Course code: 4IS05

UNIT-5

Chapter -2

perl-The Master Manipulator

perl Preliminaries:

- Perl: Perl stands for Practical Extraction and Reporting Language-a unix based programming language
- Developed by Larry Wall.
- Perl is a popular programming language because of its powerful pattern matching capabilities, rich library of functions for arrays, lists and file handling.
- Combines features of c,shell script,awk and sed
- Perl is a simple yet useful programming language that provides the convenience of shell scripts and the power and flexibility of high-level programming languages.
- Perl programs are interpreted and executed directly, just as shell scripts are; however, they also contain control structures and operators similar to those found in the C programming language.

- Unlike awk, printing isn’t perl’s default action.
- Like C, all perl statements end with a semicolon.
- Perl statements can either be executed on command line with the –e option or placed in .pl files.
- In Perl, anytime a # character is recognized, the rest of the line is treated as a comment

A sample perl script

```
#!/usr/bin/perl
# Script: sample.pl – Shows the use of variables
#
print(“Enter your name: “);
$name=<STDIN>;
Print(“Enter a temperature in Centigrade: “);
$centigrade=<STDIN>;
$fahr=$centigrade*9/5 + 32;
print “The temperature $name  in Fahrenheit is $fahr\n”;
```

```
Enter your name: stallman
Enter a temperature in Centigrade: 40.5
The temperature  stallman
In fareinheit is 104.9
```

Running a perl script

- There are two ways of running a perl script.
- One is to assign execute (x) permission on the script file and run it by specifying script filename (chmod +x filename).
- Other is to use perl interpreter at the command line followed by the script name.

The chop function

- The chop function is used to remove the last character of a line or string.
- In the previous program, the variable $name will contain the input entered as well as the newline character that was entered by the user.
- In order to remove the \n from the input variable, we use chop($name).

  Example: chop($var); will remove the last character contained in the string specified by the variable *var*.

A sample perl script

```
#!/usr/bin/perl
# Script: sample.pl – Shows the use of variables
#
print(“Enter your name: “);
$name=<STDIN>;
chop($name);
print ($name, have a nice day\n”);
```

Variables and Operators

- Perl variables have no type and need no initialization. However we need to precede the variable name with a $ for both variable initialization as well as evaluation.

  Example:
```
$var=10;
print $var;
```

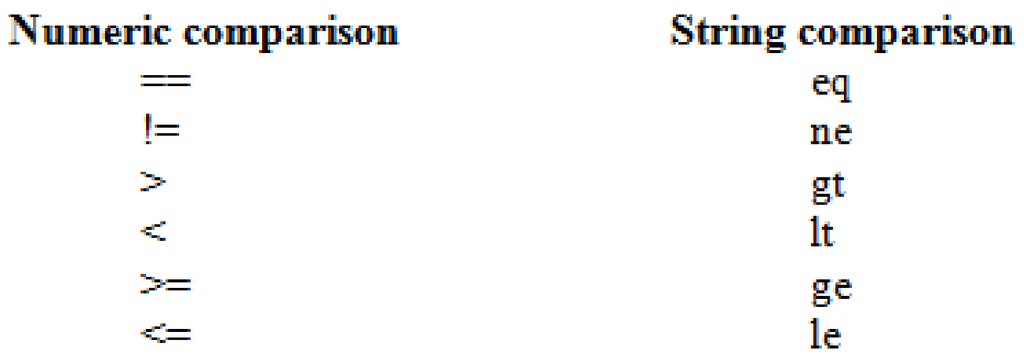
- If a variable is not defined,it is assumed to be a null string and a null string is numerically zero. Incrementing an uninitialized variable returns 1.

  Eg:
```
$ perl –e '$x++; print("$x\n);'
1
```

```
$x=$y=$z=5;
$name="larry\t\twall\n";
$ todays_date=`date`;
$ feb_days=$year%4==0?29:28;
```

Comparison Operators

- Perl supports operators similar to C for performing numeric comparison.
- It also provides operators for performing string comparison,. They are



Numeric comparison	String comparison
==	eq
!=	ne
>	gt
<	lt
>=	ge
<=	le

Concatenating and Repeating Strings

Perl provides three operators that operate on strings:

- The . operator, which joins two strings together;
- The x operator, which repeats a string; and
- The .= operator, which joins and then assigns.

