expression" -ForegroundColor Green
write-host "$myString2 = " This is a second example test string -ForegroundColor Green
write-host "$myString2 = " $myString2 -ForegroundColor Red -NoNewLine
write-host "$myString1 -eq $myString2" -ForegroundColor Red
write-host " "

# END SCRIPT

#
Expressions And Operators In PowerShell

Operators

• PowerShell contains six basic types of operators:
  1. Arithmetic operators: +, *, -, /, %
  2. Assignment operators: =, +=, -=, *=, /=, %= 
  3. Comparison operators: -eq, -ne, -gt, -ge, -lt, -le, -contains, -notcontains
  4. Pattern matching operators: -like, -notlike
  5. Regular expression operators: -match, -notmatch, -replace
  6. Logical and bitwise operators: -and, -or, -xor, -not, -band, -bor, -bxor, -bnot
Expressions And Operators In PowerShell

• Each of the comparison, pattern matching, and regular expression operators also include a “c” and “i” prefixed version. The “c” prefix, as in –ceq, indicates case sensitivity, while the “i” prefix, as in –ieq, indicates case insensitivity.

• The pattern matching and regular expression operators also have an extensive list of characters that are used with them; we’ll see these later when looking at these types of operators more closely.

• The next page illustrates a script that uses several different types of PowerShell operators.
# PS-Part6-p3
# PowerShell Notes - Part 6 Page 7 - Various Operators in PowerShell
#
#
# Script Body
#
write-host " "
write-host "Various PowerShell Operators" -ForegroundColor Green
write-host " "
$myVar = 4
$myVar += 2
write-host 'If $myVar = 4, then myVar += 2' "produces $myVar" -ForegroundColor Red
write-host " "
$myVar2 = 4
$myVar3 = 8
write-host "Is $myVar2 less than $myVar3 : " -ForegroundColor Green -NoNewLine
$myVar2 -lt $myVar3
write-host " "
write-host "Is $myVar2 greater than $myVar3 : " -ForegroundColor Green -NoNewLine
$myVar2 -gt $myVar3
write-host " "
write-host "Is apple like a?p?e : " -ForegroundColor Green
"apple" -like "a?p?e"
Various PowerShell Operators

If $myVar = 4, then myVar += 2 produces 6

Is 4 less than 8 : True
Is 4 greater than 8 : False
Is apple like a?p?e : True
Is apple like [a-c]pple : True
Is apple like a* : True
Is apple like [a][p][p][l][e] : True
Is apple not like [a][p][l][e] : False
Is apple not like [a][p][l][e] : True
Is hello -eq to Hello : True
Is hello -ceq to Hello : False
Is hello -ieq to Hello : True
Is Hello -ceq to Hello : True
Is Hello -gt than hello : False
Is Hello -igt than hello : False
Is Hello -cgt than hello : True
Pattern Matching Operators In PowerShell

• Pattern matching operators in PowerShell use Boolean logic to compare two strings of text and return a result.

• To provide more granular comparison capabilities, the pattern matching operators work in conjunction with a set of wildcard operators (characters) to create patterns for matching.

• Four different wildcard operators can be used with the pattern matching operators in PowerShell:
  − *, matches any pattern. E.g., “apple” –like “a*” returns true
  − ?, matches any single character. E.g., “apple” –like “a?p?e” returns true
  − [x-y], matches a range of characters. E.g., “apple” –like “[a-c]pple” returns true
  − [xy], matches any one of the specified characters. E.g., “apple” –like [a][p][p][l][e] returns true.
Regular Expression Operators In PowerShell

• Regular expression operators are closely related to pattern matching operators in PowerShell. If you’ve ever used Perl, Python (you’re about to), or PHP, they will be familiar to you, but I’m assuming that you are not very familiar with any of these other languages.

• Regular expression operators are more flexible than the pattern matching operations. Regular expression operations support the same type of syntax and wildcards as pattern matching operations, but the wildcard operators used with regular expressions are different from the pattern matching wildcard operators.

