CSCI-GA.3033.003 Scripting Languages

6/7/2012

Textual data processing (Perl)

Administrative

Announcements

- Homework 2 due Friday at 6pm.
- First prelim 9/27, Review on 9/25
- Additional TA:
  - Theodoros Gkountouvas
- Possible room change in the future:
  - Watch Piazza for announcements

Outline

- Perl Basics

About Perl

- Practical Extraction and Reporting Language
  - Regular expressions
  - String interpolation
  - Associative arrays
- TIMTOWDI
  - There is more than one way to do it
  - Make easy jobs easy
  - … without making hard jobs impossible
  - Pathologically Eclectic Rubbish Lister

Orthogonality

Definition of orthogonal	Language design principle	Violation of orthogonality
At right angles (unrelated)	Uniform rules for feature interaction	VBA object assignments
Not redundant	Few, but general, features	VBA positional vs. named args

Perl is diagonal rather than orthogonal:

"If I walk from one corner of the park to another, I don't walk due east and then due north. I go northeast." [Larry Wall]

$\Rightarrow$ shortcut features even when not orthogonal

Related Languages

- Predecessors: C, sed, awk, sh
- Successors:
  - PHP (“PHP 1” = collection of Perl scripts)
  - Python, JavaScript (different languages, inspired by Perl’s strengths + weaknesses)
- Perl 5 (current version, since 1994)
- Perl 6
  - Larry Wall has been talking about it since 2001
  - Evolved into a separate language

How to Write + Run Code

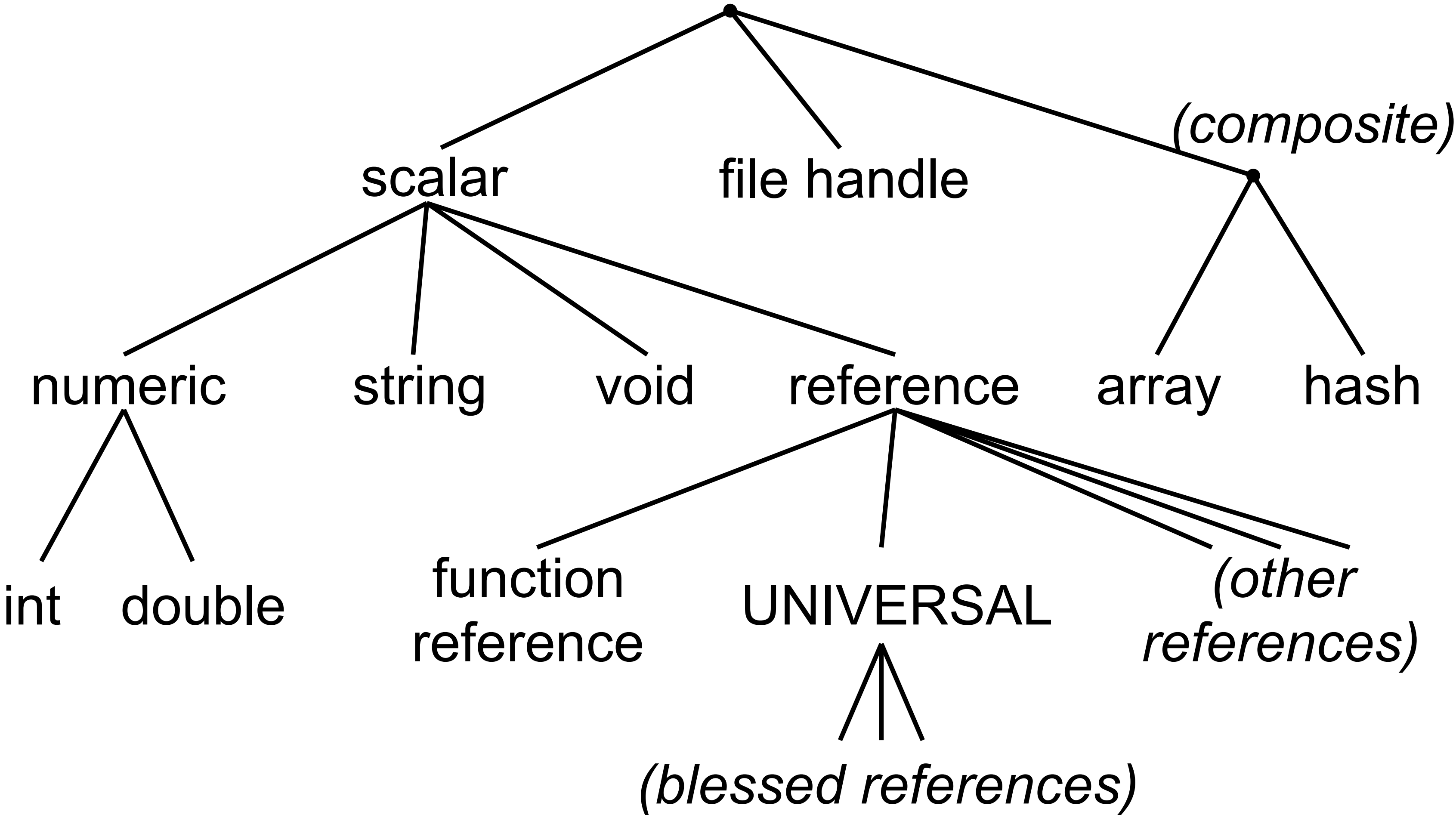
- **`perl [-w] -e '`***perl code***`'`**
  - "**`-w`**" flag produces warnings
- **`perl [-w]`** *script***`.pl`**
- *script***`.pl`**
  - Write the file in Vi or Emacs or …
  - **`chmod u+x`** *script***`.pl`**
    Makes script executable
  - **`#!/usr/bin/perl -w`**
    In first line of script specifies interpreter
- **`perl [-w] -d -e 42`**
  - Edit-eval-print loop (debug the script "**`42`**")

