Active PERL 5.6

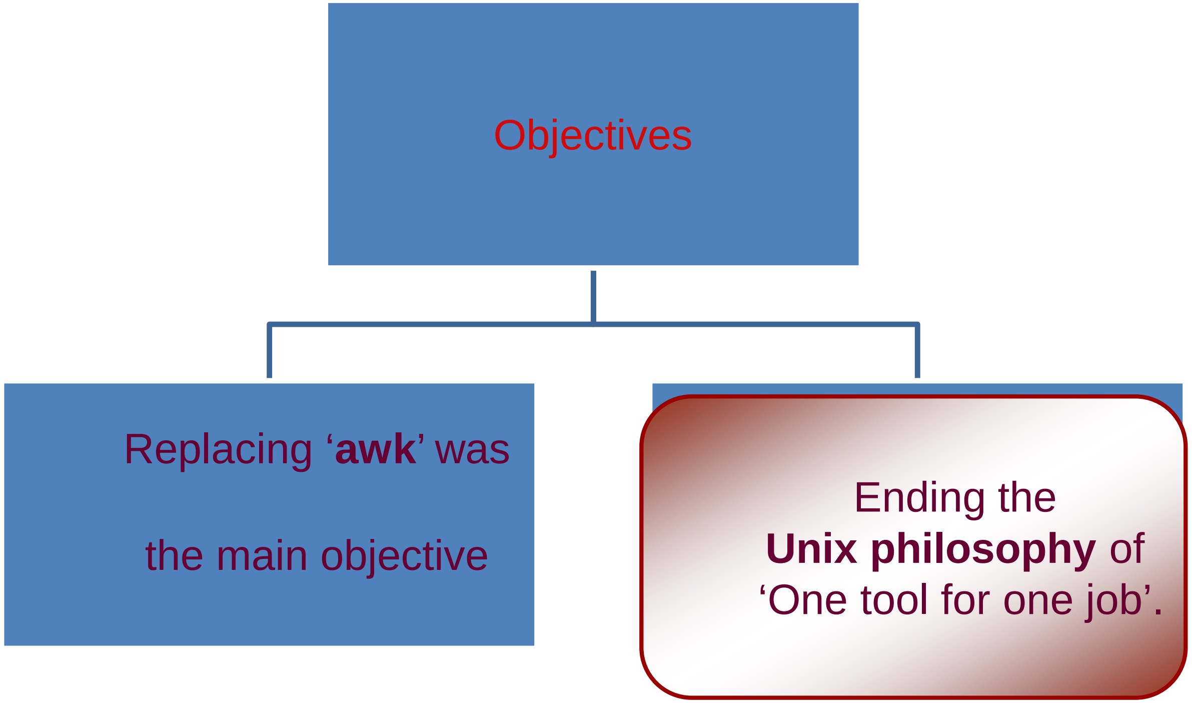
PERL

Introduction to PERL

Overview

- **Full Forms:**
  - Practical Extraction and Report Language
  - Practically Everything Really Likable
  - Pathologically Eclectic Rubbish Lister
- **PERL was developed by Larry Wall.**
- **It is originally written in C.**
- **It started as a ‘glue language’.**
- **Its first release was in December 1987.**

Objectives



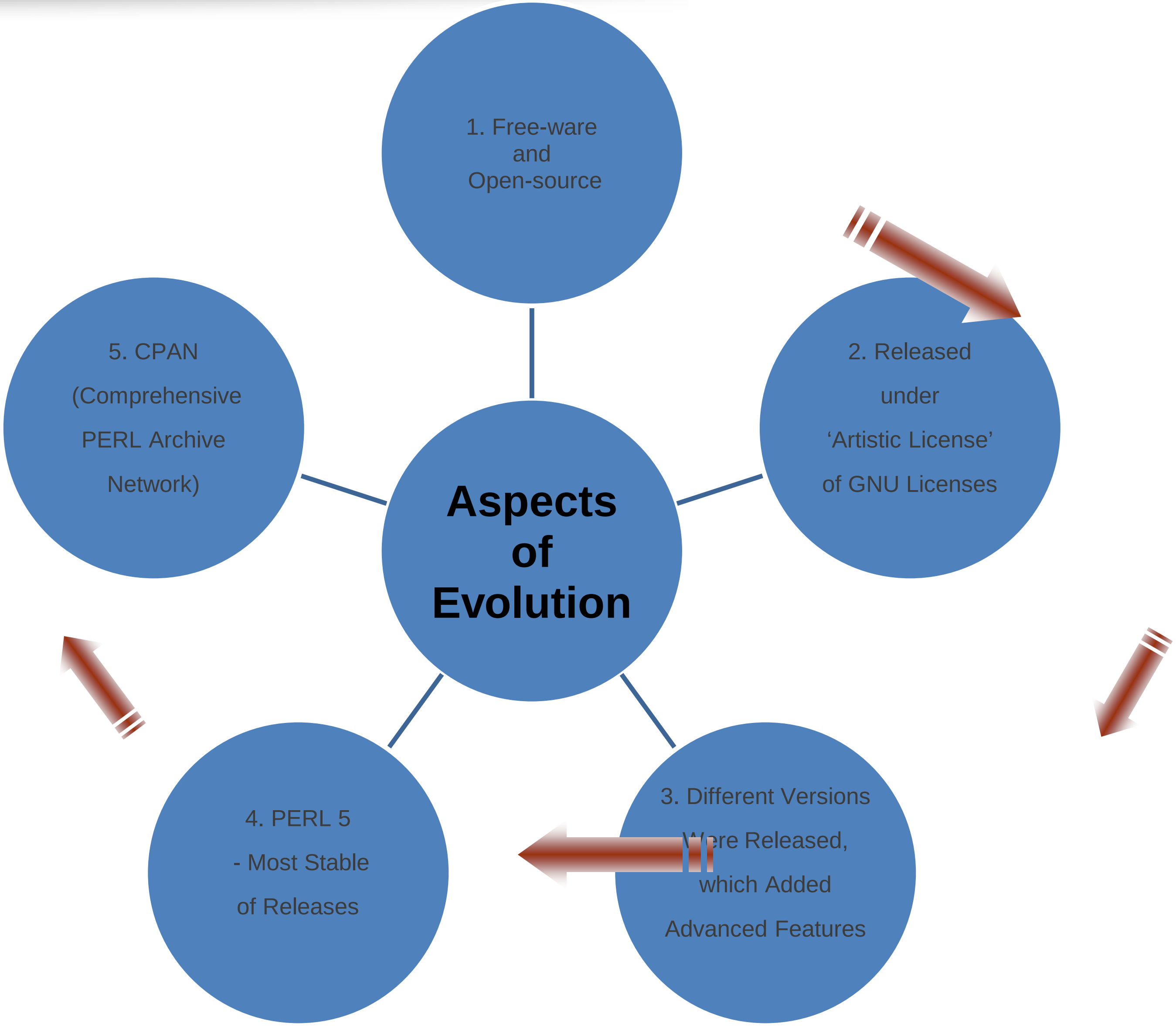
Objectives

Replacing ‘**awk**’ was

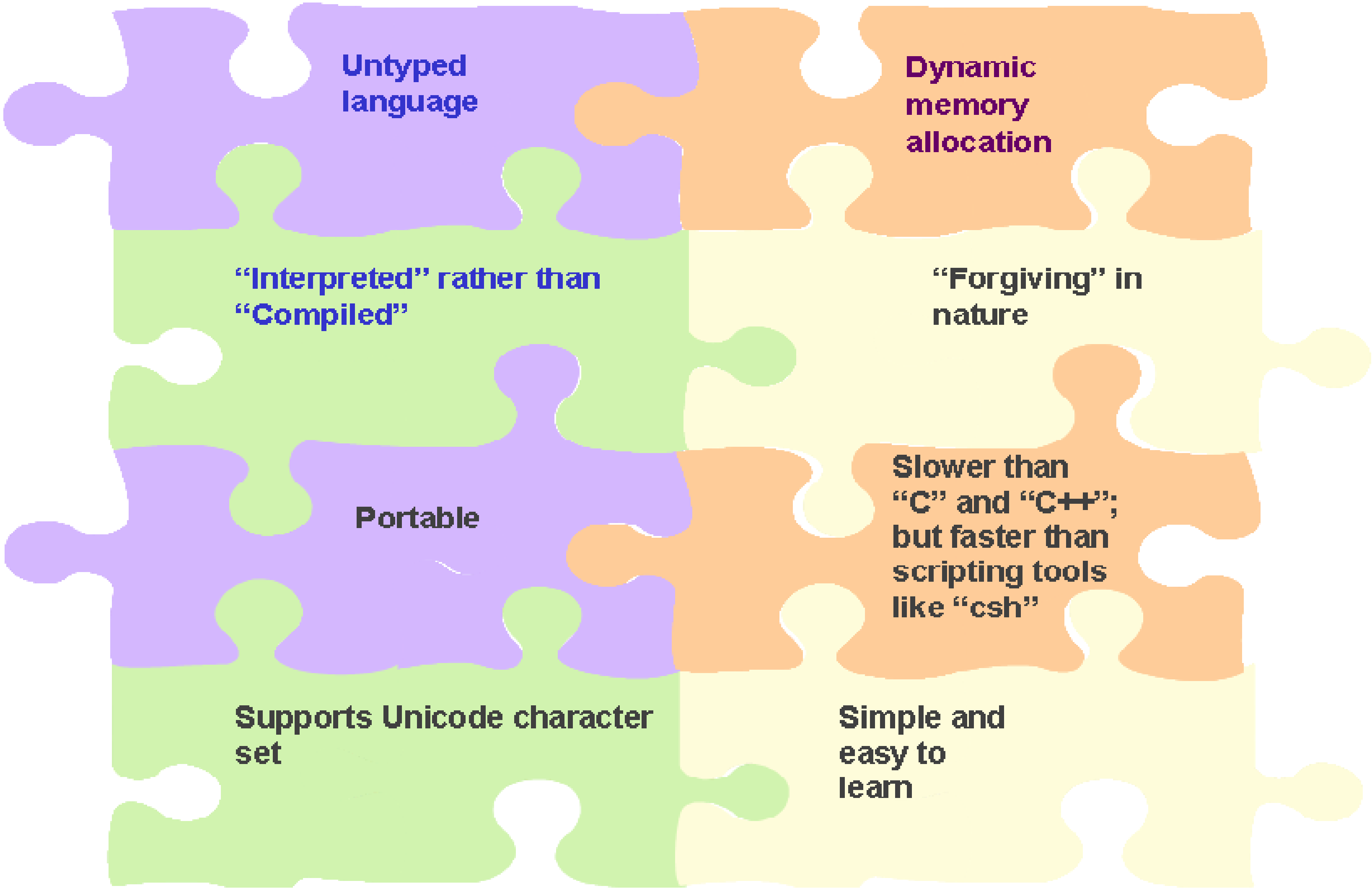
the main objective

Ending the
Unix philosophy of
‘One tool for one job’.

Several Aspects of Evolution


Aspects of Evolution
1. Free-ware and Open-source
2. Released under 'Artistic License' of GNU Licenses
3. Different Versions Were Released, which Added Advanced Features
4. PERL 5 - Most Stable of Releases
5. CPAN (Comprehensive PERL Archive Network)

Features of PERL



Untyped language

Dynamic memory allocation

"Interpreted" rather than "Compiled"