• A listing of some of the wildcard operators for regular expression operators are shown in the tables on the next two pages. These do not comprise a complete listing.
## Regular Expression Operators In PowerShell

<table>
<thead>
<tr>
<th>Character (operator)</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Matches exact characters or character sequence anywhere in the original value</td>
<td>“apple” –match “pl” → true</td>
</tr>
<tr>
<td>.</td>
<td>Matches any single character</td>
<td>“apple” –match “a…e” → true</td>
</tr>
<tr>
<td>[value]</td>
<td>Matches at least 1 of the characters between the brackets</td>
<td>“apple” –match “[pear]” → true</td>
</tr>
<tr>
<td>[range]</td>
<td>Matches at least 1 of the characters within the specified range</td>
<td>“apple” –match “a[a-z]ple“ → true</td>
</tr>
<tr>
<td>[^]</td>
<td>Matches any character except those in the brackets</td>
<td>“apple” –match “[^fig]” → true</td>
</tr>
<tr>
<td>^</td>
<td>Performs a match of the specified characters starting at the beginning of the original value</td>
<td>“apple” –match “^app” → true</td>
</tr>
<tr>
<td>$</td>
<td>Performs a match of the specified characters starting at the end of the original value.</td>
<td>“apple” –match “ple$” → true</td>
</tr>
</tbody>
</table>
# Regular Expression Operators In PowerShell

<table>
<thead>
<tr>
<th>Character (operator)</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>Matches any pattern</td>
<td>“apple” –match “a*” → true</td>
</tr>
<tr>
<td>?</td>
<td>Matches a single character in the string</td>
<td>“apple” –match “a?ple” → true</td>
</tr>
<tr>
<td>+</td>
<td>Matches a repeating instance of the preceding character</td>
<td>“apple” –match “ap+le” → true</td>
</tr>
<tr>
<td>\</td>
<td>Denotes the character following the backslash as an escaped character</td>
<td>“apple$” –match “apple$” → true</td>
</tr>
<tr>
<td>\w</td>
<td>Matches any word character</td>
<td>“abcd defg” –match “\w+” matches abcd” → true</td>
</tr>
<tr>
<td>\s</td>
<td>Matches any white-space character</td>
<td>“abcd defg” –match “\s+” matches abcd” → true</td>
</tr>
<tr>
<td>\d</td>
<td>Matches any decimal digit</td>
<td>12345 –match “\d+” → true</td>
</tr>
<tr>
<td>{n}</td>
<td>Specifies exactly n matches</td>
<td>“abc” –match “\w{2}” → true “abc” – match “\w{4}” → false</td>
</tr>
</tbody>
</table>
Advanced Operators In PowerShell

• In addition to the basic operators in PowerShell, there are also several different advanced operators.

• These advanced operators include type operators, unary operators, grouping operators, array operators, property and method operators, format operators, and redirection operators.

• We’ll look briefly at each of these categories of advanced operators.
Advanced Operators In PowerShell

Type operators

• These operators serve as a method to compare types of two different objects and return a Boolean true or false value.

• There is also an operator to change the type of an object to another type.

Unary operators

• Similar to arithmetic operators, they include: +, -, ++, --, |<type>|, and , (the comma).

• The script on the next page illustrates examples of both of these types of advanced operators.
Advanced PowerShell Operators

Is $myString1 a string : True
Is $myString1 not a string : False

23561
2356
2357

-is [string]

write-host "Is $myString1 not a string :" -ForegroundColor Red -NoNewLine

+$a
-@a
-@a
++$a

[int]"0xCABCAB"

write-host " "

Advanced Operators In PowerShell

Grouping operators

• These operators are used to bring together a set of terms and perform an operation against these terms.

• The three types available in PowerShell are parentheses (used to group expression operators), the subexpressions grouping operator (the $ used to group together collections of statements, and the array subexpressions operator (the @ symbol used to group together collections of statements and insert the results into an array).

