NOTES ON LUA-5.2

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1. Introduction and Basic Concepts

(1) Lua is an *extensional* language.
(2) Lua is *dynamically typed* i.e. variables do not have types, only values do.
(3) Inline commenting in Lua is achieved by typing two hyphens: `-- This is a comment`.
(4) Lua has 8 basic types:
   (a) *nil* type is the default. It is the type of the value `nil`. Similar to *Nonetype* in python.
   (b) *boolean*
   (c) *numbers* which stores double precision floating-point numbers.
   (d) *string*
   (e) *function*
   (f) *userdata* for storing arbitrary C data types.
   (g) *thread* for independent threads of execution, used to implement coroutines.
   (h) *table* for associative arrays which can be indexed with any Lua value except `nil`and `NaN`.
      - Tables can be heterogeneous i.e. they can contain values of all types (except `nil`).
      - A table with index set $\{1, \ldots, n\}$ for some integer n is a *sequence*.
      - Any key with value `nil`is not considered a part of the table.
      - Any key that is not part of a table has value `nil`.
      - The values of a table fields can be of any type. In particular, table field values can be functions.
      - Indexing of tables follows the definition of raw equality in the language:

        `a[i]==a[j]` $\iff$ `i` and `j` are raw equal.

(5) For a table `a`, Lua treats `a.name` as syntactic sugar for `a["name"]`.
(6) Tables, functions, threads and (full) userdata values are *objects*. Objects do not contain values, they contain references to values.
(7) An error message can be generated by calling the Lua function `error` and error message can be passed as a string argument to this function.

(8) Every value in Lua can have a *metatable*, which is an ordinary Lua table that defines the behavior of the original value under certain special operations.
- Behavior can be changed by setting specific fields in the metatable.
- Keys of the metatable are *event* names, corresponding field values are *metamethods*.
- Metatable of any value can be queried by using the `getmetatable` function.
- The metatable of a table can be replaced by using the `setmetatable` function. Metatables of other values cannot be changed in Lua because values of type other than table and full userdata all share a single metatable per type.
- Each operation is identified by a string in the metatable. The key for each operation is two underscores + the name of the operation. Example: `"__add"` for addition.
- The metamethod of an object for an event can be retrieved as such: `metatable(obj)[event]`. Access to a metamethod results in raw output and does not invoke other metamethods. Also, access to objects with no metamethods results in `nil`.

(9) Operations controlled by metamethods:
- `"__add"` encodes the `+` operation.
- `"__sub"` encodes the `-` operation.
- `"__mul"` encodes the `*` operation.
- `"__div"` encodes the `/` operation.
- `"__mod"` encodes the `%` operation.
- `"__pow"` encodes the `^` (exponentiation) operation.
- `"__unm"` encodes the unary `-` operation (for creating negative numbers).
- `"__concat"` encodes the `..` (string concatenation) operation.
- `"__len"` encodes the `#` (string length) operation.
- `"__eq"` encodes the `==` operation.
- `"__lt"` encodes the `<` (less than) operation.
- `"__le"` encodes the `<=` (less than or equal) operation. If this metamethod is absent then Lua assumes `a<=b` $\iff$ `not (b<a)`.
- `"__index"` encodes the indexing in tables (the get-value function). This is what allows one to access a value by calling `a[key]`, where `a` is some table.
- `"__newindex"` encodes the addition of new key-value pairs to the table. It is sort of a set-value function, allowing us to write expressions like `a[key] = blah`.
- `"__call"` encodes the operation of calling the value stored in a variable.

(10) The expression $a \neq b$ is encoded as `a` $\sim=$ `b`.

(11) Garbabge collection and memory management is automatic in Lua.

2. The Language