Lexical Peculiarities

- Single-line comments: `#`
- Semicolon required after statements unless `{`last; in; block`}`
- Quotes around certain strings (bare words) optional in certain cases (e.g., as hash key)
- v-string: `v13.10` = `"\x{13}\x{10}"`
- Interpolation; pick-your-own-quotes; Heredocs; POD (plain old documentation)
- Many more…

Perl

Types



Sigils, a.k.a. "Funny Characters"

- Symbol that must appear in front of variable, showing its type
  - `$`=scalar, `@`=array, `%`=hash, `&`=function, `*`=typeglob
  - E.g., `$a[0]` is element `0` of array `@a`
- Unlike shell, Perl requires sigil also on left-hand side of assignment
- `${`*id*`}` is the same as `$`*id*
- Function sigil `&` not required for call

Variable Declarations

Implicit	`print $a + 1;` `$b = 5;`	Read **`undef`** if non-existent
Local, lexical scope	`my $c;` `my ($d,$e)=(3,4);`	

Global used locally	`sub f{`
	`  our $g;`
	`  print $g++`
	`}`
		Hides locals; unlimited lifetime

Local, dynamic scope	`sub h{print $i;}`
	`sub k{`
	`  local $i=5; h`
	`}`
		Can also localize single array/hash item

Concepts

Static vs. Dynamic Scoping

Static scoping	Dynamic scoping
Bound in closest nesting scope in program text	Bound in closest calling function at runtime

Static scoping:

```
#!/usr/bin/perl -w
$x = 's';
sub g {
  my $x = 'd';
  return h()
}
sub h {
  return $x
}
print g(), "\n"; #s
print $x,  "\n"; #s
```

Dynamic scoping:

```
#!/usr/bin/perl -w
$x = 's';
sub g {
  local $x = 'd';
  return h()
}
sub h {
  return $x
}
print g(), "\n"; #d
print $x,  "\n"; #s
```

Interpolation

- Expansion of values embedded in string
- Single-quoted string literal `'abcde'`
  - Only interpolate `\'` and `\\`
- Double-quoted string literal `"abcde"`
  - More escape sequences, e.g., `\n`
  - Variables only, starting with `@` or `$`
  - Use curleys to delimit: `"time ${hours}h"`
- Trick to interpolate arbitrary expressions
  - "… `@{[`*expr*`]}` …" or "… `@{[scalar `*expr*`]}` …"