• Each of these grouping operators is illustrated with examples in the script on the next page.
# PS-Part6-p17
# PowerShell Notes - Part 6 Page 17 - Grouping Operators in PowerShell
#
#
# Script Body
#
write-host " "
write-host "Grouping PowerShell Operators" -ForegroundColor Green
write-host " "
write-host "Parentheses" -ForegroundColor Red
(4 + 7) * 4
write-host " "
write-host "Subexpression operator - $" -ForegroundColor Red
$($a = "c*"; get-process $a)
write-host " "
write-host "Array subexpression operator - @" -ForegroundColor Red
@((get-date; get-executionpolicy)
write-host " "
#
# END SCRIPT
Grouping PowerShell Operators

Parentheses

Subexpression operator – $

<table>
<thead>
<tr>
<th>Handles</th>
<th>NPM&lt;K&gt;</th>
<th>PM&lt;K&gt;</th>
<th>WS&lt;K&gt;</th>
<th>VM&lt;M&gt;</th>
<th>CPU&lt;s&gt;</th>
<th>Id</th>
<th>ProcessName</th>
</tr>
</thead>
<tbody>
<tr>
<td>511</td>
<td>5</td>
<td>1680</td>
<td>4912</td>
<td>105</td>
<td>1.19</td>
<td>496</td>
<td>csrss</td>
</tr>
<tr>
<td>239</td>
<td>7</td>
<td>7532</td>
<td>7488</td>
<td>124</td>
<td>6.66</td>
<td>540</td>
<td>csrss</td>
</tr>
</tbody>
</table>

Array subexpression operator – @

DisplayHint : DateTime
Date        : 11/14/2011 12:00:00 AM
Day         : 14
DayOfWeek   : Monday
DayOfYear   : 318
Hour        : 12
Kind        : Local
Millisecond : 213
Minute      : 45
Month       : 11
Second      : 28
Ticks       : 634568715282137500
TimeOfDay   : 12:45:28.2137500
Year        : 2011
DateTime    : Monday, November 14, 2011 12:45:28 PM
RemoteSigned

PS C:\users\Administrator\MyScripts> -
Advanced Operators In PowerShell

Property and method operators

- These operators are very commonly used operators in PowerShell.

- The basic property operator is the period (.), which is used to access properties of a variable.

```
PS C:\users\Administrator\MyScripts> $a = "12345"
PS C:\users\Administrator\MyScripts> $a.length
5
PS C:\users\Administrator\MyScripts> 
```
Advanced Operators In PowerShell

Property and method operators

• The method operators are frequently used in conjunction with the property operators to provide finer control over the data that is returned from a property query.

• The basic syntax for using method operators with the period property operator is shown below:

```powershell
<variable-name> <method-name>(method-argument1, method-argument2, ... )
```
NOTE

When you are working with properties of a variable, one of the helpful features of PowerShell is the **tab completion** feature (also see pages 6 & 7 of PowerShell Part 3 notes). Tab completion enables you to enter the variable name, the period property operator, and then press the **Tab** key to cycle through the available properties for that variable.

Try setting a variable in a PowerShell session, enter just the variable name and a period (as in `$a.`), and then press the **Tab** key repeatedly to view the property options for that variable. Note that the available properties will be dependent on the variable’s type.
Advanced Operators In PowerShell

Property and method operators

• The second most commonly used method operator is the double colon (::). This is used to access members of a specific class of objects, and it is technically referred to as a static member accessor. (Thus, the left argument to a :: must be a valid type name, and the right argument must be a valid member name for the class on the left.)

