# Perl Basics

Structure, Style, and Documentation



# Easy to read programs

- Your job as a programmer is to create programs that are:
  - easy to read
  - easy to understand,
  - easy to modify, and
  - safe and robust,
- ***They must of course be correct solutions to the problems they are supposed to solve.***
- You must believe in the importance of these objectives, otherwise you will be creating throw-away code of no use to anyone, not even yourself, not long after you write it.

# What makes code more readable?

- The following is a correct but unreadable Perl program:

```
$s=0;$i=1;while($i<=10){$s=$s+$i;$i=i+1;
}print "The sum of 1 through 10 is $s\n";
```

- It is a program that no one will want to use because it is difficult to read and understand. Why?
- For one thing, there is no use of space to separate the parts.

# White space for readability

- The same program using "white space" (blanks, tabs, newlines) to make it readable:

```
$s = 0;
$i = 1;
while ( $i <= 10 ) {
    $s = $s + $i;
    $i = $i + 1;
}
print "The sum of 1 through 10 is $s\n";
```

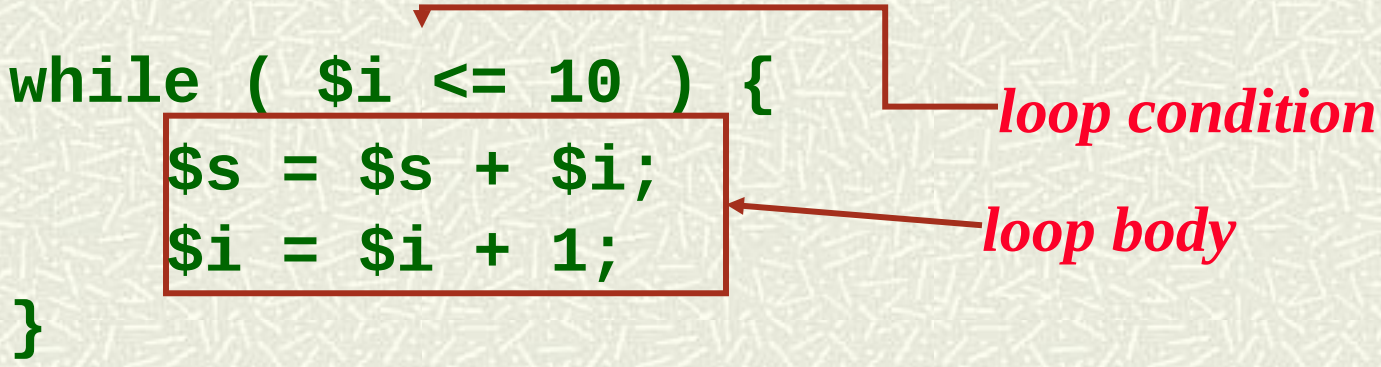
- Perl ignores all white space, so you can use it to make the program easier to read ***without affecting the meaning of the program.***

# White space wisdom

- These are good rules for using white space well:
  - ***Always*** put at most one simple statement per line.
  - ***Always*** put spaces between operators (such as `+` `<=` `=` ) and their operands (variables like `$s` and `$i`, and literals like `1` and `10`.)
  - ***Almost never*** put multiple newlines between statements that are part of a block. A ***block*** is a sequence of statements between curly braces {}.
  - ***Always*** use indentation to indicate logical structure, as explained next.

# Indentation to indicate structure

- The **`while`** keyword introduces a ***loop***. We'll learn about loops soon. Loops are just one of many program structuring concepts in general, and in Perl too.




- It is easier to identify and understand loops if the ***loop body***, i.e., the code between the curly braces, is indented from the start of the **`while`** keyword, usually by 4 spaces.

# Indentation to indicate structure

- The **`if`** keyword introduces a ***conditional branch***, sometimes called a ***decision structure.*** We'll learn about these very soon. They also require indentation, as illustrated:

```
if ( $i <  0 ) {
     statement;
     statement;
}
else {
     statement;
     statement;
}
```

***true branch***

***false branch***

# Naming things

- In all programming languages, the programmer gets to choose the names of various things used in a program. What "things" you can name depend on the language. We begin by focusing on variables. These “things” are technically called ***symbols.***
- ***A variable is a storage cell for your program.*** The program can store data in it and retrieve data from it. It exists somewhere in memory. Variables have names.
- In the example program, **`$s`** and **`$i`** are variables. (In Perl, a variable name must begin with a '**`$`**', or one of another set of funny characters like '`@`' or '**`%`**') .

# Variable names

Naming a variable **`$s`** is like naming a child, "child1". (Yes, George Foreman basically did that.) Pity the poor person who has to read this program and try to discern what **`$s`** is for.

- Variables should be given descriptive names. In this program, **`$s`** is being used to accumulate a sum that will be printed in the end. It is much better to name it **`$sum`**.
- **`$i`** stores the successive values to add to the sum. It is 1, then 2, then 3, and so on. It is like a counter. Naming it **`$counter`** is so much clearer.
- Now look at the program.

# The same program, improved again

```
$sum = 0;
$counter = 1;
while ( $counter <= 10 ) {
     $sum = $sum + $counter;
     $counter = $counter + 1;
}
print "The sum of 1 to 10 is $sum\n";
```

- Even without knowing Perl, you can probably guess what this program is doing now.

