The anatomy of maps in Go

A map is composite data type that can hold data represented by key:value pairs.

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A map is like an apartment complex with many rooms. Every room has a key and key is necessary to find out what's inside that room. Key can be made of any fixed material (data type) and a room can contain any fixed material (data type).

☛ What is a `map`?

A map is like an `array` except, instead of an integer `index`, you can have `string` or any other data types as `key`. An illustration of a map looks like

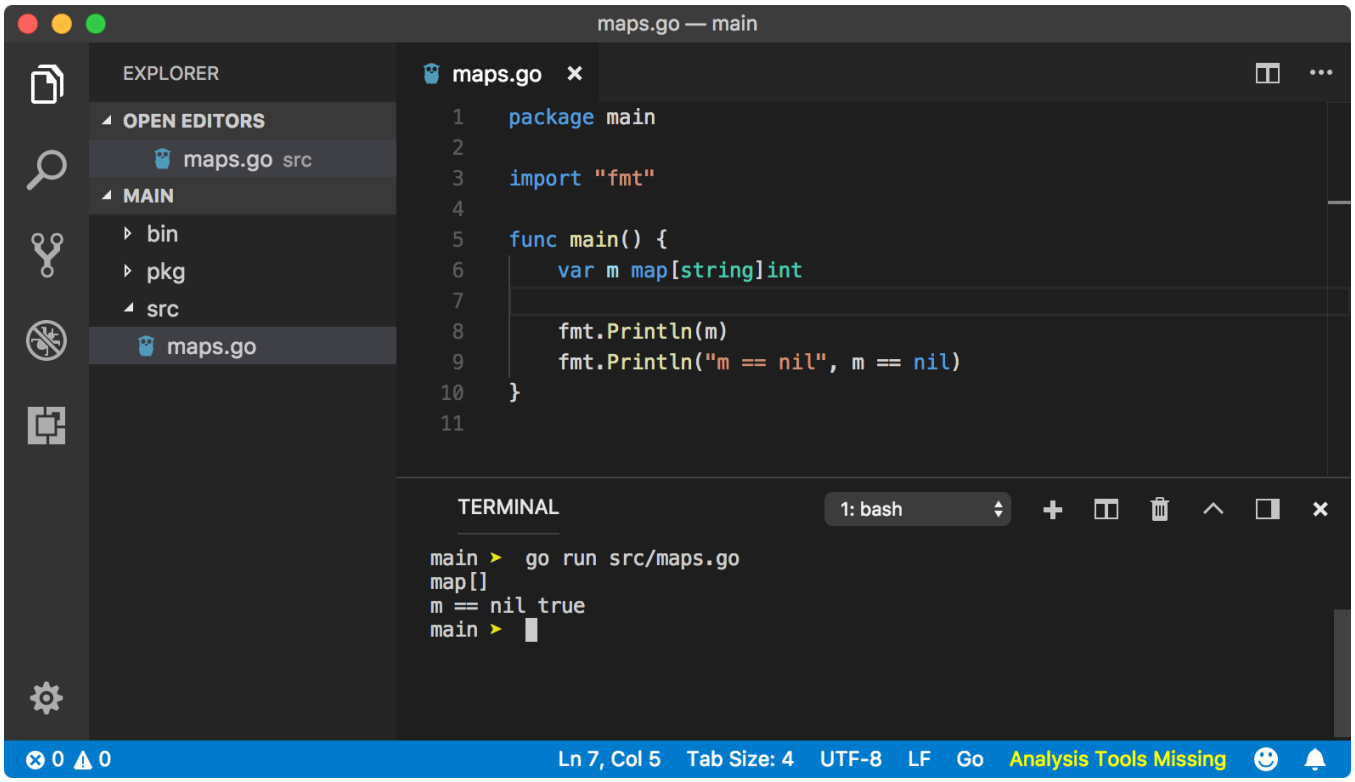
```
{
  stringKey: intValue,
  stringKey: intValue
  ...
}
```

The syntax to define a map is

```
var myMap map[keyType]valueType
```

Where `keyType` is the data type of **map keys** while `valueType` is the data type of **map values**. A `map` is a **composite data type** because it is composed of primitive data types (*see variables lesson for* ***primitive data types***).