• An example would be: `[string]::Equals`

• To obtain a list of valid methods for a given type, you can use the command: ` [<type-name>] | get-member -static`

• The next page illustrates this command.
```powershell
PS C:\users\Administrator\MyScripts> [char] ! get-member -static

TypeName: System.Char

<table>
<thead>
<tr>
<th>Name</th>
<th>MemberType</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ConvertFromUtf32</td>
<td>Method</td>
<td>static string ConvertFromUtf32(int utf32)</td>
</tr>
<tr>
<td>ConvertToUtf32</td>
<td>Method</td>
<td>static int ConvertToUtf32(char highSurrogate, char lowSurrogate), static</td>
</tr>
<tr>
<td>Equals</td>
<td>Method</td>
<td>static bool Equals(System.Object objA, System.Object objB)</td>
</tr>
<tr>
<td>GetNumericValue</td>
<td>Method</td>
<td>static double GetNumericValue(char c), static double GetNumericValue(s</td>
</tr>
<tr>
<td>GetUnicodeCategory</td>
<td>Method</td>
<td>static System.Globalization.UnicodeCategory GetUnicodeCategory(char c)</td>
</tr>
<tr>
<td>IsControl</td>
<td>Method</td>
<td>static bool IsControl(char c), static bool IsControl(string s, int index</td>
</tr>
<tr>
<td>IsDigit</td>
<td>Method</td>
<td>static bool IsDigit(char c), static bool IsDigit(string s, int index</td>
</tr>
<tr>
<td>IsHighSurrogate</td>
<td>Method</td>
<td>static bool IsHighSurrogate(char c), static bool IsHighSurrogate(string</td>
</tr>
<tr>
<td>IsLetter</td>
<td>Method</td>
<td>static bool IsLetter(char c), static bool IsLetter(string s, int index</td>
</tr>
<tr>
<td>IsLetterOrDigit</td>
<td>Method</td>
<td>static bool IsLetterOrDigit(char c), static bool IsLetterOrDigit(string</td>
</tr>
<tr>
<td>IsLower</td>
<td>Method</td>
<td>static bool IsLower(char c), static bool IsLower(string s, int index</td>
</tr>
<tr>
<td>IsLowSurrogate</td>
<td>Method</td>
<td>static bool IsLowSurrogate(char c), static bool IsLowSurrogate(string</td>
</tr>
<tr>
<td>IsNumber</td>
<td>Method</td>
<td>static bool IsNumber(char c), static bool IsNumber(string s, int index</td>
</tr>
<tr>
<td>IsPunctuation</td>
<td>Method</td>
<td>static bool IsPunctuation(char c), static bool IsPunctuation(string s,</td>
</tr>
<tr>
<td>IsSeparator</td>
<td>Method</td>
<td>static bool IsSeparator(char c), static bool IsSeparator(string s,</td>
</tr>
<tr>
<td>IsSurrogate</td>
<td>Method</td>
<td>static bool IsSurrogate(char c), static bool IsSurrogate(string s,</td>
</tr>
<tr>
<td>IsSurrogatePair</td>
<td>Method</td>
<td>static bool IsSurrogatePair(string s, int index), static bool IsSurrog</td>
</tr>
<tr>
<td>IsSymbol</td>
<td>Method</td>
<td>static bool IsSymbol(char c), static bool IsSymbol(string s, int index</td>
</tr>
<tr>
<td>IsUpper</td>
<td>Method</td>
<td>static bool IsUpper(char c), static bool IsUpper(string s, int index</td>
</tr>
<tr>
<td>IsWhiteSpace</td>
<td>Method</td>
<td>static bool IsWhiteSpace(char c), static bool IsWhiteSpace(string s,</td>
</tr>
<tr>
<td>Parse</td>
<td>Method</td>
<td>static char Parse(string s)</td>
</tr>
<tr>
<td>ReferenceEquals</td>
<td>Method</td>
<td>static bool ReferenceEquals(System.Object objA, System.Object objB)</td>
</tr>
<tr>
<td>ToLower</td>
<td>Method</td>
<td>static char ToLower(char c, System.Globalization.CultureInfo culture),</td>
</tr>
<tr>
<td>ToLowerInvariant</td>
<td>Method</td>
<td>static char ToLowerInvariant(char c)</td>
</tr>
<tr>
<td>ToString</td>
<td>Method</td>
<td>static string ToString(char c)</td>
</tr>
<tr>
<td>ToUpper</td>
<td>Method</td>
<td>static char ToUpper(char c, System.Globalization.CultureInfo culture),</td>
</tr>
<tr>
<td>ToUpperInvariant</td>
<td>Method</td>
<td>static char ToUpperInvariant(char c)</td>
</tr>
<tr>
<td>TryParse</td>
<td>Method</td>
<td>static bool TryParse(string s, System.Char&amp;, mscorlib, Version=2.0.0.0</td>
</tr>
<tr>
<td>MaxValue</td>
<td>Property</td>
<td>static System.Char MaxValue {get;}</td>
</tr>
<tr>
<td>MinValue</td>
<td>Property</td>
<td>static System.Char MinValue {get;}</td>
</tr>
</tbody>
</table>
```