"Forgiving" in nature

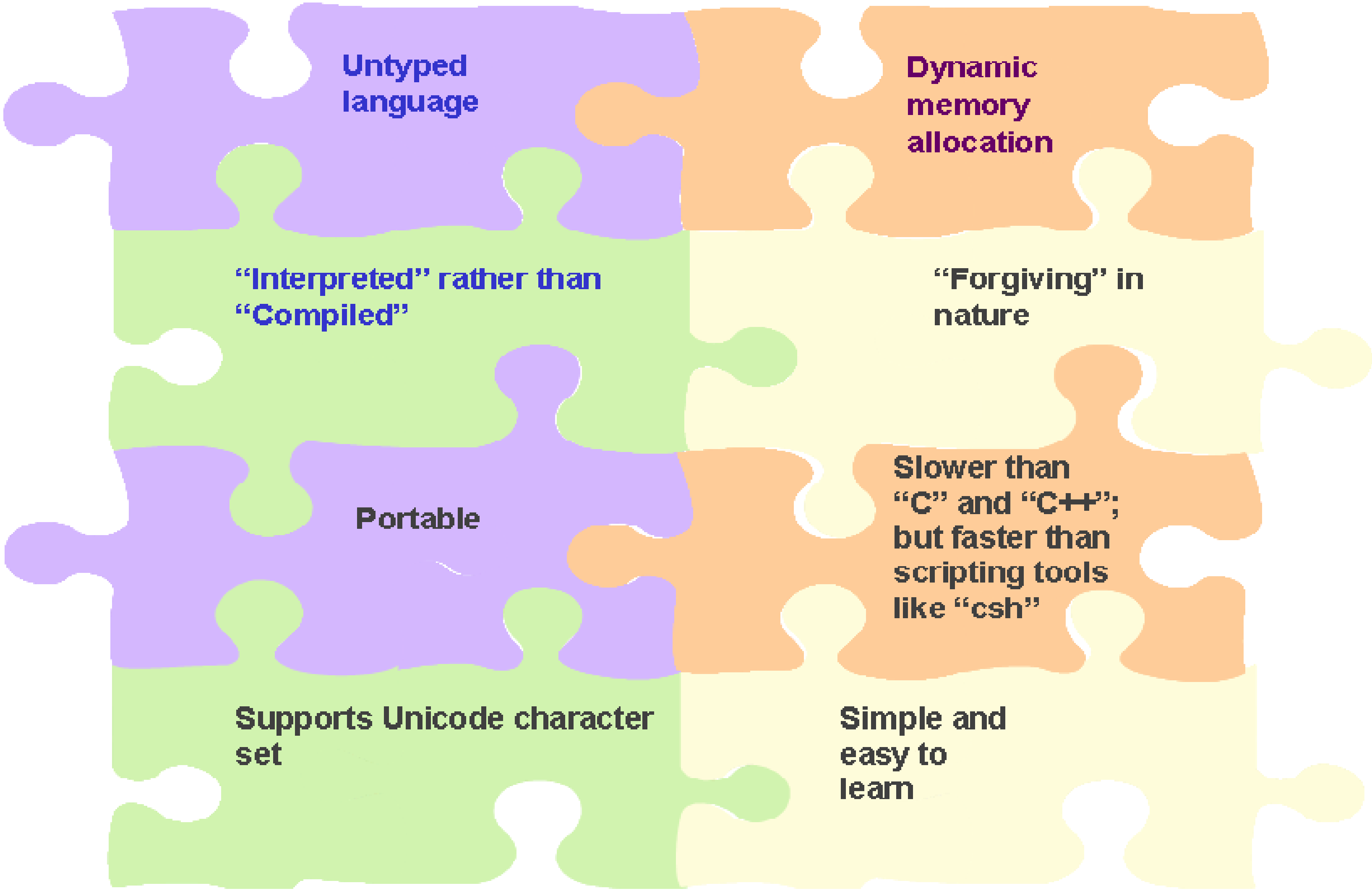
Portable

Slower than "C" and "C++"; but faster than scripting tools like "csh"

Supports Unicode character set

Simple and easy to learn

Features of PERL (Contd…)



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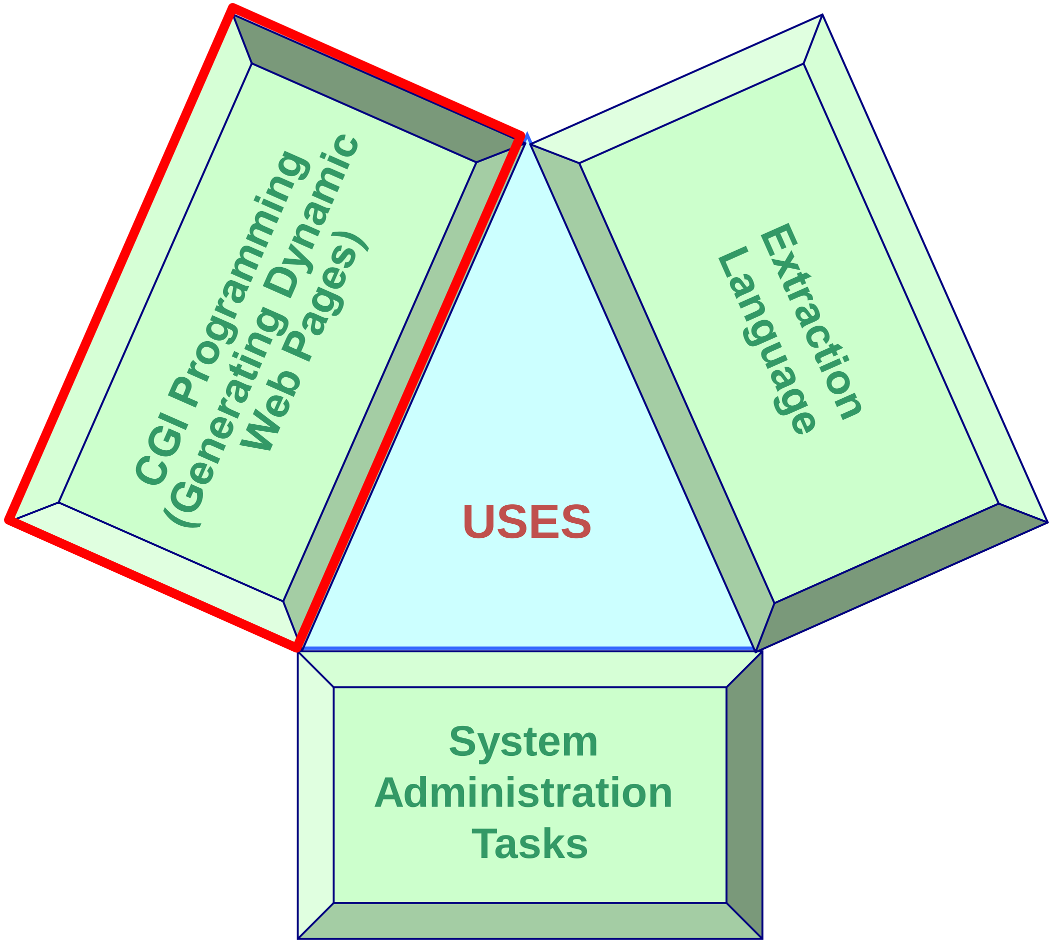
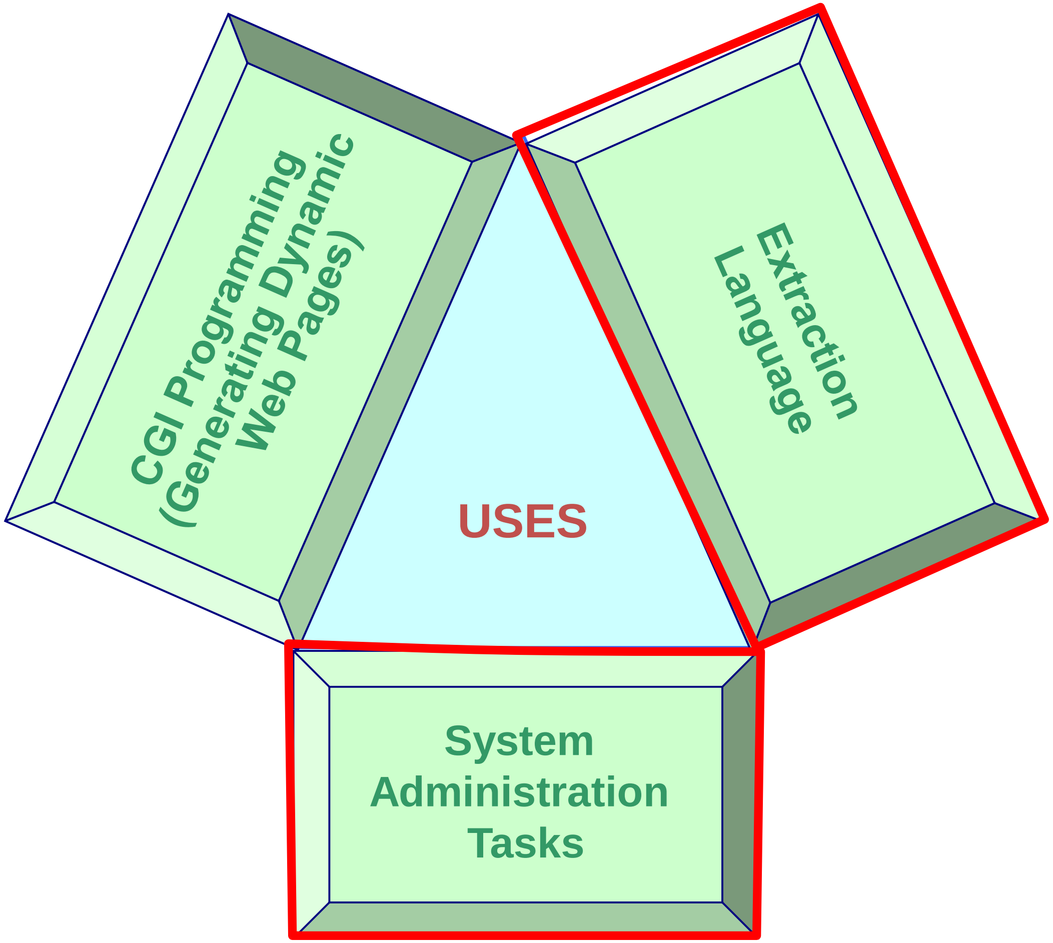
Manifold Uses of PERL



Manifold Uses of PERL (Contd…)



PERL

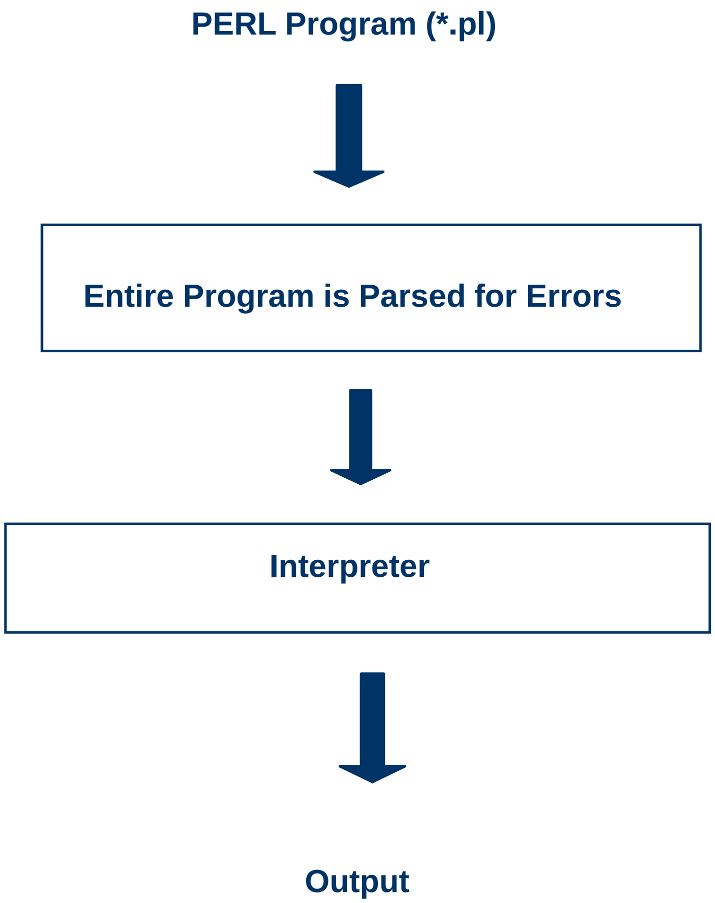
Writing PERL Program

First PERL Program

First.pl

```
#! /usr/bin/perl  -w


print (“Hello, World!\n”);
```



PERL Program (*.pl)

Entire Program is Parsed for Errors

Interpreter

Output

Using the Print Function

- **The print function dumps the output into the screen.**
- **Syntax**

```
print FILEHANDLE LIST
```

  - For example, print “Hello Good Morning”;

- **When no handler is specified, the default handler is STDOUT (Standard Output File) for the print function.**

Using the Print Function (Contd…)

- **Escape characters are used to perform text formatting.**
- **These characters are preceded by a backslash(\).**
- **Some of the escape characters as follows:**
  - \n – New Line
  - \t – Tab
  - \” – Double quotation
  - \’ – Single Quotation
  - \\ - Backslash
  - \0 – Octal characters
  - \x –Hexadecimal characters

PERL

Literals and Variables

Introduction to Literals

- **Literals are the values that remain constant throughout program execution.**
- **These are classified as follows:**
  - Numeric Literals
    - Integers
    - Floating – ponmt
    - Octal
    - Hexadecimal
    - Binary
  - String Literals

Numeric Literals

- **Following are the examples of Numeric Literals:**
  - 23(unsigned literal)
  - -23(signed literal)
  - 23_500 (Integer Literal equivalent to 25,000)
  - 23.59
  - 23E05 (Floating-point Literal using scientific notation)
  - 0712 (Octal Literal)
  - 0x12A (Hexa decimal Literal)
  - 0b101011 (Binary Literal)

String Literals

- **The String literals are always enclosed in the following:**
  - Single quotes (or q operator)

    or
  - Double quotes (or qq operator)
- **When enclosed in single quotes, the special characters or control characters are not interpolated; whereas, in double quotes, their meaning is substituted.**
- **For example,**
  - ‘Hello World\n’
  - “Hello World\n”
  - q/Hello World/
  - qq/Hello World/

Using Variables

- **Values of variables can vary throughout the program.**
- **They are categorized into the following three types based on the values they hold:**
  - Scalar Variable (preceded by $)
  - Array Variables (preceded by @)
  - Associative Array Variables (Hashes) (preceded by %)
- **Variable names are case-sensitive and they should:**
  - Specify the type of variable (scalar, array, hash)
  - Begin with an alphabet or an underscore

Scalar Variables

- Scalar Variable is the name for a data space in memory.
- It is represented by a variable name preceded by $.
- Each scalar variable holds a single value.
- The scalar variables are untyped variables.
- Their values can be numeric, string, undefined or reference.
- Assignment operator “=“ is used to assign a literal value.
- Type of data is determined in the context of uses of the variables.
- These are global variables by default.