- The . operator joins the second operand to the first operand:

Example:

  $a = “Info" . “sys"; # $a is now “Infosys"

  $x=”microsoft”; $y=”.com”; $x=$x . $y; # $x is now “microsoft.com”

  This join operation is also known as string concatenation.

- The x operator (the letter x) makes *n* copies of a string, where *n* is the value of the right operand:

  Example:

  $a = “R" x 5; # $a is now “RRRRR"

- The .= operator combines the operations of string concatenation and assignment:

  Example:

  $a = “VTU";

  $a .= “ Belgaum"; # $a is now “VTU Belgaum"

String Handling Functions

Perl has all the string handling functions that you can think of. We list some of the frequently used functions are:

- **length** determines the length of its argument.
  $x="abcdijklm";
  print length($x);   This is 9
- **index(s1, s2)** determines the position of a string **s2** within string **s1**.
  print index($x,j);   this is 5
- **substr(str,m,n)** extracts a substring from a string **str**, **m** represents the starting point of extraction and **n** indicates the number of characters to be extracted.
- Substr($x,4,0)="efgh";   stuffs $x with efgh
- **uc(str)** converts all the letters of str into uppercase.
  $name="larry wall";
  $result=uc($name); $result is LARRY WALL
  ucfirst(str) converts first letter of all leading words into uppercase.
  $result=ucfirst($name); $result is Larry Wall
- **reverse(str)** reverses the characters contained in string str.

Specifying filenames in Command Line

- Unlike awk, perl provides specific functions to open a file and perform I/O operations on it. However, perl also supports special symbols that perform the same functionality.
- The diamond operator, <> is used for reading lines from a file. When you specify STDIN within the <>, a line is read from the standard input.

Example:

```
1. perl –e 'print while (<>)'  sample.txt
2. perl –e 'print <>'  sample.txt
```

- In the first case, the file opening is implied and <> is used in scalar context (reading one line).
- In the second case, the loop is also implied but <> is interpreted in list context (reading all lines).

You can use while (<>) to read multiple files:

```
perl –e ‘print while (<>)’ foo1 foo2 foo3
```

Perl also supports –n option which implies this loop:

```
$perl –ne ‘print’ foo1  foo2 foo3
```

```
$ perl –ne ‘print if /\bgupta/’ emp.lst
5423|n.k.  gupta|chairman|admin|30/08/56|5400
```

\b is used to match word boundary

Reading files in a script

- The previous perl statement could have been placed in a script. So we have to use perl with the –n option in the interpreter line

```
 #!/usr/bin/perl –n
print if /\bgupta/;
```

$_ : The Default Variable

- perl assigns the line read from input to a special variable, $_, often called the default variable.
- It represents the last line read or the last pattern matched.
- chop, <> and pattern matching operate on $_ by default, the reason why we did not specify it explicitly in the print statement
- The $_ is an important variable, which makes the perl script compact.

Example

- Instead of writing
  ```
  $var = <STDIN>;
  chop($var);
  ```
  you can write,
  ```
  chop(<STDIN>);
  ```
- In this case, a line is read from standard input and assigned to default variable $_, of which the last character (in this case a \n) will be removed by the chop() function.
- Note that you can reassign the value of $_, so that you can use the functions of perl without specifying either $_ or any variable name as argument.

```
#!/usr/bin/perl
#grep.pl:Extracts the From:headers from the
   mailbox
#
while(<>) {
Chop();
If (/From:.*\@velvet.com/){
$slno++;
Print($slno . “  “ . $_ . “\n”);
```

```
$ grep1.pl $HOME/mbox
1 From: “Ceasar, Julius”Julius_Caesar@velvet.com
2 From: “Barnack.Oscar”<Oscar_Barnack@velvet.com
```

$. (Current Line number) And .. (The range operator)

- Perl stores the current line number is a special variable $.
- $. is perl’s counterpart of awk’s NR operator

  Example:

  perl –ne ‘print if ($. < 4)’ foo   # is similar to head –n 3 foo

  perl –ne ‘print if ($. > 7 && $. < 11)’ in.dat   # is similar to sed –n ‘8,10p’

  .. is the range operator.

