

Ruby: Introduction, Basics

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Lecture 5

Ruby vs Java: Similarities

- Imperative and object-oriented
 - Classes and instances (ie objects)
 - Inheritance
- Strongly typed
 - Classes determine valid operations
- Some familiar operators
 - Arithmetic, bitwise, comparison, logical
- Some familiar keywords
 - `if, then, else, while, for, class, new...`

But Ruby Looks Different

- Punctuation
 - Omits ;'s and often ()'s on function calls
 - Function names can end in ? or !
- New keywords and operators
 - `def`, `do...end`, `yield`, `unless`
 - `**` (exp), `=~` (match), `<=>` (spaceship)
- Rich core libraries
 - Collections: Hashes, Arrays
 - Strings and regular expressions
 - Enumerators for iteration

Deeper Differences As Well

- Interpreted (typically)
 - Run a program directly, without compiling
- Dynamically typed
 - Objects have types, variables don't
- Everything is an object
 - C.f. primitives in Java
- *Code* can be passed into a function as a parameter
 - Java has added this too (“lambdas”)

Compiling Programs

- Program = Text file
 - Contains easy-to-understand statements like “print”, “if”, “while”, *etc.*
- But a computer can only execute *machine instructions*
 - Instruction set architecture of the CPU
- A *compiler* translates the program (source code) into an executable (machine code)
 - Recall “Bugs World” from CSE 2231
- Examples: C, C++, Objective-C, Ada...

Interpreting Programs

- An interpreter reads a program and executes it *directly*
- Advantages
 - Platform independence
 - Read-eval-print loop (aka REPL)
 - Reflection
- Disadvantages
 - Speed
 - Later error detection (*i.e.*, at run time)
- Examples: JavaScript, Python, Ruby

Combination of Both

- A language is not *inherently* compiled or interpreted
 - A property of its implementation
- Sometimes a combination is used:
 - Compile source code into an intermediate representation (byte code)
 - Interpret the byte code
- Examples of combination: Java, C#

Ruby is (Usually) Interpreted

- REPL with Ruby interpreter, irb

```
$ irb
```

```
>> 3 + 4
```

```
=> 7
```

```
>> puts "hello world"
```

```
hello world
```

```
=> nil
```

```
>> def square(x) x**2 end
```

```
=> :square
```

```
>> square -4
```

```
=> 16
```

Literals

□ Numbers (Integer, Float, Rational, Complex)

83, 0123, 0x53, 0b1010011, 0b101_0011

123.45, 1.2345e2, 12345E-2

2/3r, 4+3i

□ Strings

- Delimiters " " and ' '

- Interpolation of #{...} occurs (only) inside " "

"Sum 6+3 is #{6+3}" is "Sum 6+3 is 9"

- Custom delimiters with %Q?... and %q?...

□ Ranges

- 0..4 is end *inclusive* (0, 1, 2, 3, 4)

- 0...4 is end *exclusive* (0, 1, 2, 3)

□ Arrays and hashes (later)

Comments and Statements

- Single-line comments start with #
 - Don't confuse it with string interpolation!
- Multi-line comments bracketed by
 `=begin`
 `=end`
 - Must appear at beginning of line
- Every statement has a value result
- Convention: `=>` to indicate result

```
"Hi #{name}" + "!" #=> "Hi Liam!"
puts "Bye #{name}" #=> nil
```

Operators

□ Arithmetic: + - * / % **

■ / is either ÷ or div, depending on operands

■ Integer / (div) rounds towards $-\infty$, not 0

■ % is modulus, not remainder

`1 / 3.0 #=> 0.3333333333333333`

`1 / 3 #=> 0 (same as Java)`

`-1 / 3 #=> -1 (not 0, differs from Java)`

`-1 % 3 #=> 2 (not -1, differs from Java)`

□ Bitwise: ~ | & ^ << >>

`5 | 2 #=> 7 (ie 0b101 | 0b10)`

`13 ^ 6 #=> 11 (ie 0b1101 ^ 0b0110)`

`5 << 2 #=> 20 (ie 0b101 << 2)`

To Ponder

Evaluate

$$1/3 \quad / \quad 1/2$$

$$-1/3 \quad / \quad 1/2$$

$$1/3r \quad / \quad 1/2r$$

$$(1/3r) \quad / \quad (1/2r)$$

$$0.1 + 0.2 - 0.3$$

Operators (Continued)