Let's declare a simple map.



https://play.golang.org/p/Rv6dFDtbsoZ

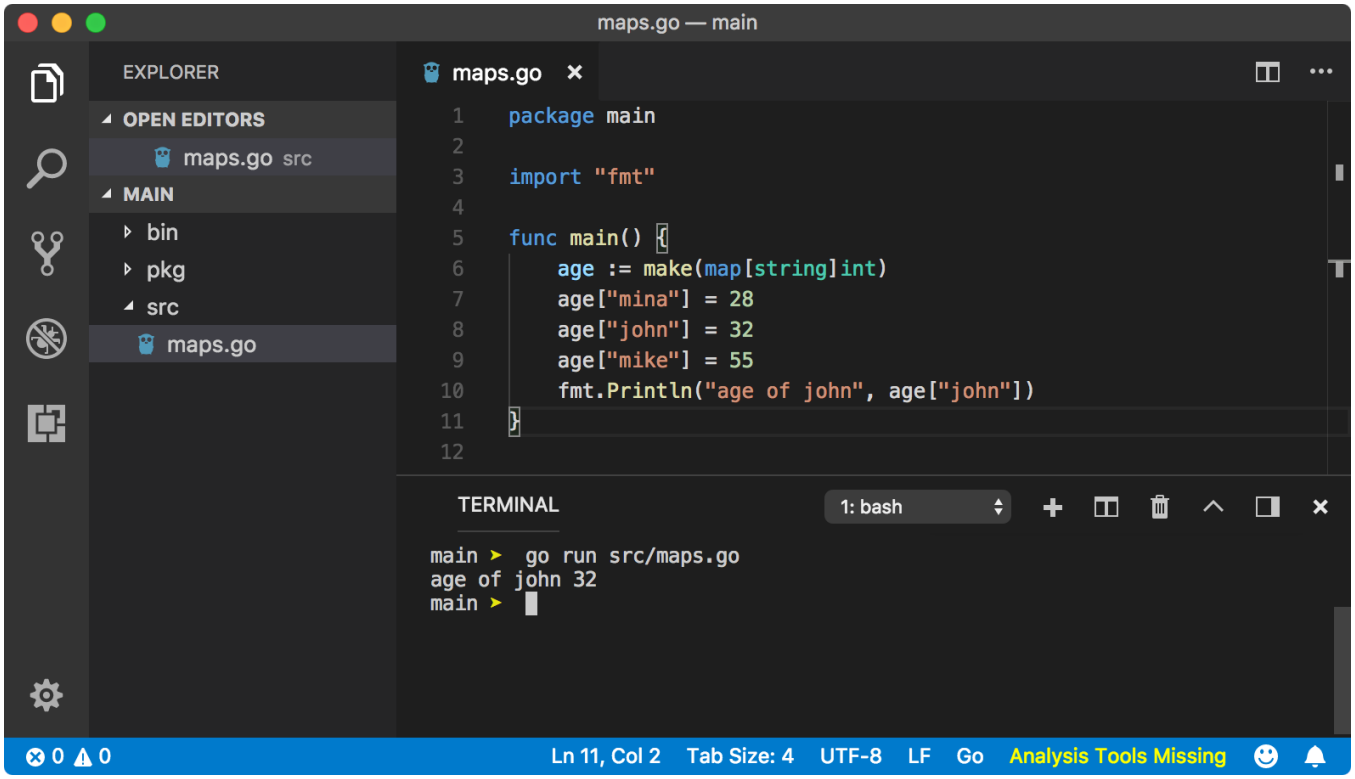
In the above program, we have declared a map `m` which is empty, because `zero-value` of a map is `nil`. But the thing about `nil` map is, we can't add values to it because like slices, `map` cannot hold any data, rather they reference internal data structure that holds the data. So, in case of `nil` map, the internal data structure is missing and assigning any data to it will case runtime panic `panic: assignment to entry in nil map`. You can use `nil` map as a variable to store another non `nil` map.

☛ Creating an empty map

An `empty map` is like an empty `slice` with internal data structure defined so that we can use it to store some data. Like `slice`, we can use `make` function to create an empty `map`.

```
m := make(map[keyType]valueType)
```

Let's create a simple map `age` in which we can save age of people.