What Is the Scope of Variables?

- **Scope of a variable refers to the visibility of the variable in the code.**
- **By default, variables are global in PERL.**
- **Variables are categorized into two types:**
  - Lexical Variables (confined to the block in which they are defined)
  - Dynamic Variables

Lexical Variables

- **Lexical Variables are:**
  - Confined to the block in which they are declared.
  - Declared using the my keyword.
    - For example,

      my $x=10;
  - Stored in a scratch patch (private symbol table and not package's symbol table), when they are created instead of symbol table.
  - Erased from memory as soon as they go beyond the scope of the block.

Dynamic Variables

- **Dynamic Variables:**
  - {Belong to the package in which they are declared.}
  - Global in nature
  - Declared using the our or local keyword
    - For example,

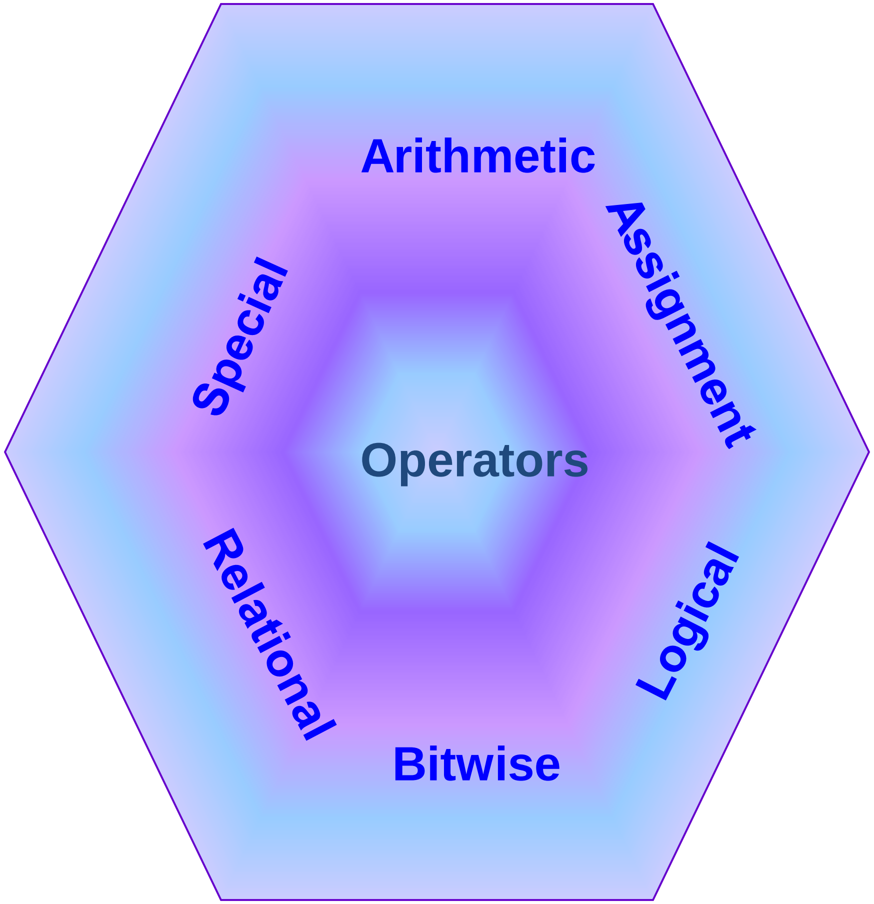
      our $x=10;
  - Stored in symbol table
  - Accessed using the name of the package in which they are defined

PERL

Operators in PERL

Introduction

- **Operators in PERL are classified into:**
  - Arithmetic Operators
  - Assignment Operators
  - Logical Operators
  - Bitwise Operators
  - Relational Operators
  - Special Operators

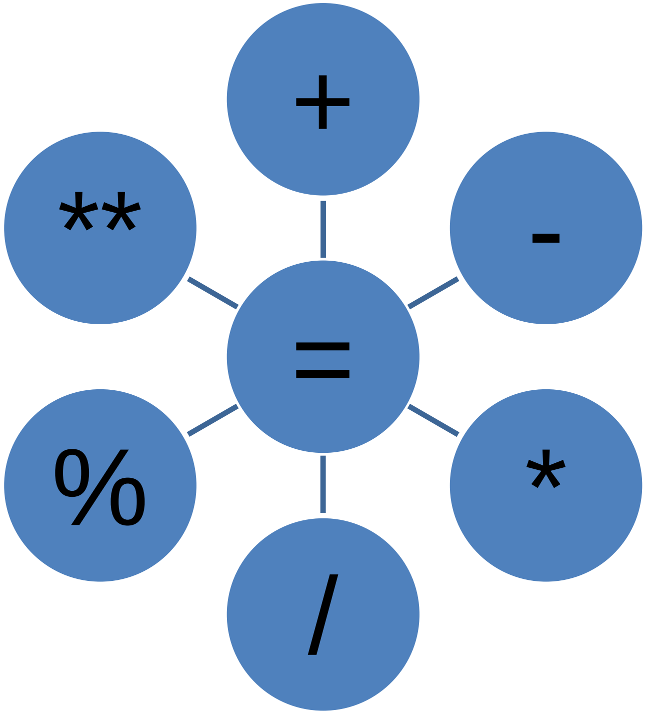


Arithmetic Operators

- **The Arithmetic operators are used to perform arithmetic operations.**
- **They are further classified into the following:**
  - Unary
    - ++(Increment), --(Decrement),-
  - Binary
    - +, -, *, /, %(Modulus), **(Exponent)

Arithmetic Operators

- **The = operator is the basic Assignment operator.**
- **Following operators perform operations and are used for the assign function:**
  - +=(Add and Assign)
  - -=(Subtract and Assign)
  - *=(Multiply and Assign)
  - /=(Divide and Assign)
  - %=(Modulus and Assign)
  - **=(Exponent and Assign)

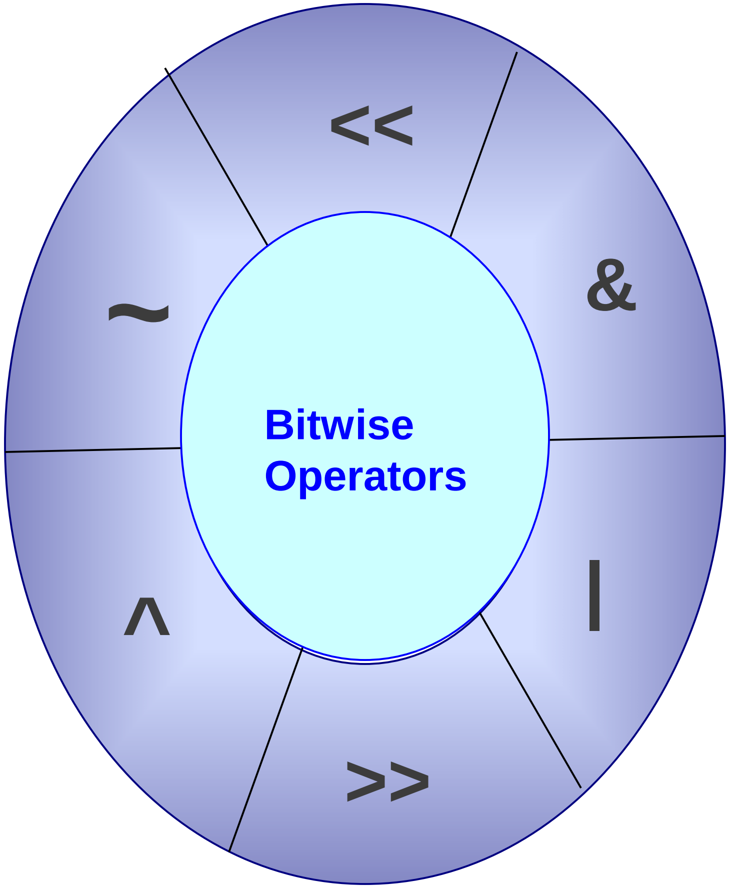


Logical Operators

- **Logical operators are mainly used to control the program flow.**
- **They are as follows:**
  - op1 && op2: logical AND.
  - op1 || op2: OR.
  - !op1:NOT.

Bitwise Operators

- **The bitwise operators work on binary representations of data, that is, at the bit-level.**
- **They are as follows:**
  - & : AND operator
  - | : OR operator
  - ^ : EXCLUSIVE-OR operator
  - ~   : COMPLEMENT operator
  - >> :SHIFT RIGHT
  - << :SHIFT LEFT



Relational Operator

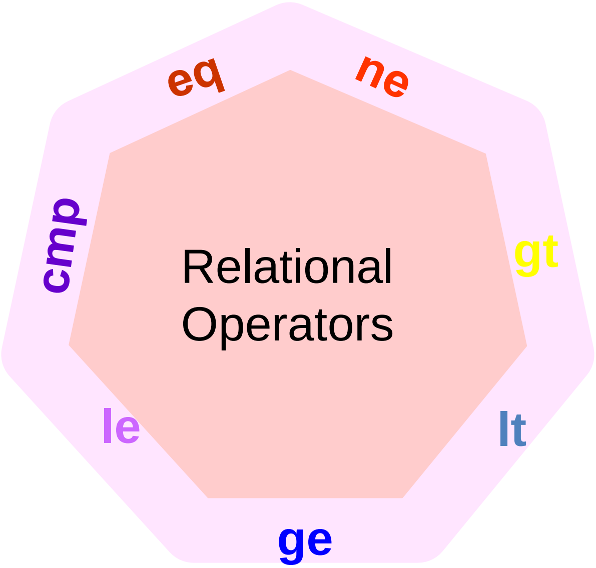
- **The Relational operators are used for comparison of numbers or strings.**
- **They work differently in both numbers and strings.**
- **They are categorized into two types:**
  - Numeric Comparison
  - String Comparison
- **When these operators are used with Numeric Comparison operators, the actual numeric value is used for comparison.**
- **When these operators are used with String Comparison operators, comparison is based on the ASCII value of the characters involved.**

Overview

- **For Numeric comparison, comparison is based on the actual numeric values.**
- **The following are called as Relational operators:**
  - ==(equal to)
  - !=(not equal to)
  - > (greater than)
  - < (less than)
  - >= (greater than or equal to)
  - <= (less than or equal to)
  - < = > Inequality Operator (Spaceship Operator)

Overview (Contd…)

- **In case of String Comparison operators, comparison is based on ASCII value of characters.**
- **Following are the Relational operators:**
  - eq (equal to)
  - ne (not equal to)
  - gt (greater than)
  - lt (less than)
  - ge (greater than or equal to)
  - le (less than or equal to)
  - cmp (Inequality Operator)



Overview

- Range Operator
  - ..
- Concatenation Operator
  - .
- Repetition Operator
  - x

PERL

Control Structures

Branching Statements

- **You use branching statements for changing the flow of program execution depending on the evaluation of a relational expression.**
- **PERL supports mainly two branching statements:**
  - If – elsif – else
  - unless

If–Else Construct

- **Syntax**

```
if (expr_1)
{
statement_block_1
}
 elsif (expr_2)
{
 statement_block_2
 }
else
{
      statement_block_4 ...
}
```

```
$x=30;
if($x > 4)
{
      print "Number is greater than 4";
}
elsif ($x < 4)
{
      print "Number is less than 4";
}
else
{
      print "Numbers are Equal";
}
```