  Example:

  perl –ne ‘print if (1..3)’ in.dat   # Prints lines 1 to 3 from in.dat

  perl –ne ‘print if (8..10)’ in.dat   # Prints lines 8 to 10 from in.dat
- You can also use compound conditions for selecting multiple segments from a file.

  Example: if ((1..2) || (13..15)) { print ;}   # Prints lines 1 to 2 and 13 to 15

Lists and Arrays

- A list is a collection of scalar values enclosed in parentheses. The following is a simple example of a list:

  (1, 5.3, "hello", 2)
- This list contains four elements, each of which is a scalar value: the numbers 1 and 5.3, the string "hello", and the number 2.
- To indicate a list with no elements, just specify the parentheses: ()

You can use different ways to form a list. Some of them are listed next.

- Lists can also contain scalar variables:
  (17, $var, "a string")
- A list element can also be an expression:
  (17, $var1 + $var2, 26 -2)
- Scalar variables can also be replaced in strings:
  (17, "the answer is $var1")
- The following is a list created using the list range operator:
  (1..10) same as (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)
- The list range operator can be used to define part of a list:
  (2, 5..7, 11)
  The above list consists of five elements: the numbers 2, 5, 6, 7 and 11

Arrays

- Perl allows you to store lists in special variables designed for that purpose. These variables are called array variables.
- Arrays in perl need not contain similar type of data. Also arrays in perl can dynamically grow or shrink at run time.

  @array = (1, 2, 3);   # Here, the list (1, 2, 3) is assigned to the array variable @array.
- Perl uses @ and $ to distinguish array variables from scalar variables, the same name can be used in an array variable and in a scalar variable:

  $var = 1;

  @var = (11, 27.1, "a string");
- Here, the name var is used in both the scalar variable $var and the array variable @var.
- These are two completely separate variables.
- You retrieve value of the scalar variable by specifying $var, and of that of array at index 1 as $var[1] respectively

@x = (2, 3, 4);

@y = (1, @x, 5);# the list (2, 3, 4) is substituted for @x, and the resulting list

# (1, 2, 3, 4,5) is assigned to @y.

$len = @y; # When used as an *rvalue* of an assignment, @y evaluates to the
length of the array.

$last_index = $#y; $# prefix to an array signifies the last index of the array.

ARGV[]: Command Line Arguments

- The special array variable @ARGV is automatically defined to contain the strings entered on the command line when a Perl program is invoked.
- For example, if the program (test.pl):

```
#!/usr/bin/perl
print("The first argument is $ARGV[0]\n");
```

  Then, entering the command

```
$ test.pl 1 2 3
```

  produces the following output:

```
The first argument is 1
```

- Note that $ARGV[0], the first element of the @ARGV array variable, does not contain the name of the program. This is a difference between Perl and C.

Modifying Array Contents

- For deleting elements at the beginning or end of an array, perl uses the shift and pop functions. In that sense, array can be thought of both as a stack or a queue.

  Example:
  ```
  @list = (3..5, 9);
  shift(@list);      # The 3 goes away, becomes 4 5 9
  pop(@list);        # Removes last element, becomes 4  5
  ```

  The unshift and push functions add elements to an array.
  ```
  unshift(@list, 1..3);  # Adds 1, 2 and 3 –- 1 2 3 4 5
  push(@list,9);  # Pushes 9 at end –- 1 2 3 4 5 9
  ```

- The splice function can do everything that shift, pop, unshift and push can do. It uses upto four arguments to add or remove elements at any location in the array.
- The second argument is the offset from where the insertion or removal should begin.
- The third argument r   epresents the number of elements to be removed. If it is 0, elements have to be added. The new replaced list is specified by the fourth argument (if present).
  ```
  splice(@list, 5, 0, 6..8);   # Adds at 6th location, list becomes 1 2 3 4 5 6 7 8 9
  splice(@list, 0, 2);  # Removes from beginning, list becomes 3 4 5 6 7 8 9
  ```

foreach: Looping Through a List

foreach construct is used to loop through a list. Its general form is,

```
    foreach $var in (@arr) {
        statements
    }
```

Example: To iterate through the command line arguments (that are specified as numbers) and find their square roots,

```
foreach $number (@ARGV) {
    print(“The square root of $number is ” .
  sqrt($number) .  “\n”);
}
```

You can even use the following code segment for performing the same task. Here note the use of $_ as a default variable.

```
foreach (@ARGV) {
 print(“The square root of $_ is “ . sqrt() . “\”);
}
```

split: Splitting into a List or Array

- There are two important array handling functions in perl that are very useful in CGI programming, viz., split and join.
- split breaks up a line or expression into fields. These fields are assigned either to variables or an array.