Advanced Operators In PowerShell

Property and method operators

• Once you have identified the available methods for a particular type, you can select the particular method that you want to use for that type, and then access it using the double colon operator.

• The examples on the next page illustrates this by defining a variable $c set to a capital A, and then the char type method ToLower being called against the $c variable to convert the variable from upper case to lower case.

• The second example shows the variable $d begin set to lower case a and then the char method ToUpper being called to convert this variable from lower to upper case.

• Some additional method operations are also illustrated.
PS C:\users\Administrator\MyScripts> $c = "A"
PS C:\users\Administrator\MyScripts> [char]::ToLower($c)
a
PS C:\users\Administrator\MyScripts> $d = "a"
PS C:\users\Administrator\MyScripts> $e = [char]::ToUpper($d)
PS C:\users\Administrator\MyScripts> $e
A
PS C:\users\Administrator\MyScripts> [char]::IsLower($e)
False
PS C:\users\Administrator\MyScripts> [char]::IsUpper($e)
True
PS C:\users\Administrator\MyScripts> [char]::Equals($d,$e)
False
PS C:\users\Administrator\MyScripts> [char]::IsLetterOrDigit($d)
True
PS C:\users\Administrator\MyScripts> [char]::IsNumber($e)
False
PS C:\users\Administrator\MyScripts> [char]::IsPunctuation($d)
False
PS C:\users\Administrator\MyScripts> [char]::IsPunctuation(",","")
True
PS C:\users\Administrator\MyScripts>
Advanced Operators In PowerShell

Format operator

• The format operator in PowerShell is used to provide more granular control over PowerShell’s output.

• The basic structure of a format operator statement includes a format string on the left and an array of values on the right, as shown in the following example:

  `{0} {1} {2}` – $1, 2, 3

• The values on the right side of a format operator statement are not limited to being numeric (character and string values are also supported). However, most of the advanced format string arguments operate primarily against numerical values.
Advanced Operators In PowerShell

Format operator

- At the basic level, the format operator is used to control the order in which element of an array are displayed, or which elements are displayed at all. See the example on page 29.

- However, the format operator can also provide a tremendous number of other output options, simply by applying different arguments to the format strings.

- The general syntax for format string arguments is: \{0:argument\} where 0 is replaced by the array element that you are interested in, and argument is replaced by the format string argument that you want to apply to the data in the array element. The table on the next page illustrates some of the possible arguments for format strings.
## Advanced Operators In PowerShell

<table>
<thead>
<tr>
<th>Format Element String</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>{0}</code></td>
<td>General format string argument; displays the specified element exactly as entered.</td>
<td>'{0}' –f &quot;myText&quot; returns MyText</td>
</tr>
<tr>
<td><code>{0:x}</code></td>
<td>Displays the specified element in hexadecimal format, with the alpha-numeric characters displayed in lower case.</td>
<td>'{0:x}' –f 12345678 returns bc614e</td>
</tr>
<tr>
<td><code>{0:p}</code></td>
<td>Displays the specified element as a percentage</td>
<td>'{0:p}' –f .372 returns 32.70%</td>
</tr>
<tr>
<td><code>{0:C}</code></td>
<td>Displays the specified element in currency format</td>
<td>'{0:C}' –f 15.78 returns $15.78</td>
</tr>
<tr>
<td><code>{0:hh}</code>, <code>{0:mm}</code></td>
<td>Returns the two-digit hour and two-digit minute value form a <code>get-date</code> command</td>
<td>'{0:hh}:{0:mm}' –f (get-date) returns something like 08:45</td>
</tr>
</tbody>
</table>

