Modul:TableTools

This module includes a number of functions for dealing with Lua tables. It is a meta-module, meant to be called from other Lua modules, and should not be called directly from #invoke.

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Loading the module

To use any of the functions, first you must load the module.

```
local TableTools = require('Module:TableTools')
```

isPositiveInteger

```
TableTools.isPositiveInteger(value)
```

Returns `true` if *`value`* is a positive integer, and `false` if not. Although it doesn't operate on tables, it is included here as it is useful for determining whether a given table key is in the array part or the hash part of a table.

isNan

```
TableTools.isNan(value)
```

Returns `true` if *`value`* is a NaN value, and `false` if not. Although it doesn't operate on tables, it is included here as it is useful for determining whether a value can be a valid table key. (Lua will generate an error if a NaN value is used as a table key.)

shallowClone

```
TableTools.shallowClone(t)
```

Returns a clone of a table. The value returned is a new table, but all subtables and functions are shared. Metamethods are respected, but the returned table will have no metatable of its own. If you want to make a new table with no shared subtables and with metatables transferred, you can use `mw.clone` instead. If you want to make a new table with no shared subtables and without metatables transferred, use `deepCopy` with the `noMetatable` option.

removeDuplicates

```
TableTools.removeDuplicates(t)
```

Removes duplicate values from an array. This function is only designed to work with standard arrays: keys that are not positive integers are ignored, as are all values after the first `nil` value. (For arrays containing `nil` values, you can use `compressSparseArray` first.) The function tries to preserve the order of the array: the earliest non-unique value is kept, and all subsequent duplicate values are removed. For example, for the table Vorlage:Code `removeDuplicates` will return Vorlage:Code.

numKeys

```
TableTools.numKeys(t)
```

Takes a table *`t`* and returns an array containing the numbers of any positive integer keys that have non-nil values, sorted in numerical order. For example, for the table Vorlage:Code, `numKeys` will return Vorlage:Code.

affixNums

```
TableTools.affixNums(t, prefix, suffix)
```

Takes a table *t* and returns an array containing the numbers of keys with the optional prefix *prefix* and the optional suffix *suffix*. For example, for the table Vorlage:Code and the prefix 'a' , affixNums will return Vorlage:Code. All characters in *prefix* and *suffix* are interpreted literally.

numData

```
TableTools.numData(t, compress)
```

Given a table with keys like "foo1", "bar1", "foo2", and "baz2", returns a table of subtables in the format Vorlage:Code. Keys that don't end with an integer are stored in a subtable named "other". The compress option compresses the table so that it can be iterated over with ipairs.

compressSparseArray

```
TableTools.compressSparseArray(t)
```

Takes an array *t* with one or more nil values, and removes the nil values while preserving the order, so that the array can be safely traversed with ipairs. Any keys that are not positive integers are removed. For example, for the table Vorlage:Code, compressSparseArray will return Vorlage:Code.

sparseIpairs

```
TableTools.sparseIpairs(t)
```

This is an iterator function for traversing a sparse array *t*. It is similar to ipairs, but will continue to iterate until the highest numerical key, whereas ipairs may stop after the first nil value. Any keys that are not positive integers are ignored.

Usually sparseIpairs is used in a generic for loop.

```
for i, v in TableTools.sparseIpairs(t) do
   -- code block
end
```

Note that sparseIpairs uses the pairs function in its implementation. Although some table keys appear to be ignored, all table keys are accessed when it is run.

size

```
TableTools.size(t)
```

Finds the size of a key/value pair table. For example, for the table Vorlage:Code, `size` will return `2`. The function will also work on arrays, but for arrays it is more efficient to use the `#` operator. Note that to find the table size, this function uses the `pairs` function to iterate through all of the table keys.

keysToList

```
TableTools.keysToList(t, keySort, checked)
```

Returns a list of the keys in a table, sorted using either a default comparison function or a custom *keySort* function, which follows the same rules as the `comp` function supplied to `table.sort`. If *keySort* is `false`, no sorting is done. Set *checked* to `true` to skip the internal type checking.

