The Perl Debugger

- Perl has a built-in debugger.
- It runs perl scripts interactively, one command at a time.
- It will only run if your script is free of syntax errors.
- The debugger can help you find run-time errors.
- Also can run perl as an interactive shell
- These tools are excellent for exploring code snippets, regular expressions, finding bugs in code logic (=debugging)

Execute perl script normally with

```
perl myScript.pl
```

or

```
./myScript.pl
```

etc

Perl will try to run the script start to end.

Easiest way to run a script in the debugger is with

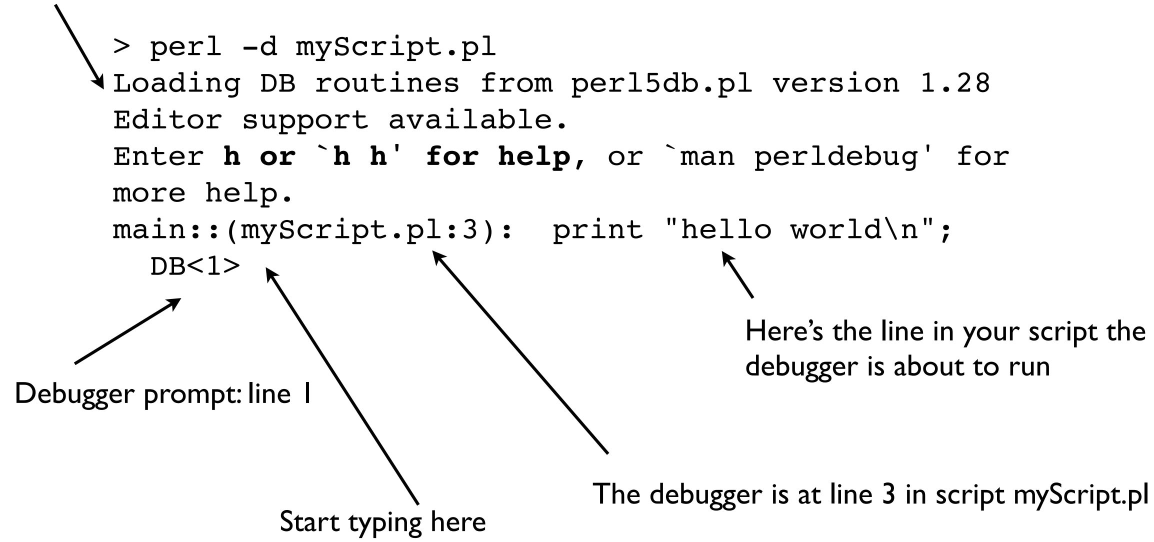
```
perl -d myScript.pl
```

You can add any command line parameters to the script as normal

```
perl -d myScript.pl infile.txt outfile.txt
```

The perl debugger

Startup lines, including info on getting help



```
> perl -d myScript.pl
Loading DB routines from perl5db.pl version 1.28
Editor support available.
Enter h or `h h' for help, or `man perldebug' for
more help.
main::(myScript.pl:3):  print "hello world\n";
  DB<1>
```

Here's the line in your script the debugger is about to run

Debugger prompt: line 1

The debugger is at line 3 in script myScript.pl

Start typing here

Debugger: controlling program flow

h	help
q	quit
n or s	next line or step through next line. Step will step down into a subroutine and go through each line in the subroutine; next goes to the next line.
<return>	repeat last n or s
c 45	continue to line 45
b 45	break at line 45
b 45 $a == 0	break at line 45 if $a equals 0
p $a	print the value of $a
x $a	unpack or extract the data structure in $a
R	restart - useful if you think you have edited the script
|	(pipe) print output one page at a time with more/less
|x @bigarray	output big array in ‘more/less’ pager

x or unpack

- x expr evaluates expr in list context, returns formatted result.
- List context means elements are listed starting at index 0
- numbers are as is; strings are quoted and include new lines, tab characters etc.

```
 DB<5> $a = 4
 DB<6> x $a
0  4

 DB<10> @a = (5,10,15)
 DB<11> x @a
0  5
1  10
2  15

  DB<16> $a = "foo\nboo"
  DB<17> x $a
0  'foo
boo'
```

note string goes across new line

Executing perl inside a script

- You can type any perl line into the debugger
-

Manipulating variables
$p = 45 set value of $p
@a = (1,2,3,4,5) set values in @a
$a[1]++ increment value in index one in array @a
$hash{foo} = baz make hash %hash and initialize key value pair foo=>baz

if (length $sequence > 45) {print "long sequence"} else {print "short sequence"}

Script myScriptErrors.pl with logic errors and mistakes.