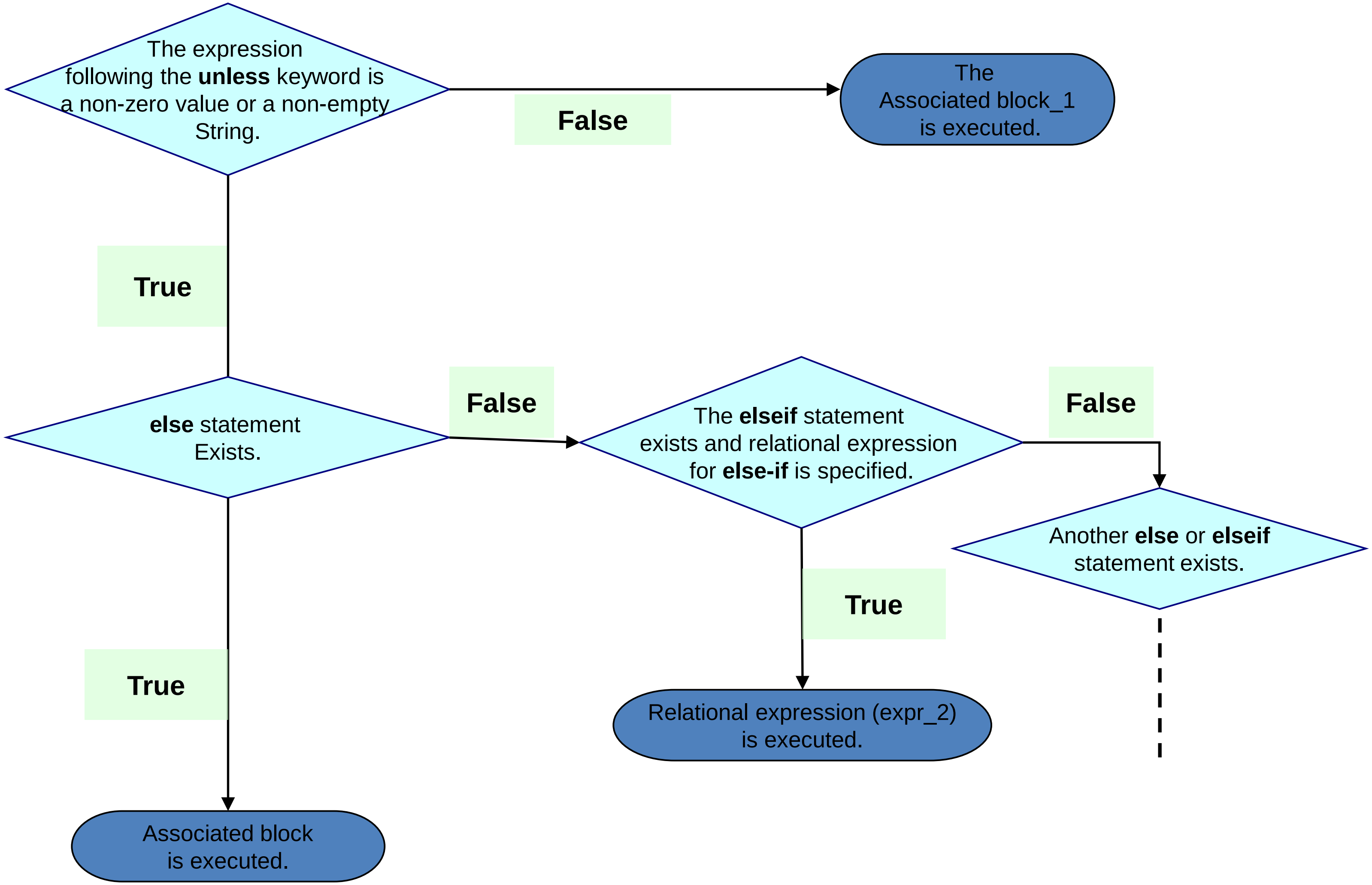
The Unless Construct

- **Syntax**

```
unless (expression)
{
        statement_block 1;
}
elsif (expression)
{
        statement_block 2;
}
else
{
        statement_block 3;
}
```

```
$x=30;
unless($x > 4)
{
        print "Number is less than 4";
}
elsif ($x > 4)
{
        print "Number is greater than
4";
}
else
{
        print "Numbers are Equal";
}
```

The Unless Construct (Contd…)


The expression following the **unless** keyword is a non-zero value or a non-empty String.
False
The Associated block_1 is executed.
True
else statement Exists.
False
The **elseif** statement exists and relational expression for **else-if** is specified.
False
Another **else** or **elseif** statement exists.
True
Relational expression (expr_2) is executed.
True
Associated block is executed.

Looping Statements

- **Statements are used to perform code iterations.**
- **Following are the Loops supported in PERL:**
  - while
  - do-while
  - until
  - Do-until
  - for
  - foreach

The While Loop

- **Syntax**

```
while (expr_1)
{
        some statements
        [while (expr_2)
        {

        statement_block
        } ]
        statement_block
}
```

```
$count = 1;
print (“\n Numbers from 1 to 5 \n");
while ($count <= 5)
{
        print  $count. "\n";
        $count = $count + 1;
 }
 print ("End of loop.\n");
```

The Do-While Loop

- **Syntax**

```
do
{
   statement_block
 } while (expression);
```

```
$count = 1;
print (“\n Numbers from 1 to 5 \n");
do{
              print  $count. "\n";
             $count = $count + 1;
 } while ($count <= 5) ;

 print ("End of loop.\n");
```

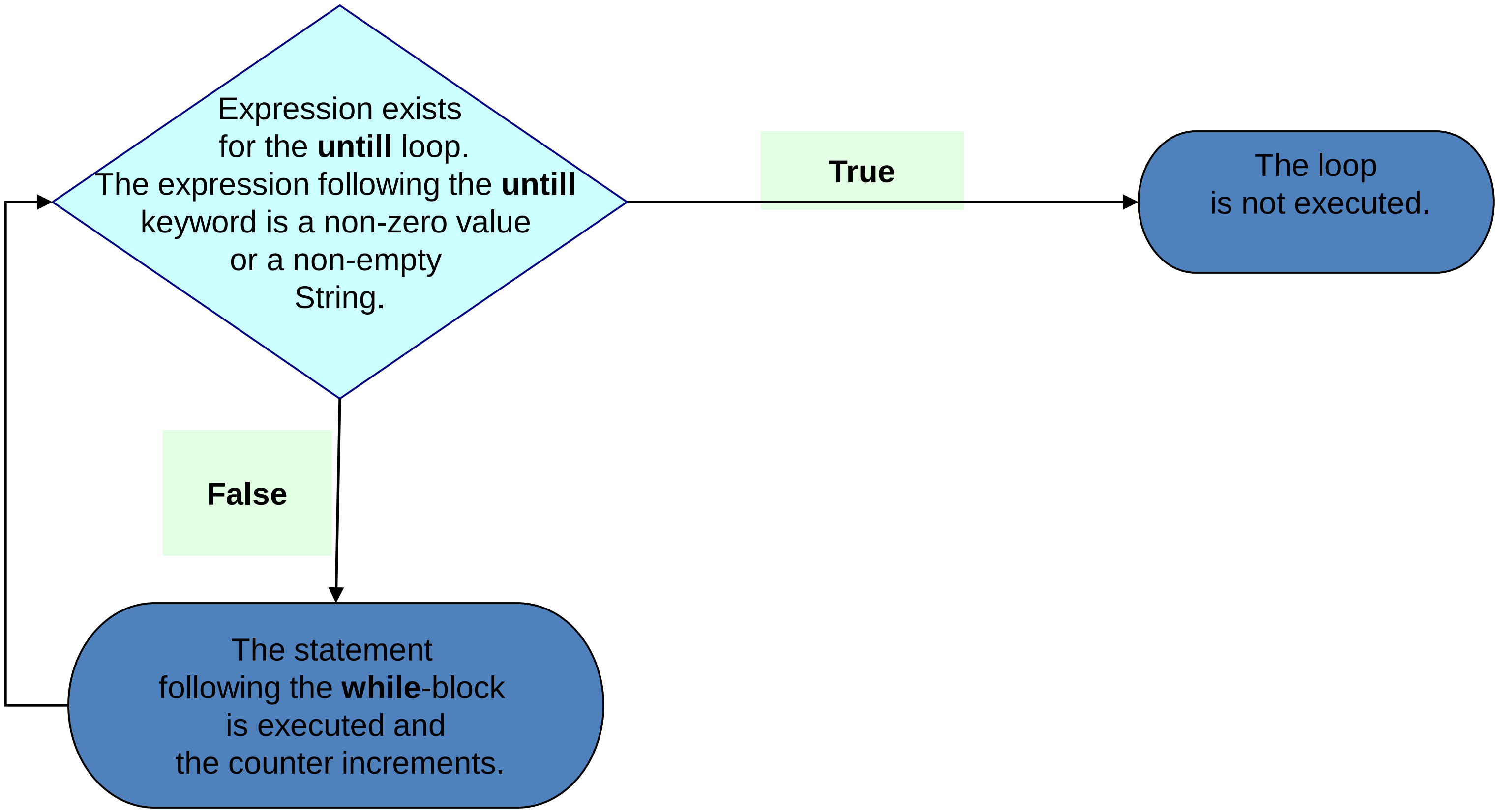
The Until Loop

- **Syntax**

```
until (expr)
{
   //statement_block
}
```

```
$count = 1;
print (“\n Numbers from 1 to 5 \n");
until ($count > 5)
{
              print  $count. "\n";
             $count = $count + 1;
 }
 print ("End of loop.\n");
```

The Until Loop (Contd…)



Expression exists
for the **untill** loop.
The expression following the **untill**
keyword is a non-zero value
or a non-empty
String.

True

The loop
is not executed.

False

The statement
following the **while**-block
is executed and
the counter increments.

The Do-Until Loop

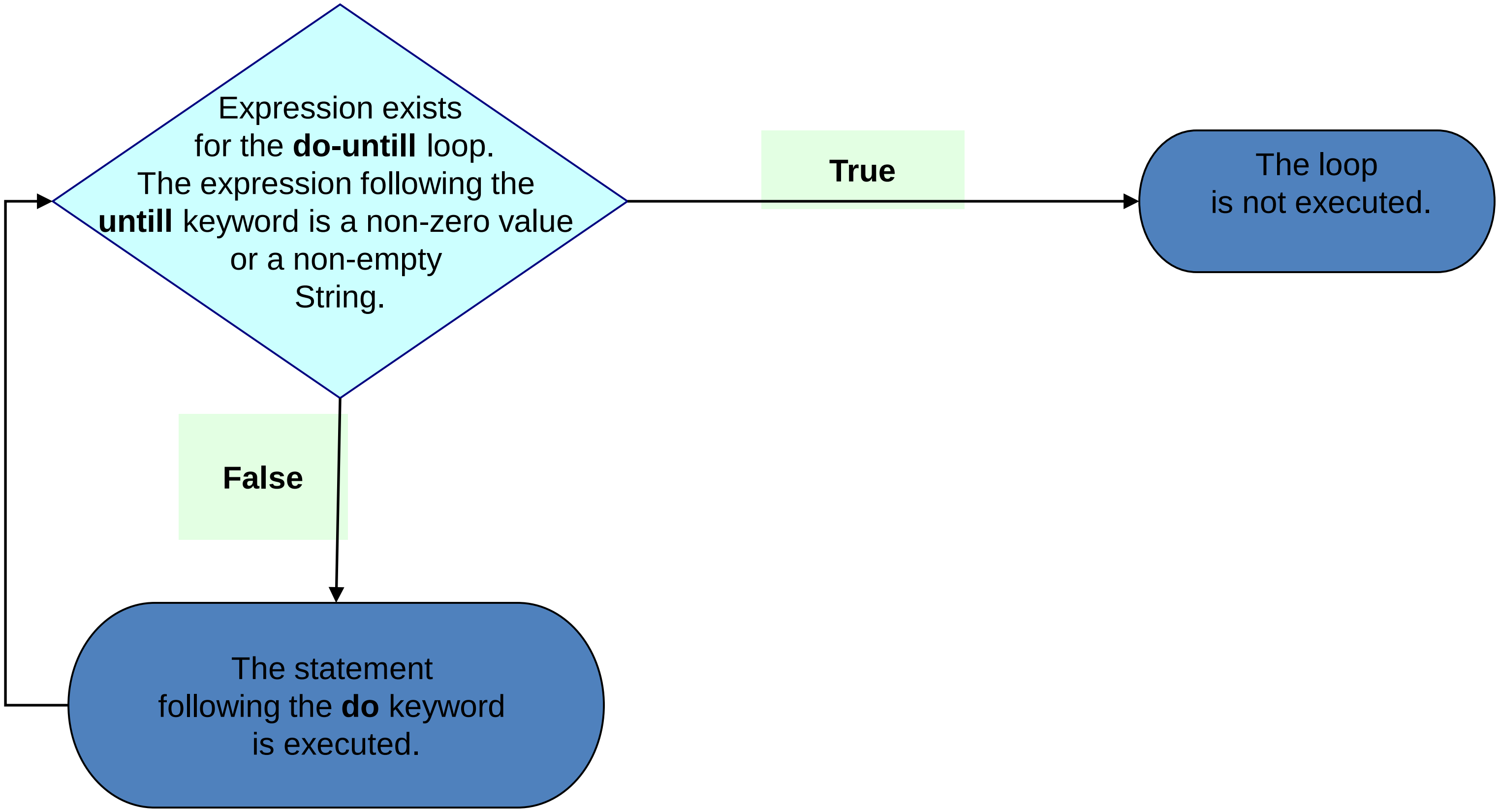
- **Syntax**

```
do
{
   //statement_block
} until (expr) ;
```

```
$count = 1;
print (“\n Numbers from 1 to 5 \n");
do{
              print  $count. "\n";
             $count = $count + 1;
 } until ($count > 5)

 print ("End of loop.\n");
```

The Do-Until Loop (Contd…)


Expression exists
for the **do-untill** loop.
The expression following the
untill keyword is a non-zero value
or a non-empty
String.
True
The loop
is not executed.
False
The statement
following the **do** keyword
is executed.