Some Format String Arguments
write-host "PowerShell Formatting Operators" -ForegroundColor Green
write-host " " -ForegroundColor Black
write-host "Basic case – used for ordering/appearance" -ForegroundColor Red
write-host "Command is: '{2} {1} {0} -f "apples","oranges","cherries"" -ForegroundColor Red
write-host "Output is: " -ForegroundColor Black -NoNewLine
'{2} {1} {0} -f "apples","oranges","cherries"
write-host " " -ForegroundColor Black
write-host "Command is: '{0} {2} {1} -f "123","456","789"" -ForegroundColor Red
write-host "Output is: " -ForegroundColor Black -NoNewLine
'{0} {2} {1} -f "123","456","789"
write-host " " -ForegroundColor Black
write-host "Command is: '{1} -f "Item 1", "item 2", "Item 3"" -ForegroundColor Red
write-host "Output is: " -ForegroundColor Black -NoNewLine
'{1} -f "Item 1", "item 2", "Item 3"
write-host " " -ForegroundColor Black
write-host "Command is: '{0:x} -f 12345678" -ForegroundColor Red
write-host "Output is: " -ForegroundColor Black -NoNewLine
'{0:x} -f 12345678
write-host " " -ForegroundColor Black
write-host "Command is: '{0:p} -f 0.456" -ForegroundColor Red
write-host "Output is: " -ForegroundColor Black -NoNewLine
'{0:p} -f 0.456
write-host " " -ForegroundColor Black
write-host "Command is: '{0:C} -f 35.94" -ForegroundColor Red
write-host "Output is: " -ForegroundColor Black -NoNewLine
'{0:C} -f 35.94
PowerShell Formatting Operators

Basic case – used for ordering/appearance

Command is: '{2} {1} {0}' -f apples,oranges,cherries
Output is: cherries oranges apples

Command is: '{0} {2} {1}' -f 123,456,789
Output is: 123 789 456

Command is: '{1}' -f Item 1, item 2, Item 3
Output is: item 2

Command is: '{0:x}' -f 12345678
Output is: bc614e

Command is: '{0:p}' -f 0.456
Output is: 45.60 %

Command is: '{0:C}' -f 35.94
Output is: $35.94

Command is: '{0:hh}:{0:mm}' -f (get-date)
Output is: 11:35
Advanced Operators In PowerShell

Format operator

• The number of different format operators is extensive and far too lengthy to cover here.

• MSDN provides a comprehensive reference on the syntax for the use of arguments in .NET Framework formatting strings in the .NET Framework Developer’s Guide in the section on Formatting Types. You can find this guide at: www.msdn.microsoft.com and searching for “formatting types”.
Advanced Operators In PowerShell

Redirection operators

• The final advanced operator type in PowerShell is the redirection operators.

• Redirection operators are used to direct command output to another location, such as a file.

• The example on the next page illustrates redirecting the output of a `get-process s*` command to a textfile named `s-processes.txt`.

NOTE: One major difference in PowerShell’s redirection operations versus other shells is that the `<` (input redirection) operator is currently not implemented. A syntax error is returned if you attempt to use an input redirection operator in a PowerShell command.
# PS-Part6-p33
# PowerShell Notes - Part 6 Page 33 - Redirection in PowerShell
#
#
# Script Body
#
write-host " "
write-host "PowerShell Redirection Operators" -Foregroundcolor Green -Backgroundcolor Black
write-host " "
write-host "Command is: get-process s* > s-processes.txt" -Foregroundcolor Black
get-process s* > s-processes.txt
write-host " "
write-host "Contents of file containing redirected output: " -Foregroundcolor Black
get-content s-processes.txt
write-host " "
#
# END SCRIPT
#
### PowerShell Redirection Operators

