

Subroutines

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```
#!/usr/bin/perl

use strict;
use warnings;

my $seq1 = "ac ggTtAa";
my $seq2 = "tTcC aaA tgg";

# clean up $seq1
# 1) make it all lower case
$seq1 = lc $seq1;
# 2) remove white space
$seq1 =~ s/\s//g;

# clean up $seq2
# 1) make it all lower case
$seq2 = lc $seq2;
# 2) remove white space
$seq2 =~ s/\s//g;

# print cleaned up sequences
print "seq1: $seq1\n";
print "seq2: $seq2\n";
```

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Problems With This Code

- The same cleanup statements are run for `$seq1` and `$seq2`.
- Duplication of code (BAD!).
- Subroutines to the rescue.

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Subroutines

- Blocks of code that you can call in different places.
- Code resides in one place.
 - Only need to write the code once.
 - Easier to maintain.
- Take arguments and return results.
- Make code easier to read.
- Like a mini-program within your program.

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Creating a Subroutine

1. Turn the code of interest into a block.

```
{  
    # clean up $seq  
    # 1) make it all lower case  
    $seq = lc $seq;  
    # 2) remove white space  
    $seq =~ s/\s//g;  
}
```

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Creating a subroutine

2. Label the block with: `sub subroutine_name`

```
sub cleanup_sequence {  
    # clean up $seq  
    # 1) make it all lower case  
    $seq = lc $seq;  
  
    # 2) remove white space  
    $seq =~ s/\s//g;  
  
}
```

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Creating a Subroutine

3. Add statements to read the subroutine argument(s) and return the subroutine result(s).

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```
sub cleanup_sequence {  
  
    # get the sequence argument to the  
    # subroutine - note that just like shift gets  
    # an argument for your program, shift gets an  
    # argument to your subroutine  
    my $seq = shift;  
  
    # clean up $seq  
  
    # 1) make it all lower case  
    $seq = lc $seq;  
    # 2) remove white space  
    $seq =~ s/\s//g;  
  
    # return cleaned up sequence  
    return $seq;  
  
}
```

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Passing Arguments to a Subroutine

Arguments are passed in `@_` a special array created by Perl.

- Analogous to `@ARGV` for program arguments.

Can use `shift` to take one argument at a time.

```
# take the first argument
my $arg1 = shift;
# take the second argument
my $arg2 = shift;
```

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Passing Arguments to a Subroutine

Can copy the contents of `@_` into a list of named variables.

```
my ($arg1, $arg2) = @_;
```

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Returning Subroutine Results

Use return operator to return results.

Usually return at the end of the subroutine but can use it to exit the subroutine earlier.

Return a single value.

```
return $single_value; #scalar
```

Return a list.

```
return ($variable, "string", 3); #list  
return @array_of_values; #array
```

Returning Subroutine Results

Return an empty list or undef depending on context.

```
return; #empty list or undef
```

Calling a Subroutine

Calling our subroutine is just like calling an existing built-in Perl function.

```
my $result = my_sub($arg1, $arg2, $arg3, ...);
```

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Location of Subroutines

Usually at the bottom of the script.

Allows you to visually separate main program from the subroutines.

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```
#!/usr/bin/perl
use strict;
use warnings;

my $seq1 = "ac ggTtAa";
my $seq2 = "tTcC aaA tgg";

# call cleanup_sequence for each sequence
$seq1 = cleanup_sequence($seq1);
$seq2 = cleanup_sequence($seq2);
# print cleaned up sequences
print "seq1: $seq1\n";
print "seq2: $seq2\n";

sub cleanup_sequence {
    # get the sequence argument
    my $seq = shift;
    # cleanup $seq
    # 1) make it all lower case
    $seq = lc $seq;
    # 2) remove white space
    $seq =~ s/\s//g;
    # return cleaned up sequence
    return $seq;
}
```

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Scope

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```
#!/usr/bin/perl
```

```
use strict;  
use warnings;
```

```
my $x = 100;  
my $y = 20;
```

```
if ($x > $y) {  
    my $z = 10;  
    $x = 30;  
    print "x (inside if block): $x\n";  
    print "y (inside if block): $y\n";  
    print "z (inside if block): $z\n";  
}
```

```
print "x (outside if block): $x\n";  
print "y (outside if block): $y\n";  
print "z (outside if block): $z\n";
```

Global symbol "\$z" requires explicit
package name at ./scope.pl line 19.

Execution of ./scope.pl aborted due
to compilation errors.

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Blocks

That's because `$z` was declared inside the if block,
so it's only accessible inside that block.

Any time we see `{ }`, we're creating a block.

Blocks are like boxes that have one way mirrors –
you can see outside the box from inside, but not
inside the box from the outside.

To fix that error, we need to declare `$z` outside the
if block.

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Blocks

Variables declared inside of a block only exist inside the block – once the block is finished, they will be destroyed.

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```
#!/usr/bin/perl
```

```
use strict;  
use warnings;
```

```
my $x = 100;  
my $y = 20;  
my $z = 5;
```

```
if ($x > $y) {  
    my $z = 10;  
    $x = 30;  
    print "x (inside if block): $x\n";  
    print "y (inside if block): $y\n";  
    print "z (inside if block): $z\n";  
}
```

```
print "x (outside if block): $x\n";  
print "y (outside if block): $y\n";  
print "z (outside if block): $z\n";
```

Output:

```
$x (inside of block):30  
$y (inside of block): 20  
$z (inside of block):10  
$x (outside if block): 30  
$y (outside if block): 20  
$z (outside if block): 5
```

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Scope

Does the program give the expected behavior?

By declaring “`my $z = 10;`” inside the if block, we’re creating a new variable called `$z` only accessible within the block.

This new variable will not modify the outside variable!

Note that we can create a new `$z` variable inside the block with no problems – if we do it outside, we’ll get a warning.

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Scope

- If we remove “`my`” from that line, the modification to `$z` will show outside the block.

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```
#!/usr/bin/perl
```

```
use strict;  
use warnings;
```

```
my $x = 100;  
my $y = 20;  
my $z = 5;
```

```
if ($x > $y) {  
    $z = 10;  
    $x = 30;  
    print "x (inside if block): $x\n";  
    print "y (inside if block): $y\n";  
    print "z (inside if block): $z\n";  
}
```

```
print "x (outside if block): $x\n";  
print "y (outside if block): $y\n";  
print "z (outside if block): $z\n";
```

Output:

```
$x (inside if block): 30  
$y (inside if block): 20  
$z (inside if block): 10  
$x (outside if block): 30  
$y (outside if block): 20  
$z (outside if block): 10
```