sortedPairs

```
TableTools.sortedPairs(t, keySort)
```

Iterates through a table, with the keys sorted using the `keysToList` function. If there are only numerical keys, `sparseIpairs` is probably more efficient.

isArray

```
TableTools.isArray(value)
```

Returns `true` if *value* is a table and all keys are consecutive integers starting at 1.

isArrayLike

```
TableTools.isArrayLike(value)
```

Returns `true` if *value* is iterable and all keys are consecutive integers starting at 1.

invert

```
TableTools.invert(arr)
```

Transposes the keys and values in an array. For example, Vorlage:Code yields Vorlage:Code.

listToSet

```
TableTools.listToSet(arr)
```

Creates a set from the array part of the table *arr*. Indexing the set by any of the values of the array returns `true`. For example, Vorlage:Code yields Vorlage:Code. See also Module:Lua set for more advanced ways to create a set.

deepCopy

```
TableTools.deepCopy(orig, noMetatable, alreadySeen)
```

Creates a copy of the table *orig*. As with `mw.clone`, all values that are not functions are duplicated and the identity of tables is preserved. If *noMetatable* is `true`, then the metatable (if any) is not copied. Can copy tables loaded with `mw.loadData`.

Similar to `mw.clone`, but `mw.clone` cannot copy tables loaded with `mw.loadData` and does not allow metatables *not* to be copied.

sparseConcat

```
TableTools.sparseConcat(t, sep, i, j)
```

Concatenates all values in the table that are indexed by a positive integer, in order. For example, Vorlage:Code yields Vorlage:Code and Vorlage:Code yields Vorlage:Code.

length

```
TableTools.length(t, prefix)
```

Finds the length of an array or of a quasi-array with keys with an optional *prefix* such as "data1", "data2", etc. It uses an exponential search algorithm to find the length, so as to use as few table lookups as possible.

This algorithm is useful for arrays that use metatables (e.g. frame.args) and for quasi-arrays. For normal arrays, just use the # operator, as it is implemented in C and will be quicker.

