

```

-- Two dashes start a one-line comment.

--[[
    Adding two ['s and ]'s makes it a
    multi-line comment.
--]]

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-- 1. Variables and flow control.
-----

num = 42 -- All numbers are doubles.
-- Don't freak out, 64-bit doubles have 52 bits for storing exact int
-- values; machine precision is not a problem for ints that need < 52 bits.

s = 'walternate' -- Immutable strings like Python.
t = "double-quotes are also fine"
u = [[ Double brackets
      start and end
      multi-line strings.]]
t = nil -- Undefined t; Lua has garbage collection.

-- Blocks are denoted with keywords like do/end:
while num < 50 do
    num = num + 1 -- No ++ or += type operators.
end

-- If clauses:
if num > 40 then
    print('over 40')
elseif s ~= 'walternate' then -- ~= is not equals.
    -- Equality check is == like Python; ok for strs.
    io.write('not over 40\n') -- Defaults to stdout.
else
    -- Variables are global by default.
    thisIsGlobal = 5 -- Camel case is common.

    -- How to make a variable local:
    local line = io.read() -- Reads next stdin line.

    -- String concatenation uses the .. operator:
    print('Winter is coming, ' .. line)
end

-- Undefined variables return nil.
-- This is not an error:
foo = anUnknownVariable -- Now foo = nil.

aBoolValue = false

-- Only nil and false are falsy; 0 and '' are true!
if not aBoolValue then print('twas false') end

-- 'or' and 'and' are short-circuited. This is similar to the a?b:c operator
-- in C/js:

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ans = aBoolValue and 'yes' or 'no' --> 'no'

karlSum = 0
for i = 1, 100 do -- The range includes both ends.
    karlSum = karlSum + i
end

-- Use "100, 1, -1" as the range to count down:
fredSum = 0
for j = 100, 1, -1 do fredSum = fredSum + j end

-- In general, the range is begin, end[, step].

-- Another loop construct:
repeat
    print('the way of the future')
    num = num - 1
until num == 0

-----
-- 2. Functions.
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function fib(n)
    if n < 2 then return n end
    return fib(n - 2) + fib(n - 1)
end

-- Closures and anonymous functions are ok:
function adder(x)
    -- The returned function is created when adder is called, and remembers the
    -- value of x:
    return function (y) return x + y end
end
a1 = adder(9)
a2 = adder(36)
print(a1(16)) --> 25
print(a2(64)) --> 100

-- Returns, func calls, and assignments all work with lists that may be
-- mismatched in length. Unmatched receivers are nil; unmatched senders are
-- discarded.

x, y, z = 1, 2, 3, 4
-- Now x = 1, y = 2, z = 3, and 4 is thrown away.

function bar(a, b, c)
    print(a, b, c)
    return 4, 8, 15, 16, 23, 42
end

x, y = bar('zaphod') --> prints "zaphod nil nil"
-- Now x = 4, y = 8, values 15..42 are discarded.

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-- Functions are first-class, may be local/global. These are the same:
function f(x) return x * x end
f = function (x) return x * x end

-- And so are these:
local function g(x) return math.sin(x) end
local g = function(x) return math.sin(x) end
-- Equivalent to local function g(x)..., except referring to g in the function
-- body won't work as expected.
local g; g = function (x) return math.sin(x) end
-- the 'local g' decl makes g-self-references ok.

-- Trig funcs work in radians, by the way.

-- Calls with one string param don't need parens:
print 'hello' -- Works fine.

-- Calls with one table param don't need parens either (more on tables below):
print {} -- Works fine too.

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-- 3. Tables.
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-- Tables = Lua's only compound data structure; they are associative arrays.
-- Similar to php arrays or js objects, they are hash-lookup dicts that can
-- also be used as lists.

-- Using tables as dictionaries / maps:

-- Dict literals have string keys by default:
t = {key1 = 'value1', key2 = false}

-- String keys can use js-like dot notation:
print(t.key1) -- Prints 'value1'.
t.newKey = {} -- Adds a new key/value pair.
t.key2 = nil -- Removes key2 from the table.

-- Literal notation for any (non-nil) value as key:
u = {'@!#' = 'qbert', [{}] = 1729, [6.28] = 'tau'}
print(u[6.28]) -- prints "tau"

-- Key matching is basically by value for numbers and strings, but by identity
-- for tables.
a = u['@!#'] -- Now a = 'qbert'.
b = u[{}] -- We might expect 1729, but it's nil:
-- b = nil since the lookup fails. It fails because the key we used is not the
-- same object as the one used to store the original value. So strings &
-- numbers are more portable keys.

-- A one-table-param function call needs no parens:
function h(x) print(x.key1) end
h{key1 = 'Sonmi~451'} -- Prints 'Sonmi~451'.