**Command is:** `get-process s* > s-processes.txt`

**Contents of file containing redirected output:**

<table>
<thead>
<tr>
<th>Handles</th>
<th>NPM(K)</th>
<th>PM(K)</th>
<th>WS(K)</th>
<th>VM(M)</th>
<th>CPU(s)</th>
<th>Id</th>
<th>ProcessName</th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
<td>6</td>
<td>2064</td>
<td>6096</td>
<td>36</td>
<td>2.30</td>
<td>628</td>
<td>services</td>
</tr>
<tr>
<td>95</td>
<td>3</td>
<td>5388</td>
<td>9604</td>
<td>39</td>
<td>1.17</td>
<td>1024</td>
<td>SLsvc</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
<td>256</td>
<td>724</td>
<td>4</td>
<td>0.11</td>
<td>428</td>
<td>smss</td>
</tr>
<tr>
<td>308</td>
<td>10</td>
<td>6676</td>
<td>12168</td>
<td>99</td>
<td>1.97</td>
<td>1520</td>
<td>spoolsv</td>
</tr>
<tr>
<td>297</td>
<td>4</td>
<td>2592</td>
<td>6140</td>
<td>38</td>
<td>3.13</td>
<td>808</td>
<td>svchost</td>
</tr>
<tr>
<td>258</td>
<td>7</td>
<td>2592</td>
<td>5992</td>
<td>35</td>
<td>0.36</td>
<td>868</td>
<td>svchost</td>
</tr>
<tr>
<td>288</td>
<td>9</td>
<td>5512</td>
<td>8408</td>
<td>45</td>
<td>5.16</td>
<td>944</td>
<td>svchost</td>
</tr>
<tr>
<td>148</td>
<td>4</td>
<td>2856</td>
<td>5772</td>
<td>35</td>
<td>0.03</td>
<td>988</td>
<td>svchost</td>
</tr>
<tr>
<td>1019</td>
<td>36</td>
<td>37884</td>
<td>46316</td>
<td>178</td>
<td>4.94</td>
<td>1004</td>
<td>svchost</td>
</tr>
<tr>
<td>577</td>
<td>16</td>
<td>5904</td>
<td>10800</td>
<td>58</td>
<td>0.83</td>
<td>1080</td>
<td>svchost</td>
</tr>
<tr>
<td>248</td>
<td>8</td>
<td>7004</td>
<td>8496</td>
<td>66</td>
<td>0.42</td>
<td>1132</td>
<td>svchost</td>
</tr>
<tr>
<td>409</td>
<td>14</td>
<td>14400</td>
<td>15472</td>
<td>87</td>
<td>1.95</td>
<td>1184</td>
<td>svchost</td>
</tr>
<tr>
<td>267</td>
<td>22</td>
<td>5952</td>
<td>9904</td>
<td>46</td>
<td>0.48</td>
<td>1324</td>
<td>svchost</td>
</tr>
<tr>
<td>125</td>
<td>5</td>
<td>1856</td>
<td>5240</td>
<td>36</td>
<td>0.14</td>
<td>1768</td>
<td>svchost</td>
</tr>
<tr>
<td>73</td>
<td>2</td>
<td>828</td>
<td>2856</td>
<td>23</td>
<td>0.03</td>
<td>1780</td>
<td>svchost</td>
</tr>
<tr>
<td>44</td>
<td>1</td>
<td>540</td>
<td>2264</td>
<td>15</td>
<td>0.03</td>
<td>1928</td>
<td>svchost</td>
</tr>
<tr>
<td>226</td>
<td>7</td>
<td>3176</td>
<td>4904</td>
<td>50</td>
<td>0.11</td>
<td>3380</td>
<td>svchost</td>
</tr>
<tr>
<td>497</td>
<td>0</td>
<td>0</td>
<td>1852</td>
<td>4</td>
<td></td>
<td>4</td>
<td>System</td>
</tr>
</tbody>
</table>
## Advanced Operators In PowerShell