# Choosing good names

- Perl lets names be up to 251 characters long, so never blame Perl for being cheap with your names.
- ***Names must begin with a letter or underscore, and after that it can contain letters, upper or lowercase, digits, and underscores.***
- Underscores can be used like spaces in names that you want to be several words (called ***underscore_case***):

```
$file_name   $money_spent_so_far    $user_reply
$line_length  $prompt_string  $word
$num_amino_acids
```

# More about names

- Some people do not use underscores. Instead they make each word after the first start with an Uppercase letter (called *camelCase*):

  `$fileName  $moneySpent $userReply $numAminoAcids`

- This is a matter of choice. In any one program though, you should adhere to one convention or the other.
- Whatever you do, do not use obscure names like **`$p`**, **`$tt`**, and **`$xyz`** when writing programs. There are certain limited conditions under which it is acceptable to name a variable **`$i`** or **`$j`**, but until you know what these are, they should not appear in your programs.

# Comments

- Every programming language provides a means to include text that will be ignored by the compiler. In Perl, the pound sign # tells the compiler that the rest of the line, including the #, should be ignored,
- This is your chance to stick stuff into the program that exists solely for you and the thousands of people who will someday read your program.
- So what stuff do you put there? ***Comments***.
- ***A comment is explanatory text that helps the reader to understand some part of the program.***

# Uses of comments

- Comments can be used in several ways:
  - At the beginning of every program file, to provide information about the file such as author, purpose, list of changes, etc. This is called a ***prologue***.
  - To explain hard-to-follow algorithms;
  - To introduce new pieces of a large program visually;
  - To provide short descriptions of data structures used in the program;
  - To temporarily remove statements from a program while testing and debugging it.

# An example program prologue

```
#!/usr/bin/perl  -w
# sums      -- prompts user to enter a number N and
#              prints the sum of all numbers <= N
# Written by  Stewart Weiss
#             October 14, 2006
# Usage:
#         sums

#-----------------------------------------
#           This is a title block
#-----------------------------------------

# ....  code goes here
```



# Good and bad comment styles

- You should look at the various “demo” programs for examples of good comments. The textbook has examples of bad commenting too.
- In general, if you have named your variables very well, you will not need to explain as much as if you have not.
- You should always have a comment block at the top of every file, with program name, author, creation date, purpose, usage information, and list of modifications.
- As we go along, I will fill in more about what needs to be in a good program.

# Being strict

- Perl lets you get away with many dangerous and sloppy habits. It also provides the means to prevent you from doing this.
- In this class, you will be required to follow the second path, the path of programming righteousness.
- Perl has two tools to accomplish this: ***warnings*** and the "`use strict`" ***pragma.*** You will have to use both of these in each program you write.
- A ***pragma*** is a command telling Perl what to do about something.



# Warnings

- Perl, like most compilers, gives you the option to turn on warning messages when it checks the syntax of your program.
- A warning can be issued when it sees something that might look like a mistake. Perl cannot be completely sure when something is a mistake, so it displays a warning and lets you decide.
- For example, if you store a value into a variable but never use the value from that variable, Perl will issue a warning, because there is no point in putting a value in a variable and never using it; this usually means that either you forgot a statement or you mistyped a variable name. By pointing it out to you, it helps you to find potential mistakes.



# Warnings

- There are a few ways to turn on warnings.
- The **`-w`** flag in the first line turns them on, but only if you use the form

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

- You can instead write

```
#!/usr/bin/env perl
use English;
$WARNING = 1;
```

- You can use the shorter form of **`$WARNING`**, namely **`$^W`** , and then you do not need the line "**`Use English;`**".
- When **`$^W`** has the value 1, it is the same thing as using the **`-w`** flag.

# Example

- To illustrate, suppose you made a mistake and wrote this program instead of the one we created earlier:

```
$sum = 0;
$i = 1;
while ( $i <= 10 ) {
    $sum = $s + $i;  # $s should be $sum
    $i = $i + 1;
}
```

The **-w** switch would catch the mistake where you forgot to change the **$s** to **$sum**.

# Strictness

- The "**`use strict;`**" ***pragma*** tells the compiler to detect when you are using certain types of constructs that are error-prone.
- A common kind of sloppiness is using variables without first declaring them, as in

```
#!/usr/bin/env perl
$fastfood = "SloppyJoe";
print "This program is like $fastfood\n";
```

- **`$fastfood`** was supposed to be "***declared***" first, meaning that perl was told that **`$fastfood`** is a certain type of variable.

# Strictness

- You should declare all variables that your program uses with "**my**" statements:

```
my $fastfood;
my ($counter, $sum, $name);
```

- If you put a strictness pragma in the program, it will catch when you are not strict:
- You can think of "**my**" as meaning that these names are names you created. This is not really accurate, but for now the goal is an easy way to remember to do this.

# A sloppy program with strictness checking

- If you try to run this program

```
#!/usr/bin/env perl
# prologue here but no room in slide
use strict;             # turn on strictness
$^W = 1;                # turn on warnings
$fastfood = "SloppyJoe";
print "This program is like $fastfood\n";
```

you will get the error message

```
Global symbol "$fastfood" requires explicit
package name at line 5 in sloppy.pl
```

# A sloppy program with strictness checking

- The correct version of the preceding program:

```
#!/usr/bin/env perl
# prologue here but no room in slide
use strict;             # turn on strictness
$^W = 1;                # turn on warnings
my $fastfood = "SloppyJoe";
print "This program is like $fastfood\n";
```

# Summary of good style

- Use white space to indicate structure.
- Choose meaningful names.
- Use comments to make your code understandable.
- Declare all variables with "`my`" and comment them if necessary.
- Use the `-w` switch or the `$^W` variable and the `use strict` pragma.
- Be consistent in the style choices you make.