```

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for key, val in pairs(u) do -- Table iteration.
    print(key, val)
end

-- _G is a special table of all globals.
print(_G['_G'] == _G) -- Prints 'true'.

-- Using tables as lists / arrays:

-- List literals implicitly set up int keys:
v = {'value1', 'value2', 1.21, 'gigawatts'}
for i = 1, #v do -- #v is the size of v for lists.
    print(v[i]) -- Indices start at 1 !! SO CRAZY!
end
-- A 'list' is not a real type. v is just a table with consecutive integer
-- keys, treated as a list.

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-- 3.1 Metatables and metamethods.
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-- A table can have a metatable that gives the table operator-overloadish
-- behaviour. Later we'll see how metatables support js-prototypey behaviour.

f1 = {a = 1, b = 2} -- Represents the fraction a/b.
f2 = {a = 2, b = 3}

-- This would fail:
-- s = f1 + f2

metafraction = {}
function metafraction.__add(f1, f2)
    local sum = {}
    sum.b = f1.b * f2.b
    sum.a = f1.a * f2.b + f2.a * f1.b
    return sum
end

setmetatable(f1, metafraction)
setmetatable(f2, metafraction)

s = f1 + f2 -- call __add(f1, f2) on f1's metatable

-- f1, f2 have no key for their metatable, unlike prototypes in js, so you must
-- retrieve it as in getmetatable(f1). The metatable is a normal table with
-- keys that Lua knows about, like __add.

-- But the next line fails since s has no metatable:
-- t = s + s
-- Class-like patterns given below would fix this.

-- An __index on a metatable overloads dot lookups:
defaultFavs = {animal = 'gru', food = 'donuts'}
myFavs = {food = 'pizza'}

```

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setmetatable(myFavs, {__index = defaultFavs})
eatenBy = myFavs.animal -- works! thanks, metatable
```

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-- Direct table lookups that fail will retry using the metatable's __index
-- value, and this recurses.
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-- An __index value can also be a function(tbl, key) for more customized
-- lookups.
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-- Values of __index, add, .. are called metamethods.
-- Full list. Here a is a table with the metamethod.
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```
-- __add(a, b)           for a + b
-- __sub(a, b)           for a - b
-- __mul(a, b)           for a * b
-- __div(a, b)           for a / b
-- __mod(a, b)           for a % b
-- __pow(a, b)           for a ^ b
-- __unm(a)              for -a
-- __concat(a, b)        for a .. b
-- __len(a)              for #a
-- __eq(a, b)            for a == b
-- __lt(a, b)            for a < b
-- __le(a, b)            for a <= b
-- __index(a, b) <fn or a table> for a.b
-- __newindex(a, b, c)   for a.b = c
-- __call(a, ...)        for a(...)
```

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-- 3.2 Class-like tables and inheritance.
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-- Classes aren't built in; there are different ways to make them using
-- tables and metatables.
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-- Explanation for this example is below it.
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Dog = {} -- 1.
```

```
function Dog:new() -- 2.
    local newObj = {sound = 'woof'} -- 3.
    self.__index = self -- 4.
    return setmetatable(newObj, self) -- 5.
end
```

```
function Dog:makeSound() -- 6.
    print('I say ' .. self.sound)
end
```

```
mrDog = Dog:new() -- 7.
mrDog:makeSound() -- 'I say woof' -- 8.
```

```
-- 1. Dog acts like a class; it's really a table.
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-- 2. "function tablename:fn(...)" is the same as
--     "function tablename.fn(self, ...)", The : just adds a first arg called
--     self. Read 7 & 8 below for how self gets its value.
-- 3. newObj will be an instance of class Dog.
-- 4. "self" is the class being instantiated. Often self = Dog, but inheritance
--     can change it. newObj gets self's functions when we set both newObj's
--     metatable and self's __index to self.
-- 5. Reminder: setmetatable returns its first arg.
-- 6. The : works as in 2, but this time we expect self to be an instance
--     instead of a class.
-- 7. Same as Dog.new(Dog), so self = Dog in new().
-- 8. Same as mrDog.makeSound(mrDog); self = mrDog.