<table>
<thead>
<tr>
<th>Redirection Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;</td>
<td>Redirects the output of a command to the specified file. The specified file is overwritten.</td>
</tr>
<tr>
<td>&gt;&gt;</td>
<td>Redirects the output of a command to the specified file. If the specified file exists, the output of the command is appended to the existing file.</td>
</tr>
<tr>
<td>2&gt;</td>
<td>Redirects any errors generated by a command to the specified file. The specified file is overwritten if it exists.</td>
</tr>
<tr>
<td>2&gt;&gt;</td>
<td>Redirects any errors generated by a command to the specified file. If the specified file exists, any errors generated by the command are appended to the existing file.</td>
</tr>
<tr>
<td>2&gt;&amp;1</td>
<td>Redirects any errors generated by a command to the output pipe (displaying the errors at the console) instead of redirecting to a file.</td>
</tr>
</tbody>
</table>
Escape Sequences In PowerShell

• The grave-accent or backtick (`) acts as the PowerShell escape character. Depending on when this character is used, PowerShell interprets characters immediately following it in a certain way.

• If the backtick character is used at the end of a line in a script, it acts as a continuation character. In other words, it allows you to break long lines of code into smaller chunks.

• If the backtick character precedes a PowerShell variable, the characters immediately following it should be passed on without substitution or processing.

• If the backtick character is used in a string or interpreted as part of a string, that means the next character is interpreted as a special character. For example, if you want to put a TAB in your string, you use the `\t` escape character. See next page for examples of each.
Continuing a very long command

```powershell
$reg = Get-Process a* | \n  Format-Table
$reg
```

Preceding a variable

```
The string is: $string1
The string is: $string1 the line continues.
This line contains a tab: `\t [TAB] character.
This line contain not 1 `\t [TAB], but 2 `\t [TAB] characters.
```

```"PowerShell Escape Sequences" -ForegroundColor Green -BackgroundColor Black
Continuing a very long command" -ForegroundColor Black
```
```powershell
write-host "PowerShell Escape Sequences" -ForegroundColor Green -BackgroundColor Black
write-host "Continuing a very long command" -ForegroundColor Black
$reg = Get-Process a* | \n  Format-Table
$reg
write-host "" "
write-host "PowerShell Escape Sequences" -ForegroundColor Green -BackgroundColor Black
write-host "Continuing a very long command" -ForegroundColor Black
$reg = Get-Process a* | \n  Format-Table
$reg
write-host "" "
write-host "Preceding a variable " -ForegroundColor Green -BackgroundColor Black
$string1 = "Is this working?"
write-host "The string is: $string1"
write-host "The string is: $string1 the line continues."
$string2 = "This line contains a tab: `\t [TAB] character."
$string2
$string3 = "This line contain not 1 `\t [TAB], but 2 `\t [TAB] characters."
$string3
write-host "" "
```
### Escape Character Sequences Supported By PowerShell

<table>
<thead>
<tr>
<th>Character Sequence</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>` '</td>
<td>Single quotation mark</td>
</tr>
<tr>
<td>` &quot;</td>
<td>Double quotation mark</td>
</tr>
<tr>
<td>` 0</td>
<td>Null character</td>
</tr>
<tr>
<td>` a</td>
<td>Alert (bell or beep signal to computer’s speaker)</td>
</tr>
<tr>
<td>` b</td>
<td>backspace</td>
</tr>
<tr>
<td>` f</td>
<td>Form feed (used only for printer output)</td>
</tr>
<tr>
<td>` n</td>
<td>Newline</td>
</tr>
<tr>
<td>` r</td>
<td>Carriage return</td>
</tr>
<tr>
<td>` t</td>
<td>Horizontal tab (8 spaces)</td>
</tr>
<tr>
<td>` v</td>
<td>Vertical tab (used only for printer output)</td>
</tr>
</tbody>
</table>