inArray

```
TableTools.inArray(arr, valueToFind)
```

Returns `true` if *valueToFind* is a member of the array *arr*, and `false` otherwise.

```
--------------------------------------------------------------------------------
--                                  TableTools
--
-- This module includes a number of functions for dealing with Lua tables.
-- It is a meta-module, meant to be called from other Lua modules, and should not
-- be called directly from #invoke.
--------------------------------------------------------------------------------
```

```
local libraryUtil = require('libraryUtil')

local p = {}

-- Define often-used variables and functions.
local floor = math.floor
local infinity = math.huge
local checkType = libraryUtil.checkType
local checkTypeMulti = libraryUtil.checkTypeMulti

------------------------------------------------------------------------
-- isPositiveInteger
--
-- This function returns true if the given value is a positive integer, and false
-- if not. Although it doesn't operate on tables, it is included here as it is
-- useful for determining whether a given table key is in the array part or the
-- hash part of a table.
------------------------------------------------------------------------
function p.isPositiveInteger(v)
	return type(v) == 'number' and v >= 1 and floor(v) == v and v < infinity
end

------------------------------------------------------------------------
-- isNan
--
-- This function returns true if the given number is a NaN value, and false if
-- not. Although it doesn't operate on tables, it is included here as it is useful
-- for determining whether a value can be a valid table key. Lua will generate an
-- error if a NaN is used as a table key.
------------------------------------------------------------------------
function p.isNan(v)
	return type(v) == 'number' and v ~= v
end

------------------------------------------------------------------------
-- shallowClone
--
-- This returns a clone of a table. The value returned is a new table, but all
-- subtables and functions are shared. Metamethods are respected, but the returned
-- table will have no metatable of its own.
------------------------------------------------------------------------
function p.shallowClone(t)
	checkType('shallowClone', 1, t, 'table')
	local ret = {}
	for k, v in pairs(t) do
		ret[k] = v
	end
	return ret
end

------------------------------------------------------------------------
-- removeDuplicates
--
-- This removes duplicate values from an array. Non-positive-integer keys are
-- ignored. The earliest value is kept, and all subsequent duplicate values are
-- removed, but otherwise the array order is unchanged.
------------------------------------------------------------------------
function p.removeDuplicates(arr)
	checkType('removeDuplicates', 1, arr, 'table')
	local isNan = p.isNan
	local ret, exists = {}, {}
	for _, v in ipairs(arr) do
		if isNan(v) then
```

```
                        -- NaNs can't be table keys, and they are also unique, so
                        ret[#ret + 1] = v
                else
                        if not exists[v] then
                                ret[#ret + 1] = v
                                exists[v] = true
                        end
                end
        end
        return ret
end

--------------------------------------------------------------------------------
-- numKeys
--
-- This takes a table and returns an array containing the numbers of any numerical
-- keys that have non-nil values, sorted in numerical order.
--------------------------------------------------------------------------------
function p.numKeys(t)
        checkType('numKeys', 1, t, 'table')
        local isPositiveInteger = p.isPositiveInteger
        local nums = {}
        for k in pairs(t) do
                if isPositiveInteger(k) then
                        nums[#nums + 1] = k
                end
        end
        table.sort(nums)
        return nums
end

--------------------------------------------------------------------------------
-- affixNums
--
-- This takes a table and returns an array containing the numbers of keys with the
-- specified prefix and suffix. For example, for the table
-- {a1 = 'foo', a3 = 'bar', a6 = 'baz'} and the prefix "a", affixNums will return
-- {1, 3, 6}.
--------------------------------------------------------------------------------
function p.affixNums(t, prefix, suffix)
        checkType('affixNums', 1, t, 'table')
        checkType('affixNums', 2, prefix, 'string', true)
        checkType('affixNums', 3, suffix, 'string', true)

        local function cleanPattern(s)
                -- Cleans a pattern so that the magic characters ()%.[]*+-?^$ are
                return s:gsub('([%(%)%%%.%[%]%*%+%-%?%^%$])', '%%%1')
        end

        prefix = prefix or ''
        suffix = suffix or ''
        prefix = cleanPattern(prefix)
        suffix = cleanPattern(suffix)
        local pattern = '^' .. prefix .. '([1-9]%d*)' .. suffix .. '$'

        local nums = {}
        for k in pairs(t) do
                if type(k) == 'string' then
                        local num = mw.ustring.match(k, pattern)
                        if num then
                                nums[#nums + 1] = tonumber(num)
                        end
                end
        end
```

```
        table.sort(nums)
        return nums
end

--------------------------------------------------------------------------------
-- numData
--
-- Given a table with keys like {"foo1", "bar1", "foo2", "baz2"}, returns a table
-- of subtables in the format
-- {[1] = {foo = 'text', bar = 'text'}, [2] = {foo = 'text', baz = 'text'}}.