Syntax:

```
($var1, $var2, $var3 ……. ) = split(/sep/, str);
@arr = split(/sep/, str);
```

- It splits the string **str** on the pattern **sep**. Here **sep** can be a regular expression or a literal string. **str** is optional, and if absent, **$_** is used as default. The fields resulting from the split are assigned to a set of variables , or to an array.

join: Joining a List

- It acts in an opposite manner to split. It combines all array elements in to a single string. It uses the delimiter as the first argument. The remaining arguments could be either an array name or a list of variables or strings to be joined.

  $x = join(" ", "this", "is", "a", "sentence"); # $x becomes "this is a sentence".

  @x = ("words","separated","by");

  $y = join("::",@x,"colons"); #$y becomes "words:: separated::by::colons".

- To undo the effects of join(), call the function split():

```
$y = "words::separated::by::colons";
@x = split(/::/, $y);
```

dec2bin: Converting a Decimal Number to Binary

- Here we summarize our understanding of array handling functions with an illustrative script that converts a input decimal number into its binary equivalent.
- The script logic is to repeatedly divide the number by two and collecting the remainders and finally printing the reverse of all the collected remainders.

The script is as follows:

```
#!/usr/bin/perl
foreach $num (@ARGV) {
  $temp = $num;
  until ($num == 0) {
     $bit = $num % 2;
     unshift(@bit_arr, $bit);
     $num = int($num/2);
}
  $binary_num = join(“”,@bit_arr);
  print (“Binary form of $temp is $binary_num\n”);
  splice(@bit_arr, 0, $#bit_arr+1);
}
```

Output

The output of the above script (assuming script name is dec2bin.pl) is,

```
$ dec2bin.pl 10
Binary form of 10 is 1010

$ dec2bin.pl 8 12 15 10
Binary form of 8 is 1000
Binary form of 12 is 1100
Binary form of 15 is 1111
Binary form of 10 is 1010

$
```

grep: Searching an array for pattern

- grep function of perl searches an array for a pattern and returns an array which stores the array elements found in the other array.

  Example:
- $found_arr = grep(/^$code/, @dept_arr); # will search for the specified $code at the beginning of the element in the array @dept_arr.

Associative Arrays

- In ordinary arrays, you access an array element by specifying an integer as the index:

```
@fruits = (9, 23, 11);
$count = $fruits[0];     # $count is now 9
```

- In associative arrays, you do not have to use numbers such as 0, 1, and 2 to access array elements.
- When you define an associative array, you specify the scalar values you want to use to access the elements of the array. For example, here is a definition of a simple associative array:

```
%fruits=("apple", 9, "banana", 23, "cherry", 11);
```

- It alternates the array subscripts and values in a comma separated strings. i.e., it is basically a key-value pair, where you can refer to a value by specifying the key.

  $fruits{“apple”} will retrieve 9. $fruits{“banana”} will retrieve 23 and so on

There are two associative array functions, keys and values.

- keys: Holds the list of subscripts in a separate array.
- values: Holds the value of each element in another array.

- Normally, keys returns the key strings in a random sequence. To order the list alphabetically, use sort function with keys.

1. foreach $key (sort(keys %region)) {   # sorts on keys in the associative array, region
2. @key_list = reverse sort keys %region; # reverse sorts on keys in assoc. array, region

Regular Expressions and Substitution

- perl supports different forms of regular expressions we have studied so far. It makes use of the functions s and tr to perform substitution and translation respectively.

The s function: Substitution

- You can use the =~ operator to substitute one string for another:

```
$val =~ s/abc/def/;     # replace abc with def
$val =~ s/a+/xyz/;      # replace a, aa, aaa, etc., with xyz
$val =~ s/a/b/g;        # replace all a's with b's;It also uses the g
flag                    # for global    substitution
```

- Here, the s prefix indicates that the pattern between the first / and the second is to be replaced by the string between the second / and the third.