□ Comparison: `<` `>` `<=` `>=` `<=>`

■ Last one is so-called “spaceship operator”

■ Returns -1/0/1 iff LHS is
smaller/equal/larger than RHS

`'cab' <=> 'da' #=> -1`

`'cab' <=> 'ba' #=> 1`

□ Logical: `&&` `||` `!` `and` `or` `not`

■ Words have low precedence (below =)

■ “do_this or do_that” idiom needs low-binding

`x = crazy or raise 'problem'`

Pseudo Variables

□ Objects

- **self**, the receiver of the current method (recall “this” keyword in Java)
- **nil**, nothingness (recall null)

□ Booleans

- **true**, **false**
- nil evaluates to false
- 0 is *not* false, it is true just like 1 or -4!

□ Specials

- **__FILE__**, the current source file name
- **__LINE__**, the current line number

Significance in Names

- A variable's *name* affects semantics!
- Variable name determines its scope
 - Local: start with lowercase letter (or _)
 - Global: start with \$
 - Many pre-defined global variables exist, *e.g.*:
 - \$/ is the input record separator (newline)
 - \$; is the default field separator (space)
 - Instance: start with @
 - Class: start with @@
- Variable name determines mutability
 - Constant: start with uppercase (**Size**)
but idiom is all upper case (**SIZE**)

Basic Statements: Conditionals

□ Classic structure

```
if (boolean_condition) [then]
    ...
else
    ...
end
```

□ But usually omit ()'s and “then” keyword

```
if x < 10
    puts 'small'
end
```

□ `if` can also be a *statement modifier*

```
x = x + 1 if x < LIMIT
```

- Good for single-line body
- Good when statement execution is common case
- Good for positive conditions

Variations on Conditionals

- Unless: equivalent to “if not...”

```
unless size >= 100
  puts 'small'
end
```

- Do not use else with unless
- Do not use negative condition (`unless !...`)

- Can also be a statement modifier

```
x = x + 1 unless x >= LIMIT
```

- Good for: single-line body, positive condition
- Used for: Guard at beginning of method

```
raise 'negative argument' unless x >= 0
```

Pitfalls with Conditionals

- Keyword `elsif` (not "else if")

```
if x < 10
  puts 'small'
elsif x < 20
  puts 'medium'
else
  puts 'large'
end
```

- If's *do not* create nested lexical scope

```
if x < 10
  y = x
end

puts y # y is defined, but could be nil
puts z # NameError: undefined local var z
```

Case Statements are General

```
[variable = ] case expression
when nil
    statements execute if the expr was nil
when value # e.g. 0, 'start'
    statements execute if expr equals value
when type # e.g. String
    statements execute if expr resulted in Type
when /regexp/ # e.g. /[aeiou]/
    statements execute if expr matches regexp
when min..max
    statements execute if the expr is in range
else
    statements
end
```

Basic Iteration: While and Until

- Classic loop structure

```
while boolean_condition [do]
```

```
...
```

```
end
```

- Can also be used as a statement modifier

```
work while awake
```

- **until** is equivalent to "while not..."

```
until i > count
```

```
...
```

```
end
```

- Can also be used as a statement modifier

- Pitfall: Modified *block* executes at least once

```
sleep while is_dark # may not sleep at all
```

```
begin i = i + 1 end while i < MAX
```

```
    # always increments i at least once
```

Functions

□ Definition: keyword `def`

```
def foo(x, y)
    return x + y
end
```

□ Notice: no types in signature

- No types for parameters
- No type for return value

□ But all functions return *something*

- Value of last statement is implicitly returned
- Convention: Omit explicit return statement

```
def foo(x, y)
    x + y # last statement executed
end
```

Function Calls

- Dot notation for method call

```
Math::PI.rationalize() # recvr Math::PI
```

- Convention: Omit ()'s in definition of functions with no parameters

```
def launch() ... end # bad
```

```
def launch ... end # good
```

- Paren's can be omitted in calls too!

```
Math::PI.rationalize
```

```
puts 'hello world'
```

- Convention: Omit for “keyword-like” calls

```
attr_reader :name, :age
```

- Note: needed when chaining

```
foo(13).equal? value
```


Summary

- Ruby is a general-purpose, imperative, object-oriented language
- Ruby is (usually) interpreted
 - REPL
- Familiar flow-of-control and syntax
 - Some new constructs (e.g., unless, until)
 - Terse (e.g., optional parentheses, optional semicolons, statement modifiers)