```

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-- Inheritance example:

```

LoudDog = Dog:new()                                -- 1.

function LoudDog:makeSound()
  local s = self.sound .. ' '                      -- 2.
  print(s .. s .. s)
end

seymour = LoudDog:new()                             -- 3.
seymour:makeSound() -- 'woof woof woof'             -- 4.

```

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-- 1. LoudDog gets Dog's methods and variables.
-- 2. self has a 'sound' key from new(), see 3.
-- 3. Same as "LoudDog.new(LoudDog)", and converted to "Dog.new(LoudDog)" as
--     LoudDog has no 'new' key, but does have "__index = Dog" on its metatable.
--     Result: seymour's metatable is LoudDog, and "LoudDog.__index = Dog". So
--     seymour.key will equal seymour.key, LoudDog.key, Dog.key, whichever
--     table is the first with the given key.
-- 4. The 'makeSound' key is found in LoudDog; this is the same as
--     "LoudDog.makeSound(seymour)".

```

-- If needed, a subclass's new() is like the base's:

```

function LoudDog:new()
  local newObj = {}
  -- set up newObj
  self.__index = self
  return setmetatable(newObj, self)
end

```

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-- 4. Modules.

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--[[ I'm commenting out this section so the rest of this script remains
--    runnable.

```

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-- Suppose the file mod.lua looks like this:
local M = {}

local function sayMyName()
    print('Hrunkner')
end

function M.sayHello()
    print('Why hello there')
    sayMyName()
end

return M

-- Another file can use mod.lua's functionality:
local mod = require('mod') -- Run the file mod.lua.

-- require is the standard way to include modules.
-- require acts like:      (if not cached; see below)
local mod = (function ()
    <contents of mod.lua>
end)()
-- It's like mod.lua is a function body, so that locals inside mod.lua are
-- invisible outside it.

-- This works because mod here = M in mod.lua:
mod.sayHello() -- Says hello to Hrunkner.

-- This is wrong; sayMyName only exists in mod.lua:
mod.sayMyName() -- error

-- require's return values are cached so a file is run at most once, even when
-- require'd many times.

-- Suppose mod2.lua contains "print('Hi!')".
local a = require('mod2') -- Prints Hi!
local b = require('mod2') -- Doesn't print; a=b.

-- dofile is like require without caching:
dofile('mod2') --> Hi!
dofile('mod2') --> Hi! (runs again, unlike require)

-- loadfile loads a lua file but doesn't run it yet.
f = loadfile('mod2') -- Calling f() runs mod2.lua.

-- loadstring is loadfile for strings.
g = loadstring('print(343)') -- Returns a function.
g() -- Prints out 343; nothing printed before now.

--]]

```

## References

I was excited to learn Lua so I could make games with the Love 2D game engine. That's the why.

I started with BlackBulletIV's Lua for programmers. Next I read the official Programming in Lua book. That's the how.

It might be helpful to check out the Lua short reference on [lua-users.org](http://lua-users.org).

The main topics not covered are standard libraries:

- string library
- table library
- math library
- io library
- os library

By the way, the entire file is valid Lua; save it as `learn.lua` and run it with `lua learn.lua` !

This was first written for [tylerneylon.com](http://tylerneylon.com), and is also available as a [github gist](#). Have fun with Lua!