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

my $data_line = 'ABC1\thuman\tMGTYIPLWQST\n';
my $sequence_index = 1;
my @fields = split /\t/, $data_line;
my $sequence = $fields[$sequence_index];
print "Protein sequence is: $sequence\n";
```

```
[Epinephrine:~] simonp% perl myScriptErrors.pl
Use of uninitialized value $sequence in concatenation
(.) or string at myScriptErrors.pl line 9.
Protein sequence is:
```

Debugger session to investigate run-time errors (1 of 2)

```
[Epinephrine:~] simonp% perl -d myScriptErrors.pl

Loading DB routines from perl5db.pl version 1.33
Editor support available.

Enter h or `h h' for help, or `man perldebug' for more help.

main::(myScriptErrors.pl:5):  my $data_line = 'ABC1\thuman
\tMGTYIPLWQST\n';
  DB<1> n
main::(myScriptErrors.pl:6):  my $sequence_index = 1;
  DB<1> p $data_line
ABC1\thuman\tMGTYIPLWQST\n
```

Problem!! We see \t not <tab> character

```
  DB<2>
main::(myScriptErrors.pl:7):  my @fields = split /\t/, $data_line;
  DB<2>
main::(myScriptErrors.pl:8):  my $sequence = $fields[$sequence_index];
  DB<2> x @fields
0  'ABC1\\thuman\\tMGTYIPLWQST\\n'
```

Problem!! Only one array element

```
  DB<3> n
main::(myScriptErrors.pl:9):  print "Protein sequence is: $sequence
\n";
```

Debugger session (2 of 2)

```
  DB<3> p $fields[$sequence_index]

```

This variable is empty

```
  DB<4> p $sequence

```

So is this one

```
  DB<5> n
Use of uninitialized value $sequence in concatenation (.) or string at
myScriptErrors.pl line 9.
```

Perl prints this warning

```
 at myScriptErrors.pl line 9
Protein sequence is:
Debugged program terminated.  Use q to quit or R to restart,
  use o inhibit_exit to avoid stopping after program termination,
  h q, h R or h o to get additional info.
  DB<5>
```

There are three problems with this script: i) double quotes needed in line 5; ii) sequence_index should be 2 not 1; chomp needed after line 5

The interactive perl debugger

```
> perl -de 4
Loading DB routines from perl5db.pl version 1.28
Editor support available.

Enter h or `h h' for help, or `man perldebug' for more help.

main::(-e:1):   4
  DB<1> $a = {foo => [1,2] , boo => [2,3] , moo => [6,7]}
  DB<2> x $a
0  HASH(0x8cd314)
   'boo' => ARRAY(0x8c3298)
      0   2
      1   3
   'foo' => ARRAY(0x8d10d4)
      0   1
      1   2
   'moo' => ARRAY(0x815a88)
      0   6
      1   7
```

Last words on the debugger

Inside the debugger,

`use strict;`

`use warnings;`

Behave a little differently from the way you are used to.

-- if you print an undefined variable with 'p' or 'x' it will just be blank, you won't get a warning that you tried to print an uninitialized variable.

-- if the script you are running in the debugger prints an uninitialized variable, you will get a warning.

Here's an example

```
DB<1> p $a
```

No warning

```
DB<2>
```

But you get a warning if the line you run comes from the script instead of something you typed into the debugger

```
main::(myScriptErrors.pl:12): my $a;
  DB<1>
main::(myScriptErrors.pl:13): print $a;
  DB<1>
Use of uninitialized value $a in print at
myScriptErrors.pl line 13.
 at myScriptErrors.pl line 13
```