-- Keys that don't end with an integer are stored in a subtable named "other". Th
-- compress option compresses the table so that it can be iterated over with
-- ipairs.
--------------------------------------------------------------------------------
function p.numData(t, compress)
        checkType('numData', 1, t, 'table')
        checkType('numData', 2, compress, 'boolean', true)
        local ret = {}
        for k, v in pairs(t) do
                local prefix, num = mw.ustring.match(tostring(k), '^([^0-9]*)([1-
                if num then
                        num = tonumber(num)
                        local subtable = ret[num] or {}
                        if prefix == '' then
                                -- Positional parameters match the blank string;
                                prefix = 1
                        end
                        subtable[prefix] = v
                        ret[num] = subtable
                else
                        local subtable = ret.other or {}
                        subtable[k] = v
                        ret.other = subtable
                end
        end
        if compress then
                local other = ret.other
                ret = p.compressSparseArray(ret)
                ret.other = other
        end
        return ret
end

--------------------------------------------------------------------------------
-- compressSparseArray
--
-- This takes an array with one or more nil values, and removes the nil values
-- while preserving the order, so that the array can be safely traversed with
-- ipairs.
--------------------------------------------------------------------------------
function p.compressSparseArray(t)
        checkType('compressSparseArray', 1, t, 'table')
        local ret = {}
        local nums = p.numKeys(t)
        for _, num in ipairs(nums) do
                ret[#ret + 1] = t[num]
        end
        return ret
end

--------------------------------------------------------------------------------
-- sparseIpairs
--
-- This is an iterator for sparse arrays. It can be used like ipairs, but can
```

```
-- handle nil values.
--------------------------------------------------------------------------------
function p.sparseIpairs(t)
	checkType('sparseIpairs', 1, t, 'table')
	local nums = p.numKeys(t)
	local i = 0
	local lim = #nums
	return function ()
		i = i + 1
		if i <= lim then
			local key = nums[i]
			return key, t[key]
		else
			return nil, nil
		end
	end
end

--------------------------------------------------------------------------------
-- size
--
-- This returns the size of a key/value pair table. It will also work on arrays,
-- but for arrays it is more efficient to use the # operator.
--------------------------------------------------------------------------------
function p.size(t)
	checkType('size', 1, t, 'table')
	local i = 0
	for _ in pairs(t) do
		i = i + 1
	end
	return i
end

local function defaultKeySort(item1, item2)
	-- "number" < "string", so numbers will be sorted before strings.
	local type1, type2 = type(item1), type(item2)
	if type1 ~= type2 then
		return type1 < type2
	elseif type1 == 'table' or type1 == 'boolean' or type1 == 'function' ther
		return tostring(item1) < tostring(item2)
	else
		return item1 < item2
	end
end
--------------------------------------------------------------------------------
-- keysToList
--
-- Returns an array of the keys in a table, sorted using either a default
-- comparison function or a custom keySort function.
--------------------------------------------------------------------------------
function p.keysToList(t, keySort, checked)
	if not checked then
		checkType('keysToList', 1, t, 'table')
		checkTypeMulti('keysToList', 2, keySort, {'function', 'boolean',
	end

	local arr = {}
	local index = 1
	for k in pairs(t) do
		arr[index] = k
		index = index + 1
	end

	if keySort ~= false then
```

```
                keySort = type(keySort) == 'function' and keySort or defaultKeySo
                table.sort(arr, keySort)
        end

        return arr
end

--------------------------------------------------------------------------------
-- sortedPairs
--
-- Iterates through a table, with the keys sorted using the keysToList function.
-- If there are only numerical keys, sparseIpairs is probably more efficient.
--------------------------------------------------------------------------------
function p.sortedPairs(t, keySort)
        checkType('sortedPairs', 1, t, 'table')
        checkType('sortedPairs', 2, keySort, 'function', true)

        local arr = p.keysToList(t, keySort, true)

        local i = 0
        return function ()
                i = i + 1
                local key = arr[i]
                if key ~= nil then
                        return key, t[key]
                else
                        return nil, nil
                end
        end
end

--------------------------------------------------------------------------------
-- isArray
--
-- Returns true if the given value is a table and all keys are consecutive
-- integers starting at 1.
--------------------------------------------------------------------------------
function p.isArray(v)
        if type(v) ~= 'table' then
                return false
        end
        local i = 0
        for _ in pairs(v) do
                i = i + 1
                if v[i] == nil then
                        return false
                end
        end
        return true
end

--------------------------------------------------------------------------------
-- isArrayLike
--
-- Returns true if the given value is iterable and all keys are consecutive
-- integers starting at 1.
--------------------------------------------------------------------------------