The For Loop

- **Syntax**

```
for (starting assignment;
test condition; increment)
{
    statement_block
}
```

```
print (“\n Numbers from 1 to 5");
for ($count=1;$count<=5;$count++)
{
            print  $count. "\n";
 }
 print ("End of loop.\n");
```

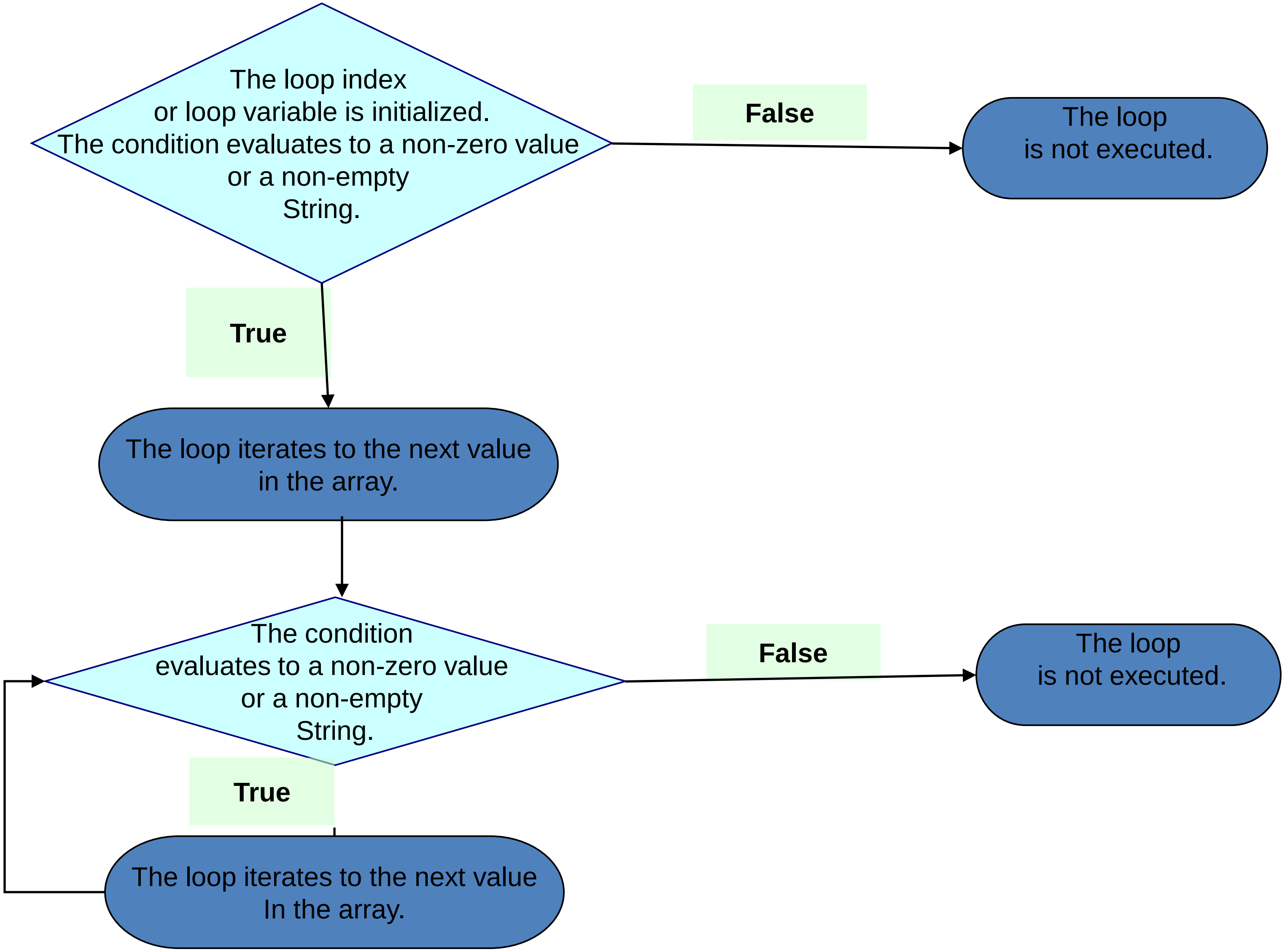
The Foreach Loop

- **Syntax**

```
foreach variable(arrayname)
{
   statement_block
}
```

```
print (“\n Numbers from 1 to 5 \n");
foreach $x (1..5)
{
              print  $x. "\n";
 }
 print ("End of loop.\n");
```

The Foreach Loop (Contd…)


The loop index
or loop variable is initialized.
The condition evaluates to a non-zero value
or a non-empty
String.
False
The loop
is not executed.
True
The loop iterates to the next value
in the array.
The condition
evaluates to a non-zero value
or a non-empty
String.
False
The loop
is not executed.
True
The loop iterates to the next value
In the array.

Other Control Structures

- **PERL supports some other control structures also which can be used in conjunction with the basic flow structures to change the flow of control.**
- **They are as follows:**
  - continue
  - next
  - last
  - redo
  - goto

The Continue Block

- **Continue block is normally attached to a block (while, until or foreach).**
- **It is executed before the condition is evaluated for the next iteration.**
- **It is used in situations, where the code is to be executed after each iteration of loop.**

The Continue Block (Contd…)

- **Syntax**

```
continue
{
  statement_block

 }
```

```
$count = 1;
print (“\n Numbers from 1 to 5");
while($count<=5)
{
            print $count."\n";
}
continue
{
            $count++;
}
 print ("End of loop.\n");
```

The Next Block

- The next block alters the flow of execution within the loop body.
- It is also known as a loop modifier. Other modifiers are last and redo.
- It skips the rest of processing of body to go forward with the next iteration of loop.
- It executes the continue block, if present before the start of the next iteration.

The Next Block (Contd…)

- **Syntax**

```
next [LABEL];
```

```
$count=1;
print "Odd numbers \n";
while($count<=5)
{
          if ($count%2==0)
          {          next;     }
          else
          {          print $count."\n";          }
}
continue
{          $count++;   }
print "\n End of Loop";
```

The Last Block

- **The last modifier skips the rest of processing of the body to exit the loop.**
- **The control is transferred beyond the last iteration of the loop.**
- **It doesn’t execute the code in the continue block.**

The Last Block (Contd…)

- **Syntax**

```
last [LABEL];
```

```
$count = 0;
print (“\n Numbers from 1 to 5");
while ($count<=10)
{
            $count++;
            print "$count\n";
            last if $count==5;
}
 print ("End of loop.\n");
```

The Redo Loop

- This modifier restarts with the current iteration of the loop.
- Loop condition is not re-evaluated.
- It retains the current value of the loop iterator.
- Continue block is not executed.

The Redo Loop (Contd…)

- **Syntax:**

```
redo;
```

```
$count=1;
while ($count<=10)
{
        $count++;
        print"$count\n";
        if ($count==5)
        {
                print "$count \n";
                redo;
        }
}
```

The Goto Modifier

- **The goto modifier is used to jump over iterations or statement thereby altering the normal flow of control.**
- **As soon as goto is encountered, control is transferred over to the LABEL or expression that evaluates to a LABEL or to the subroutine being referred to.**

The Goto Modifier (Contd…)

- **Syntax**

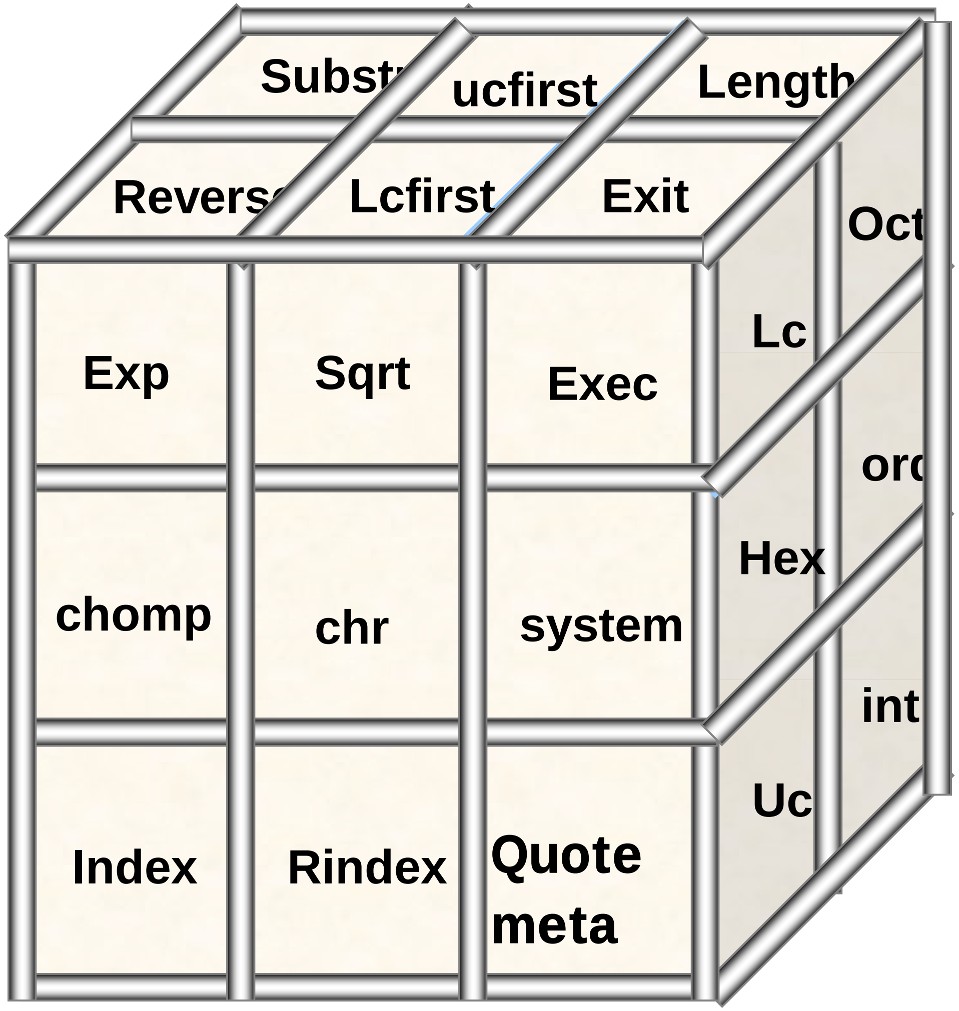
```
goto LABEL
Or
goto EXPR
Or
goto &NAME
```

```
print "\n Hi";
goto Second;

print "\n So let's part";
goto First;
First: print "Good Bye";
Second : print “ Hello";
```

Built-in Functions in PERL

PERL contains the following built-in functions:



Subst ucfirst Length

Revers Lcfirst Exit

Exp Sqrt Exec

chomp chr system

Index Rindex Quote meta

Lc Hex Uc

Oct ord int

Built-in Functions in PERL (Contd…)

The Abs Function:

- The **abs** function returns the absolute value of the given value.
- If no argument is passed, it returns the absolute of the value contained in $_.

For example,

```
print abs(-3);
#prints the output as 3.
```

The Sqrt Function:

- The **sqrt** function returns the square root of the given value.
- It gives an error, if the specified value is a non-numeric value or expression, or if the value evaluates to a negative number.

For example,

```
print sqrt(4);
#prints the value as 2.
```

Built-in Functions in PERL (Contd…)

The Exp Function:

- The **exp** function returns the value of e to the power of the given value.

  For example,

```
print exp(-3);
```

#prints the output as e-3. i.e 0.498706

The int Function:

- The **int** function returns the integer part given value.

  For example,

```
print int(-3.9);
```

#prints the output as -3.

Built-in Functions in PERL (Contd…)

- **The Chomp Function:**
  - The **chomp** function returns the value after removing the new line-character.

    For example,

    ```
    $str="Hello World \n";
    chomp( $str);
    print $str;
    ```

    #prints the value Hello World but does not take the cursor to the next line.

Built-in Functions in PERL (Contd…)

The Chr Function:

- The **chr** function returns the character corresponding to a specific ASCII code.

  For example,

```
$asc=65;
print chr($asc);
```

#prints A.

The Ord Function:

- The **ord** function returns the ASCII code for a particular character.

  For example,

```
$chr=“A”;
print ord($chr);
```

#prints 65.

Built-in Functions in PERL (Contd…)

- **The Hex Function:**
  - The **hex** function returns the decimal value of an expression interpreted as a hexadecimal string.

    For example,

```
$x = hex ("0xa2");
# value of $x is 162

$x = hex ("a2");
# value of $x is 162

$x = hex (0xa2);
# value of $x is 354 (!)
```

Built-in Functions in PERL (Contd…)

The Oct Function

- The **oct** function returns the decimal value of an expression interpreted as a octal string.

  For example,

```
$x = oct ("042");
# $x is 34.
$x = oct ("42");
# $x is 34.
$x = oct ("0x42");
# $x is 66.
```

Built-in Functions in PERL (Contd…)

The Length Function:

- The **length** function returns the number of characters in the given string.

For example,

```
print length(“KLFS Computers”);
#prints the value as 15.
```

The lc Function:

- The **lc** function converts all the characters of the given string to lowercase.