Perl

Operators

<table>
<tr><td>(…), "…", `…`, print, sort, …</td><td></td><td>L</td><td>Terms, function call, quoting, list operators (leftward)</td></tr>
<tr><td>-></td><td>2</td><td>L</td><td>Dereference and member access</td></tr>
<tr><td>++, --</td><td>1</td><td>N</td><td>Auto-increment, auto-decrement</td></tr>
<tr><td>**</td><td>2</td><td>R</td><td>Exponentiation</td></tr>
<tr><td>!, ~, \, +, -</td><td>1</td><td>R</td><td>Negation (!, ~, -), reference (\),no-op (+)</td></tr>
<tr><td>=~, !~</td><td>2</td><td>L</td><td>Binding to regular expression pattern match</td></tr>
<tr><td>*, /, %, x</td><td>2</td><td>L</td><td>Multiplicative (x is string repetition)</td></tr>
<tr><td>+, -, .</td><td>2</td><td>L</td><td>Additive (. is string concatenation)</td></tr>
<tr><td><<, >></td><td>2</td><td>L</td><td>Bitwise shift</td></tr>
<tr><td>eval, sqrt, -f, -e, …</td><td>1</td><td>N</td><td>Named unary operators, file test operators</td></tr>
<tr><td><, >, <=, >=, lt, gt, le, ge</td><td>2</td><td>N</td><td>Relational (lt, gt, le, ge is for strings)</td></tr>
<tr><td>==, !=, <=>, eq, ne, cmp</td><td>2</td><td>N</td><td>Equality (eq, ne, cmp is for strings) (<=>, cmp yield -1/0/1)</td></tr>
<tr><td>&, |, ^</td><td>2</td><td>L</td><td>Bitwise (not all same precedence)</td></tr>
<tr><td>&&</td><td>2</td><td>L</td><td>Logical and (short-circuit)</td></tr>
<tr><td>||, //</td><td>2</td><td>L</td><td>Logical or (||), Defined-or (//) (short-circuit)</td></tr>
<tr><td>.., ...</td><td>2</td><td>N</td><td>Range (in list context) or bistable (in scalar context)</td></tr>
<tr><td>?:</td><td>3</td><td>R</td><td>Ternary conditional</td></tr>
<tr><td>=, +=, -=, *=, …</td><td>2</td><td>R</td><td>Assignment; return l-value of target</td></tr>
<tr><td>,, =></td><td>2</td><td>L</td><td>List (in list context) or sequencing (in scalar context)</td></tr>
<tr><td>print, sort, …</td><td></td><td>N</td><td>List operators (rightward)</td></tr>
<tr><td>not, and, or, xor</td><td>2</td><td>R</td><td>Logical (short-circuit; not all same precedence)</td></tr>
</table>

Perl

Operators: List vs. Named Unary

- Different precedence rules
- List operator (most user-defined functions)
  - High leftward, low rightward precedence
  - `@a = (1,5,sort 9,2); print @a; #1529`
- Named unary operator
  - Lower than arithmetic, higher than comparison
  - `@a = (1,5,sqrt 9,2); print @a; #1532`
- Call either one with parentheses
  - Highest precedence
  - `@a = (1,5,sort(3+6),2); print @a; #1592`

Input and Output

- Output
  - `print "Hello, world!";`
  - `print STDERR "boo!";`
  - `printf "sqrt(%.2f)=%.2f\n", 2, sqrt(2);`
- Input
  - `$lineFromStdIn = <>;`
  - `open MYFILE, '<recipe' or die "$!";`
  - `$lineFromMyFile = <MYFILE>;`
  - `@allLines = <MYFILE>;`

Arrays

- Resizable
- Literals: list `@a=(1,3,5)`, range `@b=2..4`
- Indexing: e.g. `$a[1]`
  - Zero-based; negative index counts from end
  - `$#a` returns last index of `@a`, in this case, `2`
  - Write to non-existent index auto-vivifies
- Free: `undef @a`, truncate: `$#a=1`
- Array slice: using multiple indices, e.g., `@a[0,2]` or `@a[1..2]`
- Using array in scalar context: returns length
  - `scalar(@a); # 3 = size`

Perl Poetry

```
#!/usr/bin/perl -w
while ($leaves > 1) {
    $root = 1;
}
foreach($lyingdays{'myyouth'}) {
    sway($leaves, $flowers);
}
while ($i > $truth) {
    $i--;
}
sub sway {
    my ($leaves, $flowers) = @_;
    die unless $^O =~ /sun/i;
}
```

Though leaves are many, the root is one;
Through all the lying days of my youth
I swayed my leaves and flowers in the sun;
Now I may wither into the truth

Wayne Myers port of the Yeats poem,
"*The Coming Of Wisdom with Time*"

Administrative

Last Slide

- Today's lecture
  - Basics of Perl
- Nest lecture
  - Associative arrays
  - Regular expressions