The tr function: Translation

- You can also translate characters using the tr prefix:

  $val =~ tr/a-z/A-Z/;   # translate lower case to upper

- Here, any character matched by the first pattern is replaced by the corresponding character in the second pattern.

The IRE and TRE features

- **perl accepts the IRE and TRE used by grep and sed, except that the curly braces and parenthesis are not escaped.**

  For example, to locate lines longer than 512 characters using IRE:
- perl –ne ‘print if /.{513,}/’ filename # Note that we didn’t escape the curly braces

Editing files in-Place

- perl allows you to edit and rewrite the input file itself. Unlike sed, you don’t have to redirect output to a temporary file and then rename it back to the original file.
- To edit multiple files in-place, use –I option.

  ```
  perl –p –I –e “s/<B>/<STRONG>/g” *.html *.htm
  ```
- The above statement changes all instances of <B> in all HTML files to <STRONG>. The files themselves are rewritten with the new output. If in-place editing seems a risky thing to do, oyu can back the files up before undertaking the operation:

  ```
  perl –p –I .bak –e “tr/a-z/A-Z” foo[1-4]
  ```
- This first backs up foo1 to foo1.bak, foo2 to foo2.bak and so on, before converting all lowercase letters in each file to uppercase

File Handling

- To access a file on your UNIX file system from within your Perl program, you must perform the following steps:

1. First, your program must open the file. This tells the system that your Perl program wants to access the file.
2. Then, the program can either read from or write to the file, depending on how you have opened the file.
3. Finally, the program can close the file. This tells the system that your program no longer needs access to the file.

- To open a file we use the open() function.

  open(INFILE, “/home/srm/input.dat”);
- INFILE is the file handle.
- The second argument is the pathname.
- If only the filename is supplied, the file is assumed to be in the current working directory.

  open(OUTFILE,”>report.dat”); # Opens the file in write mode

  open(OUTFILE,”>>report.dat”); # Opens the file in append mode

Example

- The following script demonstrates file handling in perl. This script copies the first three lines of one file into another.

```
#!/usr/bin/perl
open(INFILE, “desig.dat”) || die(“Cannot open file”);
open(OUTFILE, “>desig_out.dat”);
while(<INFILE>) {
  print OUTFILE if(1..3);
}
close(INFILE);
close(OUTFILE);
```

File Tests

- perl has an elaborate system of file tests that overshadows the capabilities of Bourne shell and even find command that we have already seen.
- You can perform tests on filenames to see whether the file is a directory file or an ordinary file, whether the file is readable, executable or writable, and so on.
- Some of the file tests are listed next, along with a description of what they do.

if -d *filename*	True if file is a directory
if -e *filename*	True *if* this file exists
if -f *filename*	True if it is a file
if -l *filename*	True if file is a symbolic link
if -s *filename*	True if it is a non-empty file
if -w *filename*	True if file writeable by the person running the program
if -x *filename*	True if this file executable by the person running the program
if -z *filename*	True if this file is empty
if -B *filename*	True if this is a binary file
if -T *filename*	True if this is a text file

Subroutines

- The use of subroutines results in a modular program. We already know the advantages of modular approach. (They are code reuse, ease of debugging and better readability).
- Frequently used segments of code can be stored in separate sections, known as subroutines. The general form of defining a subroutine in perl is:

```
sub procedure_name  {
        # Body of the subroutine
}
```

- Example: The following is a routine to read a line of input from a file and break it into words.

```
sub get_words {
$inputline = <>;
@words = split(/\s+/, $inputline);
       }
```

Subroutines

Precede the name of the subroutine with & to tell perl to call the subroutine.
The following example uses the previous subroutine get_words to count the number of occurrences of the word “the”.

```
#!/usr/bin/perl
$thecount = 0;
&get_words;                Call the subroutine
while ($words[0] ne "") {
  for ($index = 0; $words[$index] ne "";                                   $index += 1) {
   $thecount += 1 if $words[$index] eq "the";
}
&get_words;
}
```

Return Values

In perl subroutines, the last value seen by the subroutine becomes the subroutine's return value.
That is the reason why we could refer to the array variable @words in the calling routine.