For example,

```
print lc(“KLFS Computers”);
#prints the value as klfs computers.
```

Built-in Functions in PERL (Contd…)

The Lcfirst Function:

- The **lcfirst** function converts the first character of the given string to lowercase.

For example,

```
print lcfirst(“KLFS Computers”);
#prints the value as klfs Computers.
```

The Ucfirst Function:

- The **ucfirst** function converts the first character of the given string to uppercase.

For example,

```
print ucfirst(“klfs Computers”);
#prints the value as KLFS Computers.
```

Built-in Functions in PERL (Contd…)

- **The Uc Function:**
  - The **uc** function converts all the characters of the given string to uppercase.

    For example,

```
print uc("KLFS Computers");
```

#prints the value as KLFS COMPUTERS.

Built-in Functions in PERL (Contd…)

The Reverse Function:

- The **reverse** function reverses the characters in the given string or array or hash.
- It does not make changes in the actual data structure.

For example,

```
$str=reverse("KLFS Computers");

print "\n",$str;
```

#prints the value sretupmoC SFLK .

```
print "\n".reverse("A B C D");
```

#prints the value D C B A.

```
print "\n".reverse("101 102 103");
```

#prints the value as 301 201 101.

Built-in Functions in PERL (Contd…)

The Substr Function:

- The **substr** function returns a part of the given string.
- Syntax:

```
substr($str, $offset, $length)
```

- String is the string for which the subpart is to be fetched.
- Offset is the position from which the values should be fetched.
- Length is the number of characters to be fetched from the specified offset.

Built-in Functions in PERL (Contd…)

- **Code snippet (substr)**

```
$str=substr("KLFS Computers ",3,5);
print "\n",$str
#prints the value ni Co

$str=substr("KLFS Computers ",5);
print "\n",$str;
#prints the value Computers

$str=substr("KLFS Computers ",-5);
print "\n",$str;
#prints unpredicted values
```

Built-in Functions in PERL (Contd…)

- **The Index Function:**
  - The **index** function returns the position of the first occurrence of the substring in the given string.
  - -1 is returned, if the substring is not found.
  - Search commences from left to right.

Built-in Functions in PERL (Contd…)

- Syntax

```
index (String, Substring, Postion)
```

- String is the string for which the subpart is to be searched.
- Substring specifies the part of string to be searched.
- Position from which the search should begin. It is optional. If not specified, the search starts from the beginning of the string.

Built-in Functions in PERL (Contd…)

- **Code snippet**

```
$x= index ("KLFS Computers", « F");
print "\n $x";
# $x is 2

$x = index ("KLFS Computers", "bob");
print "\n $x";
# $x is -1

$x = index ("KLFS COMPUTERS", "S",
4);
print "\n $x";
# $x is 13
```

Built-in Functions in PERL (Contd…)

- **The Rindex Function:**
  - The **rindex** function is same as index, except the Search, which commences in the reverse order from right to left.

Built-in Functions in PERL (Contd…)

- **Code snippet (rindex)**

```
$x= rindex ("KLFS Computers", "t");
print "\n $x";
# $x is 10

$x = rindex ("KLFS Computers", "bob");
print "\n $x";
# $x is -1

$x = rindex ("KLFS COMPUTERS", "s");
print "\n $x";
# $x is 13
```

Built-in Functions in PERL (Contd…)

The Quotemeta Function:

- The **quotemeta** function quotes all non-alphanumeric characters in a string with backslashes.

  For example,

```
$str=quotemeta("KLFS’s Training");
print "\n",$str;
#prints the value KLFS\’s\ Training
```

Built-in Functions in PERL (Contd…)

The Exit Function:

- The **exit** function causes immediate exit from the current program.
- It returns value 1 or 0:
  - 1 indicates failure.
  - 0 indicates success.

Built-in Functions in PERL (Contd…)

The Exec Function:

- The **exec** function abandons the current program to run the given system command.
- It returns no value.
- It does not continue with the program execution after executing system command.

For example,

```
exec(dir);
```

Built-in Functions in PERL (Contd…)

The System Function:

- The **system** function runs the given system command.
- It returns 1 or 0 value.
  - 1 indicates failure in executing the command.
  - 0 indicates successful command execution.
- It continues with the program execution after executing system command.

For example,

```
$x=system(dir);
print “Result of Command execution is :”,$x;
```

Obtaining Input from Keyboard

- **Code snippet**

```
$inputline = <STDIN>;
# read a line of input

print( $inputline );
# write the line out
```

PERL

Arrays

What Are Arrays?

- **Variable storages used for lists are called arrays.**
- **Arrays are also known as collections of scalar values.**
- **They are represented by preceding the variable name by the @ sign.**
- **They can shrink and grow dynamically as elements are added or deleted in the list.**

Array Creation

- **In the following examples, arrays are created from lists:**

```
@language=(“PERL”,”C”,”C++”);
@numbers=(1..10);
@country=(1,”India”,2,”USA”,3,”UK”,4);
@zero=(0)x10;
```

Array Creation (Contd…)

- **In the following examples, arrays are created from other arrays:**

```
@language=(“Hindi”, ”English”, ”French”);
@array=@language;
@languages=(“German”, @language,”Irish”);
@x=(1..20,@languages,@array[2]);
@y=@languages[0,3,4];
@z=@languages[0..3];
```

Process of Accessing Array Elements

- **Following are the examples of accessing individual array elements:**

```
@numbers=qw(one two three four);
$numbers[1];
// Returns two
$numbers[-1];
// Returns four
$numbers[1.9]
// Returns two
```

Process of Accessing Array Elements (Contd…)

- **You can print an entire array.**
  - For example: print @numbers;
    - Output: onetwothreefour
  - For example: print “@numbers”;
    - Output: one two three four
- **Special variable $, stores the output field separator.**
  - For example: $,=“:”;

    print @numbers;
    - Output: :one:two:three:four,

Process of Accessing Array Elements (Contd…)

- **There are other ways to access, process or traverse all the array elements individually. This can be achieved using the following loops:**
  - The **foreach** loop
  - The **while** loop
  - The **for** loop

Accessing Array Elements - The Foreach Loop

- **Code snippet**

```
@numbers = qw ( one two three four);
print “The Array contains : \n";
foreach $number (@numbers)
{
        print "$number\n";
}
```

Accessing Array Elements - The While Loop

- **Code snippet**

```
@numbers=qw ( one two three four);
$n = 0;
print “The Array contains : \n";
while ($numbers[$n])
 {
      print "\n $numbers[$n] \n";
      $n++;
}
```

Accessing Array Elements - Length of Array

- **Length of the array or the number of elements in an array can be determined in two ways:**
  - Scalar
    - For example,

```
print “length of Array: scalar(@numbers)”;
```

  - Assigning array to a scalar value
    - For example,

```
$length=@numbers;
print “Length Of Array: $length”;
```

Accessing Array Elements - The For Loop

- **Code snippet**

```
@numbers=qw(one two three four);
print “The Array contains : \n";
for $number (@numbers)
 {
      print "\n $numbers[$n] \n";
}
```

Push Function

- **The push function adds element to the end or right of the array.**
- **Syntax:**

```
push (array,element)
```

- **The function takes two attributes:**
  - First argument: Array name
  - Second Argument: Element to be added

pop Function

- **The pop function deletes or removes an element at the end of the array and returns the element.**
- **Syntax:**

```
pop (array)
```

- **The function takes only one argument:**
  - First argument : Array name

unshift Function

- **The unshift function adds element to the beginning or left of the array.**
- **Syntax:**

```
unshift (array,element)
```

- **The function takes two attributes:**
  - First argument : Array name
  - Second Argument : Element to be added

shift Function

- **The shift function deletes or removes an element from the beginning or left of the array.**
- **Syntax:**

```
shift(array)
```

- **The function takes only one argument:**
  - First argument : Array name

delete Function

- **The delete function deletes the specified element from the array.**
- **Syntax:**

```
delete (array element)
```

- **Example:**

```
delete ($numbers[3]);
```

- **Assigning an empty list to array deletes the entire array.**

chop and chomp Functions

- **The chop function removes the last character of each and every array element.**
- **The chomp function removes the newline character from each and every array element.**
- **Syntax:**

```
chop (array)
chomp(array)
```

splice Function

- **The splice function deletes or replaces elements within an array.**
- **Syntax:**

```
splice(array,starting index,length,[replacement list])
```

- **The function can take more than four arguments:**
  - First argument: Array to be spliced
  - Second argument: Index number of the element where you wish to start the splice (starts counting at zero)
  - Third Argument: The number of elements to be spliced
  - Fourth Argument (optional): Elements to be replaced

Reverse and Exists Functions

- **Reverse()**
  - The **reverse** function returns the elements of the array in the reverse order.
  - It returns the reversed array, but does not make any changes to the original array.
- **Exists()**
  - The **exists** function determines whether the array element has been initialized or not.
  - It returns a Boolean value.

Split Function

- **The split function splits a string at the specified delimiter and returns an array of split elements.**
- **Syntax:**

```
split (delimiter,string)
```

- **The function takes two arguments:**
  - First argument – Delimiter
  - Second Argument – String to be split

Join Function

- **The join function splits array elements and returns a string separated by the specified delimiter.**
- **Syntax:**

```
join (delimiter,array)
```

- **The function takes two arguments:**
  - First argument – Delimiter
  - Second Argument – Array to be split

sort() Function

- **The sort function sorts each element of an array according to ASCII Numeric standards.**
- **You require to provide an algorithm or define a comparison routine while sorting numbers.**
- **The function does not make changes to the underlying data structure (arrays, lists or hashes)**
- **Syntax:**

```
sort arrayname
```

Command-Line Arguments Used in PERL

- **Command-line arguments are stored in the built-in @ARGV array of PERL.**
- **Code snippet:**

```
print “Command-Line Arguments.”;
foreach(@ARGV)
{
        print $_ ,”\n”;
}
```

Predefined Variables Used in PERL

- **$! – current error that has occurred**
- **$$ - process number of the current script**
- **$; - specifies output field separator**
- **$] - current version of PERL (numeric format)**
- **$^C – Boolean value indicating the status of –c switch**
- **$^E – error message specific to the Operating System**
- **$^O – name of the Operating System**
- **$^R – result of last successful Regular Expression**
- **$^T – starting time of the PERL script**

PERL

Associative Arrays in PERL

What Are Associative Arrays?

- **Associative arrays are also known as hashes in common language.**
- **Hashes are represented using the % symbol.**
- **Hash uses $ to dereference values.**
- **It uses key-value pairs to store data.**
- **Keys are always unique, but data or value can be duplicate.**
- **Order of data is not guaranteed as in case of arrays.**

Associative Array Creation

- **There are different ways to create a hash.**
  - Creating a hash as an ordinary list of pairs:

For example,

```
%numbers=(“one”, 1, ”two”, 2, ”three”, 3);
```

  - Using relationship operator:

For example,

```
%numbers=(one  => 1,two => 2,three => 3);
```

Associative Array Creation (Contd…)

- **Creating an associative array using array or hash variable:**
  - Using array:

    For example,

```
@numbers=qw (one 1 two 2 three 3);
%numbers=@numbers;
```

  - Using another associative array:

    For example,

```
%numbers=(one  => 1,two => 2,three => 3);
%num=%numbers;
```

Associative Array Creation (Contd…)

- **We can also create associative elements by adding individual elements.**

  For example,

```
$numbers{one}=1;
$numbers{two}=2;
```

Process of Accessing Associative Array Elements

- **Instead of using [] as in case of arrays , use {} to access individual elements.**
- **Instead of providing index values, use key values to identify the element to be accessed.**

For example,

```
@numbers=qw (one 1 two 2 three 3);
%numbers=@numbers;
print $numbers{three};
```

Process of Accessing Associative Array Elements (Contd...)

- **We can also traverse through the individual elements in the list of associative arrays and process it using the following:**
  - The **foreach** loop
  - The **each** construct and **while** loop
- **The following two functions return a list of key and values in the specified array:**
  - Keys
  - values

Process of Accessing Associative Array Elements (Contd…)

- **The keys function:**
  - The **keys** function returns a list of the keys (indices) of the associative array.

- **Code snippet:**

```
%numbers=(one  => 1,two => 2,three => 3);
@num_keys = keys (%numbers);
```

Process of Accessing Associative Array Elements (Contd…)

- **The values function:**
  - The **values** function returns a list of the values of the associative array.

- **Code snippet:**

```
%numbers=(one  => 1,two => 2,three => 3);
 @num_values = values(%numbers);
```

Accessing Associative Arrays - The foreach Loop

- **Code snippet**

```
%numbers=(one  => 1,two => 2,three => 3);
foreach (keys %numbers)
{
        print $numbers{$_},"\n";
}
```

Accessing Associative Arrays - The Each Loop

- **The each construct:**
  - The **each** construct returns a two element lists:
    - One list of key
    - One list of its value
  - Every time **each** is called in the **while** loop, it returns another key/value pair (that is, the next key/value pair in the iteration).