function p.isArrayLike(v)
        if not pcall(pairs, v) then
                return false
        end
        local i = 0
        for _ in pairs(v) do
                i = i + 1
```

```
                if v[i] == nil then
                        return false
                end
        end
        return true
end

--------------------------------------------------------------------------------
-- invert
--
-- Transposes the keys and values in an array. For example, {"a", "b", "c"} ->
-- {a = 1, b = 2, c = 3}. Duplicates are not supported (result values refer to
-- the index of the last duplicate) and NaN values are ignored.
--------------------------------------------------------------------------------
function p.invert(arr)
        checkType("invert", 1, arr, "table")
        local isNan = p.isNan
        local map = {}
        for i, v in ipairs(arr) do
                if not isNan(v) then
                        map[v] = i
                end
        end

        return map
end

--------------------------------------------------------------------------------
-- listToSet
--
-- Creates a set from the array part of the table. Indexing the set by any of the
-- values of the array returns true. For example, {"a", "b", "c"} ->
-- {a = true, b = true, c = true}. NaN values are ignored as Lua considers them
-- never equal to any value (including other NaNs or even themselves).
--------------------------------------------------------------------------------
function p.listToSet(arr)
        checkType("listToSet", 1, arr, "table")
        local isNan = p.isNan
        local set = {}
        for _, v in ipairs(arr) do
                if not isNan(v) then
                        set[v] = true
                end
        end

        return set
end

--------------------------------------------------------------------------------
-- deepCopy
--
-- Recursive deep copy function. Preserves identities of subtables.
--------------------------------------------------------------------------------
local function _deepCopy(orig, includeMetatable, already_seen)
        -- Stores copies of tables indexed by the original table.
        already_seen = already_seen or {}

        local copy = already_seen[orig]
        if copy ~= nil then
                return copy
        end

        if type(orig) == 'table' then
                copy = {}
```

```
                for orig_key, orig_value in pairs(orig) do
                        copy[_deepCopy(orig_key, includeMetatable, already_seen)]
                end
                already_seen[orig] = copy

                if includeMetatable then
                        local mt = getmetatable(orig)
                        if mt ~= nil then
                                local mt_copy = _deepCopy(mt, includeMetatable, a
                                setmetatable(copy, mt_copy)
                                already_seen[mt] = mt_copy
                        end
                end
        else -- number, string, boolean, etc
                copy = orig
        end
        return copy
end

function p.deepCopy(orig, noMetatable, already_seen)
        checkType("deepCopy", 3, already_seen, "table", true)
        return _deepCopy(orig, not noMetatable, already_seen)
end

--------------------------------------------------------------------------------
-- sparseConcat
--
-- Concatenates all values in the table that are indexed by a number, in order.
-- sparseConcat{a, nil, c, d}  =>  "acd"
-- sparseConcat{nil, b, c, d}  =>  "bcd"
--------------------------------------------------------------------------------
function p.sparseConcat(t, sep, i, j)
        local arr = {}

        local arr_i = 0
        for _, v in p.sparseIpairs(t) do
                arr_i = arr_i + 1
                arr[arr_i] = v
        end

        return table.concat(arr, sep, i, j)
end

--------------------------------------------------------------------------------
-- length
--
-- Finds the length of an array, or of a quasi-array with keys such as "data1",
-- "data2", etc., using an exponential search algorithm. It is similar to the
-- operator #, but may return a different value when there are gaps in the array
-- portion of the table. Intended to be used on data loaded with mw.loadData. For
-- other tables, use #.
-- Note: #frame.args in frame object always be set to 0, regardless of  the numbe
-- of unnamed template parameters, so use this function for frame.args.
--------------------------------------------------------------------------------
function p.length(t, prefix)
        -- requiring module inline so that [[Module:Exponential search]] which is
        -- only needed by this one function doesn't get millions of transclusions
        local expSearch = require("Module:Exponential search")
        checkType('length', 1, t, 'table')
        checkType('length', 2, prefix, 'string', true)
        return expSearch(function (i)
                local key
                if prefix then
                        key = prefix .. tostring(i)
```

```
                else
                        key = i
                end
                return t[key] ~= nil
        end) or 0
end

--------------------------------------------------------------------------------
-- inArray
--
-- Returns true if valueToFind is a member of the array, and false otherwise.
--------------------------------------------------------------------------------
function p.inArray(arr, valueToFind)
        checkType("inArray", 1, arr, "table")
        -- if valueToFind is nil, error?

        for _, v in ipairs(arr) do
                if v == valueToFind then
                        return true
                end
        end
        return false
end

return p
```