Accessing Associative Arrays - each()

- **Code snippet**

```
%numbers=(one  => 1,two => 2,three => 3);
while (($key, $value) = each(%numbers))
{
    print $key.", ".$value."\n";
}
```

Functions Used in Associative Arrays

- **Some of the functions in associative arrays are:**
  - **delete**
  - **undef**
  - **defined**
  - **exists**
  - **sort** (same as that in arrays)
  - **reverse** (same as that in arrays)

Functions Used in Associative Arrays (Contd…)

- **The delete function:**
  - This function deletes a key/value pair from an associative array.
- **Code snippet:**

```
%pages = ( “PERL” =>101, “C” =>100, “Java” => 300 );
delete ($pages{‘C'});
```

Functions Used in Associative Arrays (Contd…)

- **The undef function:**
  - This function deletes an associative array.
- **Code snippet:**

```
%pages = ( “PERL” =>101, “C” =>100, “Java” => 300 );
undef(%pages);
```

Functions Used in Associative Arrays (Contd…)

- **The defined function:**
  - This function tests if a hash is defined.
  - It returns **TRUE**, if hash is defined; otherwise, it returns **FALSE**.
- **Code snippet:**

```
%pages = ( “PERL” =>101, “C” =>100, “Java” => 300
);
if(defined(%pages))
{
        print "Defined";
}
else
{
        print "Not Defined";
}
```

Functions Used in Associative Arrays (Contd…)

- **The exists function:**
  - This function tests for the existence of key within the associative array.
  - It returns **TRUE,** if the key exists; otherwise, it returns **FALSE.**
- **Code snippet:**

```
%pages = ( “PERL” =>101, “C” =>100, “Java” => 300
);
if (exists($pages{‘UNIX'}))
{
      print $pages{‘UNIX'};
}
```

PERL

References in PERL

What Are References?

- **References are the addresses of data items in memory.**
- **These are scalar values.**
- **They are categorized into two types:**
  - Hard References: They hold the addresses and types of the data item.
  - Soft References (Symbolic References): They hold names of the data items.
- **Extracting the value referred to by the reference variable is called dereferencing.**

Creating Hard References

- **The backslash(\) operator is used to create a hard reference. A hard reference can be created to a named data or to an anonymous data variable.**
  - Creating references to a named data variable:
    - Reference to a scalar variable:

      For example,

```
$scalar =10;
$scalar_ref=\$scalar;
```

    - Reference to an array variable:

      For example,

```
@array =(1,2,3,4,5);
$array_ref=\@array;
```

Creating Hard References (Contd…)

- Reference to a hash variable:

  For example,

```
$hash =(Java => 1000 , PERL => 200 , C => 1500 );
  $hash_ref=\$hash;
```

- References to a list:

  For example,

```
$list_ref= \(1,2,3,4,5);
```

Creating Hard References (Contd…)

- Creating references to anonymous data:
  - Creating anonymous array reference
  - Uses [] instead of ()

  For example,

```
$array_ref=[1,2,3,4,5];
```

  - Creating anonymous hash reference
  - Uses {} instead of ()

  For example,

```
$hash_ref={Java => 1000 , PERL => 200 , C => 1500 };
```

Overview

- **Getting value from a reference is called dereferencing.**
- **To dereference, put the reference in curly braces.**
- **References that are generated is a scalar value.**
- **Dereferencing can be done in two ways:**
  - You can use prefix dereferences such as **$, @** , %, and **&** to dereference references.
  - The infix dereference operators is the arrow operator (**->**).

Overview (Contd…)

- **Dereferencing using prefix dereferences:**
  - Dereferencing scalar variables:
    - For example,

```
$scalar =10;

$scalar_ref=\$scalar;

           print $$scalar_ref;
```

Overview (Contd…)

- **Dereferencing can be carried out using infix dereferencers.**
- **These are normally used when working with arrays, hashes and subroutines.**
  - Dereferencing array variables
    - For example,

```
@array =(1..5);
$array_ref=\@array;
print $array_ref->[0];
```

# prints the array element and index position 0.

Overview (Contd…)

- Dereferencing hash variables
  - For example,

```
%hash =
(US=>“dollar”,Japan=>“Yen”,UK=>“Pound”);
 $hash_ref=\%hash;
for(keys % {$has_ref})
{
print “Value:”,$hash_ref -> {$_};
}
```

# prints the hash elements.

PERL

Subroutines

Introduction

- **Subroutine is a name given to a section of code.**
- **It is similar to a user-defined function in C.**
- **It is mainly created to:**
  - Reuse code
  - Manage code
- **It can be placed anywhere in the program (at the beginning or the end).**

Overview

- **There are three sections in the declaration of the subroutine:**
  - The sub keyword
  - Name of the subroutine
  - Block of code
- **The @_ list array variable is the special variable in PERL that gets created for every subroutine and holds the arguments passed to the subroutine.**

Overview (Contd…)

- **Syntax**

```
sub subname
{
            code block
}
Or
sub subname (PROTOTYPE)
{
            code block
}
```

Overview (Contd…)

- **Code snippet**

```
sub fun
{
        print “Hello World";
}
fun;
```

Overview (Contd…)

- **Code snippet**

```
sub greet{
            @names = @_;
             foreach my $name (@names)
            {
                        print “Hello , $name!\n";
            }
}
print greet( “john", “Harry", “Maggie");
```

Subroutine Prototype

- **Code snippet**

```
sub greet($$)
{
    ($greeting , $name)=(shift,shift);
    print $greeting ,”,”,$name;
}
```

Local Operator

- **The local operator creates dynamic scoped variables.**
- **It is declared using the local keyword.**
  - For example,

    ```
    local $x=10;
    ```
- **It creates a temporary copy of global variable.**
- **It’s a run-time construct rather than a compile–time one.**
- **It is stored in runtime stack and restored when variables go out of scope.**

Local Operator

- **Code snippet**

```
sub inside
{
        local($a, $b); # Make local variables
        ($a, $b) = ($_[0], $_[1]);# Assign values
        print "\n A=$a”;
        print “\n B=$b";
}
inside(“Hello", “World");
print "Local Value A:$a\n”;
print “Local Value B:$b\n";
```

Local Vs My

- **Code snippet**

```
$x = 10;
global_sub(  );
local_sub(  );
my_sub(  );

sub global_sub {            print "Global Vlue :$x\n";  }
sub local_sub {
            print "Using local subroutine\n";
            local($x) = 100; global_sub(  );  }
sub my_sub {
            print "Using my Subroutine\n";
            my($x) = 1000;  global_sub(  );  }
```

PERL

Regular Expressions

Introduction to Regular Expressions

- **Regular Expression is a string used to describe or match a string as per the specified expression or pattern.**
- **A regular expression is made up of many parts:**
  - Modifiers
  - Character classes
  - Alternative match patterns
  - Quantifiers
  - Assertions
- **The =~ operator is used to test the match and !~ is used to negate the match.**

Regular Expressions - Modifiers

- **Modifiers are used to match or replace a pattern.**
- **They are as follows:**
  - **m//** : Matches a pattern
  - **s ///** : Substitutes the pattern matched with a string.
- **Some modifiers can be used with m// and s/// to make the search more effective. They are:**
  - **g** : globally performs all the operations
  - **i** : Ignore case
  - **x** : Ignore white-space in pattern and allow comments.

Regular Expressions - Modifiers (Contd…)

- **m//**

  Used to match the specified pattern

  Pattern match is case sensitive

  Returns TRUE/FALSE

  Syntax:

```
m/pattern/
```

Regular Expressions - Characters

- **Code snippet**

```
$str = “How are you";
if ($str =~ m/are/gi)
{
        print "Match found";
}
```

Regular Expressions - Characters (Contd…)

- **s///:**
  - Used to match the specified pattern and substitute it with another string.
  - Pattern match is case sensitive.
  - Returns TRUE/FALSE
  - Syntax:

```
s/pattern_to_search/pattern_to_be_replaced/
```

Regular Expressions - Characters (Contd…)

- **Code snippet**

```
$str = “How are you ?";
if ($str =~ s/you/they/gi)
{
            print “\n $str";
}
```

Regular Expressions - Characters (Contd…)

- **Some of the special characters used with regular expressions are as follows:**
  - **\D** : Non digit character
  - **\d** : Digit character
  - **\S** : Non white-space character
  - **\s** : White-space character
  - **\W** : Non word-character
  - **\w** : word-character (alphanumeric as well _)

Regular Expressions - Characters (Contd…)

- **Code snippet (\D)**

```
$str = "KLFS Computer Systems - 13";
if ($str =~ m/\D/) {
            print "\n Found Non-digit Character";
}else{
            print "\n Found Digit Character";
}
$str = "25345";
if ($str =~ m/\D/) {
            print "\n Found Non-digit Character";
}else{
            print "\n Found Digit Character";
}
```

Regular Expressions - Characters (Contd…)

- **Code snippet (\d)**

```
$str = "KLFS Computer Systems - 13";
if ($str =~ m/\d/) {
            print "\n Found Digit Character";
}else{
             print "\n Found Non-digit Character";
}
$str = "25345";
if ($str =~ m/\d/) {
             print "\n Found Digit Character";
}else{
             print "\n Found Non-digit Character"; }
```

Regular Expressions - Characters (Contd…)

- **Code snippet (\s)**

```
$str = "KLFS Computer Systems - 13";
if ($str =~ m/\s/) {
            print "\nFound White space Character";
}else{
            print "\nFound No White space Character";
}
$str = "25345";
if ($str =~ m/\s/) {
            print "\nFound White space Character";
}else{
            print "\nFound No White space Character";
}
```

Regular Expressions - Characters (Contd…)

- **Code snippet (\w)**

```
$str = "KLFS Computer Systems - 13";
if ($str =~ m/\w/) {
            print "\nFound Word";
}else{
            print "\nFound Special Characters";
}
$str = "**\\!";
if ($str =~ m/\w/) {
            print "\nFound Word";
}else{
            print "\nFound Special Characters";
}
```

Regular Expressions – Character Classes

- **Characters can be grouped into character class and the class matches one character inside it.**
- **Character class is represented using [].**
- **You can also specify the range of characters within character classes using -.**

Regular Expressions - Characters

- **Code snippet**

```
$str = "KLFS Computer Systems _ 13";
if ($str =~ m/[aeiou]/) {
            print "There are vowels";
} else {
            print "\n There are no vowels";
}
$str = "Hw W'll";
if ($str =~ m/[aeiou]/) {
            print "There are vowels";
} else {
            print "\n There are no vowels";
}
```

Regular Expressions - Characters

- **Code snippet**

```
$str = "KLFS Computer Systems _ 13";
if ($str =~ m/[0-9]/)
{
        print "The string contains numerals";
}
else
{
        print "\n There are no numerals within the string";
}
```

Regular Expressions – Alternative Match Patterns

- **We can also search for more than one alternate possibilities.**
- **Character used to search for alternatives is |.**

Regular Expressions – Alternative Match Patterns

- **Code snippet**

```
$str = "KLFS Computer Systems _ 13";
if ($str =~ m/(KLFS|klfs|Klfs)/)
{
            print "The string contains the word klfs";
}
else
{
            print "\n The string does not contain the word klfs";
}
```

Regular Expressions - Quantifiers

- **Quantifiers are used to specify that a pattern should be repeated a specific number of times.**
- **The quantifiers are as follows:**
  - ***** : Zero or more times
  - **+** : one or more times
  - **?** : one or zero times
  - **{n}** : n times exactly
  - **{n,}** :at least n times
  - **{n, m}**: at least n times and at the most m times.

Regular Expressions – Quantifiers

- **Code snippet**

```
$_ =  "Academy Of KLFS Computers is located in
Thane, Mumbai, Maharashtra,India.";

if ( /Of (.*),/ )
{
        print "$1\n";
}
```

Regular Expressions – Quantifiers

- **Code snippet**

```
$_ =  "Academy Of KLFS Computers is located in
Thane,Mumbai,Maharashtra,India.";

if ( /Of (.*?),/ )
{
        print "$1\n";
}
```

Regular Expressions – Quantifiers

- **Code snippet**

```
$str = "The programming republic of Perl";


$str =~ /(m{1,3})(.*)/;
 # matches, $1 = 'mm‘  $2 = 'ing republic of Perl'


print "\n $1 \n $2 ";
```

Regular Expressions - Assertions

- **Assertions are also known as anchors.**
- **They are used to match certain string conditions rather than the data part.**
- **Assertions include:**
  - **^**: Beginning of the line
  - **$**: End of the line
  - **\B**: non-word boundary
  - **\b**: Word-boundary

Regular Expressions - Assertions

- **Code snippet**

```
$str = "The programming language Perl";
$str =~ /^(.+)(e|r)(.*)$/;

 # matches,
                          # $1 = 'The programming language Pe'
                          # $2 = 'r'
                          # $3 = 'l‘

print "\n $1 \n $2 \n $3";
```

Regular Expressions - Assertions

- **Code snippet**

```
$str = "The programming language Perl";
$str =~ /^(.+?)(e|r)(.*)$/;  # matches,
                  # $1 = 'Th'
                  # $2 = 'e'
                  # $3 = 'programming language Perl'
print "\n $1 \n $2 \n $3";
```

Regular Expressions - Assertions

- **Code snippet**

```
$str= "KLFS Computer Systems Ltd.";
if($str=~ m/FS\b/)
{
            print "\n There is a word which ends with the charcater
\‘FS\'  within the given string ";
}
else
{
            print "\n None of the words ends with the charcater \‘FS\'
within the given string ";

}
```

PERL

File Handling in PERL

File Handling

- **This lesson deals with file handling and basics of files in PERL.**
- **It involves the following operations:**
  - Opening a file (with the **open** function)
  - Reading from a file (with the **read** or **getc** function)
  - Writing to a file (with the **print** function)
  - Closing a file (with the **close** function)
- **You need to create a FILEHANDLE variable, which will be used to refer to the file.**

File Opening

- **The open function is used to open a file.**
- **The function creates an input or output channel depending on the mode in which the file has been opened.**
- **It returns TRUE if successful and undefined otherwise.**
- **It mainly takes three arguments:**
  - First Argument: **FILEHANDLE**
  - Second Argument: Specifies mode in which the file is to be opened
  - Third Argument: Specifies list of files to be opened

Opening a File

- **Syntax**

open FILEHANDLE ,MODE , LIST of file names.

Opening a File

- **Different modes of opening a file are as follows:**
  - <: Read Mode
  - >: Write Mode
  - >>: Append Mode
  - +> or +<: Read and Write Mode

Reading from a File

- **The angle operator <> is used for reading from a file.**
- **The operator returns the next line of input from the file.**
- **Syntax**

```
< FILEHANDLE.>
```

- **If FILEHANDLE is omitted, it reads from STDIN.**

Reading from a File

- **Code snippet**

```
open (HANDLE, "trial.txt");
while(<HANDLE>)
{
        print "$_\n";
}
close HANDLE;
```

Reading From a file

- **The Read function is also used to read data from a file.**
- **It returns the number of bytes that are actually read.**
- **It can take four arguments:**
  - First Argument: FILEHANDLER
  - Second Argument: Scalar variable into which the bytes are read
  - Third Argument: Number of bytes to read
  - Fourth Argument: Offset from which the read operation has to start

Reading From a file

- **Syntax**

```
read FILEHANDLE,SCALAR,LENGTH,OFFSET
Or
read FILEHANDLE,SCALAR,LENGTH,OFFSET
```

Reading from a file

- **Code snippet**

```
open (HANDLE, "trial.txt");
while(read (HANDLE,$str,2)
{
        print "$str \n";
}
close HANDLE;
```

Reading from a File

- **The getc function reads character by character.**
- **It returns the character read or undefined if end of the file has been reached.**
- **Syntax**

```
getc FILEHANDLE
Or
getc
```

Reading from a File

- **Code snippet**

```
open (HANDLE, “file.txt") or die "$!";
while($char = getc HANDLE )
{
   print $char;
}
close(HANDLE);
```

Writing to a File

- The Print function is used for writing to a file.
- It returns TRUE if the write operation is successful.
- FILEHANDLE has to be specified to print or write into the file.
- If FILEHANDLE is not specified, it will be written to STDOUT.
- Syntax

```
Print FILEHANDLE LIST
```

Writing to a File

- **Code snippet**

```
open (fin,">>","text1.txt") or die "File cannot be opened.";

print fin "Hello\n";
print fin "World\n";

close (fin);
```

Closing a File

- **The Close function is used to close a file.**
- **It returns TRUE if the file has been closed successfully.**
- **Syntax**

```
Close FILEHANDLE.
```

File Handling Functions

- **There are some in-built functions provided by PERL to handle files. They are as follows:**
  - **copy:** copies one file to another
  - **move:** moves the **FILEHANDLE** function
  - **rename:** renames the file
  - **unlink:** deletes the file
  - **seek:** moves the **FILEHANDLE** function to a particular position
  - **tell:** returns the current position of **FILEHANDLE**

File Handling Functions

- **The copy function copies one file to another.**
- **It takes two parameters:**
  - File to be copied
  - Name of the copy file to be created
- **Syntax**

```
copy($filetobecopied, $newfile)
```

File Handling Functions

- **The rename function renames the file.**
- **It returns TRUE, if the file has been renamed successfully, and FALSE otherwise.**
- **Syntax**

```
rename OLDFILE , NEWFILE
```

File Handling Functions

- **The unlink function deletes the file.**
- **It returns TRUE, if the file has been deleted successfully.**
- **Syntax**

```
unlink (filename)
```

File Handling Functions

- **The tell function returns the current position of FILEHANDLE.**
- **Syntax**

```
tell FILEHANDLE
```

File Handling Functions

- **The seek function moves the FILEHANDLE function to a particular position.**
- **It takes three parameters:**
  - First Parameter: **FILEHANDLE**
  - Second Parameter: The byte position to which the **FILEHANDLE** must move to
  - Third Parameter: Options regarding the position (can be 0,1,2)
- **Syntax**

```
seek FILEHANDLE, POSITION, OPTION;
```

File Handling Functions

- **Code snippet**

```
open (HANDLE, "< test.txt") or die "oops: $!";

seek HANDLE, 10, 0;

print tell HANDLE;

close(HANDLE);
```

File Tests

- **There are certain tests that can be performed on FILEHANDLEs to understand the behavior of certain files.**
- **They include the following:**
  - **-r** : File or directory is readable
  - **-w** : File or directory is writable
  - **-x** : File or directory is executable
  - **-o** : File or directory is owned by user
  - **-e** : File or directory exists
  - **-z** : File exists and has zero size (directories are never empty)

File Tests

- **-s**: File/directory exists and has a nonzero size (the value is the size in bytes).
- **-d**: Entry is a directory.
- **-T**: File is "text“.
- **-B**: File is "binary“.

File Tests

- **Code snippet**

```
$neededfile=“trial.pl";
if (-e $neededfile)
{
        print(“File Does Exist");
}
else
{
      print ("File Does not exist");
}
```

Directory Handling

- **Just like file handling, we can also handle the directories in PERL.**
- **It includes the following:**
  - Making a directory (using the **mkdir** function)
  - Opening a directory (using the **opendir** function)
  - Reading a directory entry (using the **readdir** function)
  - Closing a directory (using the **closedir** function)
  - Changing a directory (using the **chdir** function)
  - Removing a directory (using the **rmdir** function)

PERL

Packages in PERL

Packages

- **Packages are used to create namespaces in PERL.**
- **They are declared using the keyword ‘package’.**
- **By default, PERL script starts compiling into the package ‘main’.**
- **Package definition can stretch to multiple files.**
- **You should always specify a return value.**

Creation of Package

- **Code snippet**

```
package p1;
sub sub1
{
        print "Subroutine 1";
}
sub sub2
{
        print "Subroutine 2";
}
return 1;
```

Accessing a Package

- The require keyword is used to make use of a package
- Package members can be accessed using the delimiter ::
- Current package name can be determined by the built-in identifier __PACKAGE__.

Accessing a Package

- **Code snippet**

```
require 'pack.pl';
p1::sub1();
```

Package Constructors and Destructors

- Package constructors are used to initialize the package variables.
- The BEGIN subroutine is known as package constructor.
- Package destructors are used to perform clean up operations.
- The END subroutine is known as package destructor.

Package Constructors and Destructors

- **Code snippet**

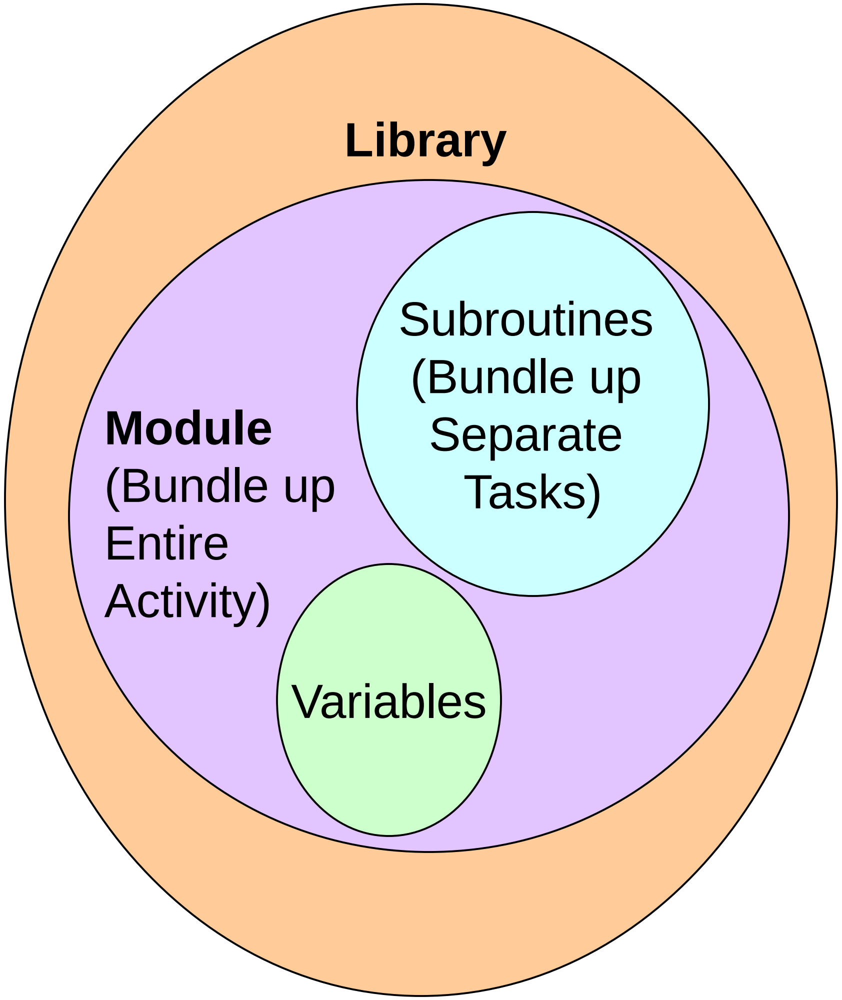
```
package p1;
BEGIN {
        print "Initializing Package variable text .\n";
        $text="Hello World";
}
sub sub1 {
        print "\n $text";
}
END {
        print “Finished execution of  :“,__PACKAGE__;
}
return 1;
```

PERL

Modules in PERL

Modules

- **PERL contains a large library of modules.**
- **Standard modules are installed when PERL is been installed.**
- **Module is a collection of subroutines and variables belonging to the same package.**


Library
Module
(Bundle up Entire Activity)
Subroutines (Bundle up Separate Tasks)
Variables

Creation of Modules

- The package keyword is used to create a module.
- The file name should be the same as the module name.
- The file is stored with a .pm suffix.
- Last statement should be the return statement that returns a TRUE value.

Creation of Modules

- **Code snippet**

```
package Mathtest;
our ($pi, $e);
$pi = 3.14159;   # Define $Mathtest::pi
$e = 2.7182818;  # Define $Mathtest::e
sub circle_area  # Declare a subroutine  {
      my $radius = shift;
      return ($pi * $radius * $radius);
}
```

Accessing Modules

- **Code snippet**

```
use Mathtest;

my $log_e = $Mathtest::e;
print "Log base: $log_e\n";      # Prints 2.7182818

my $radius = 10;
my $area = Mathtest::circle_area($radius);
print "Area = $area\n";          # Prints 314.159
```

Accessing Modules

- **Code snippet**

```
package NewModule;
use vars qw($VERSION @ISA @EXPORT EXPORT_OK);
require Exporter;
@ISA = qw(Exporter AutoLoader);
@EXPORT = qw();
$VERSION = '0.01';
sub subroutine1{
        print "\n Hello World";
}
# Prints 314.159
```

Accessing Modules

- **Code snippet**

```
use NewModule;

print "\n Calling Subroutine .";
NewModule::subroutine1;
```

The @INC and %INC Arrays

- **The @INC array contains a list of directories from which Perl modules and libraries can be loaded.**
- **%INC is used to cache the names of the files and the modules that were successfully loaded and compiled .**
- **If the file is successfully loaded and compiled, then a new key-value pair is added to %INC.**
  - key - name of the file or module
  - value - is the full path to it in the file system.

Loading Modules

- A module can be loaded in three ways:
  - do
  - require
  - use

Loading Modules

- **The do Statement:**
  - The do statement reads the contents of the file at run-time.
  - It searches the @INC and updates the contents of %INC.
- **Syntax**

```
do $filename
```

Loading Modules

- **The require Statement:**
  - The require statement pulls the code-module at run-time.
  - It checks if the file has been already loaded.
    - It does not load the file if already loaded.
    - It generates a run-time error if the file is not found.
  - It has the ability to effect the compilation of the script.
- **Syntax**

```
require $filename
```

Loading Modules

- **The use Statement:**
  - The use statement pulls the code-module at compile-time.
  - It detects the error at compile-time itself at the time of loading.
  - It lets a module export symbol.
- **Syntax**

```
use $filename
```