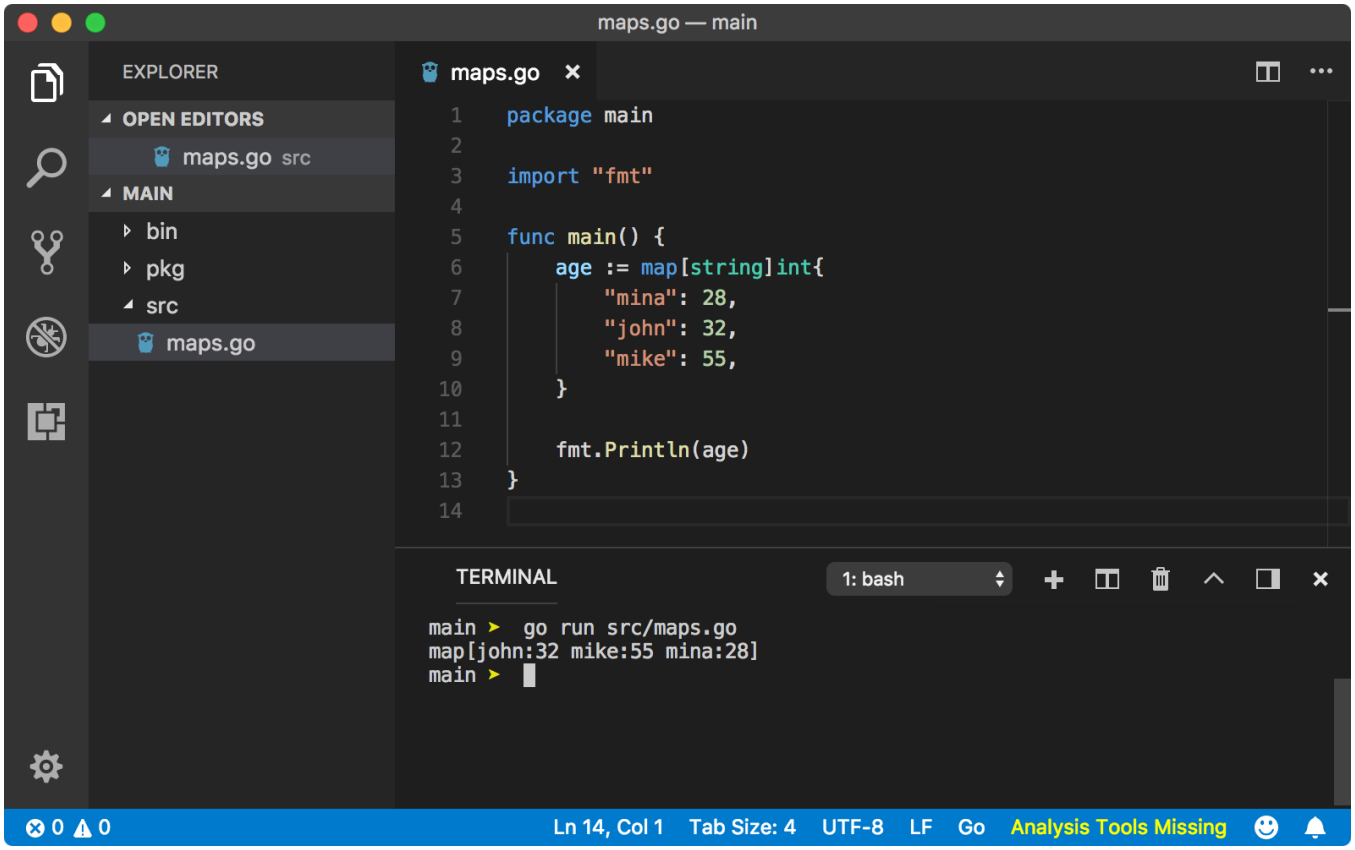
https://play.golang.org/p/mrQ_Hw0lZI0

In the above program, we have created an empty map `age` which holds `int` data and referenced by `string` keys. You can access or assign a value of a map using key like `map[key]`.

Using that information, we assigned some age data of `mina`, `john` and `mike`. You can add as many values as you want, as `map` like `slice` can hold a variable number of elements.

☛ Initializing a map

Instead of creating `empty` map and assigning new data, we can create a map with some initial data, like `array` and `slice`.



https://play.golang.org/p/49br11mmkqx

☛ Accessing map data

In case `array` or `slice`, when you are trying to access out of index element (*when the index does not exist*), go will throw an error. But not in case of `map`. When you are trying to access the value by the `key` which is not present in the map, go will not throw an error, instead, it will return `zero` value of `valueType`.

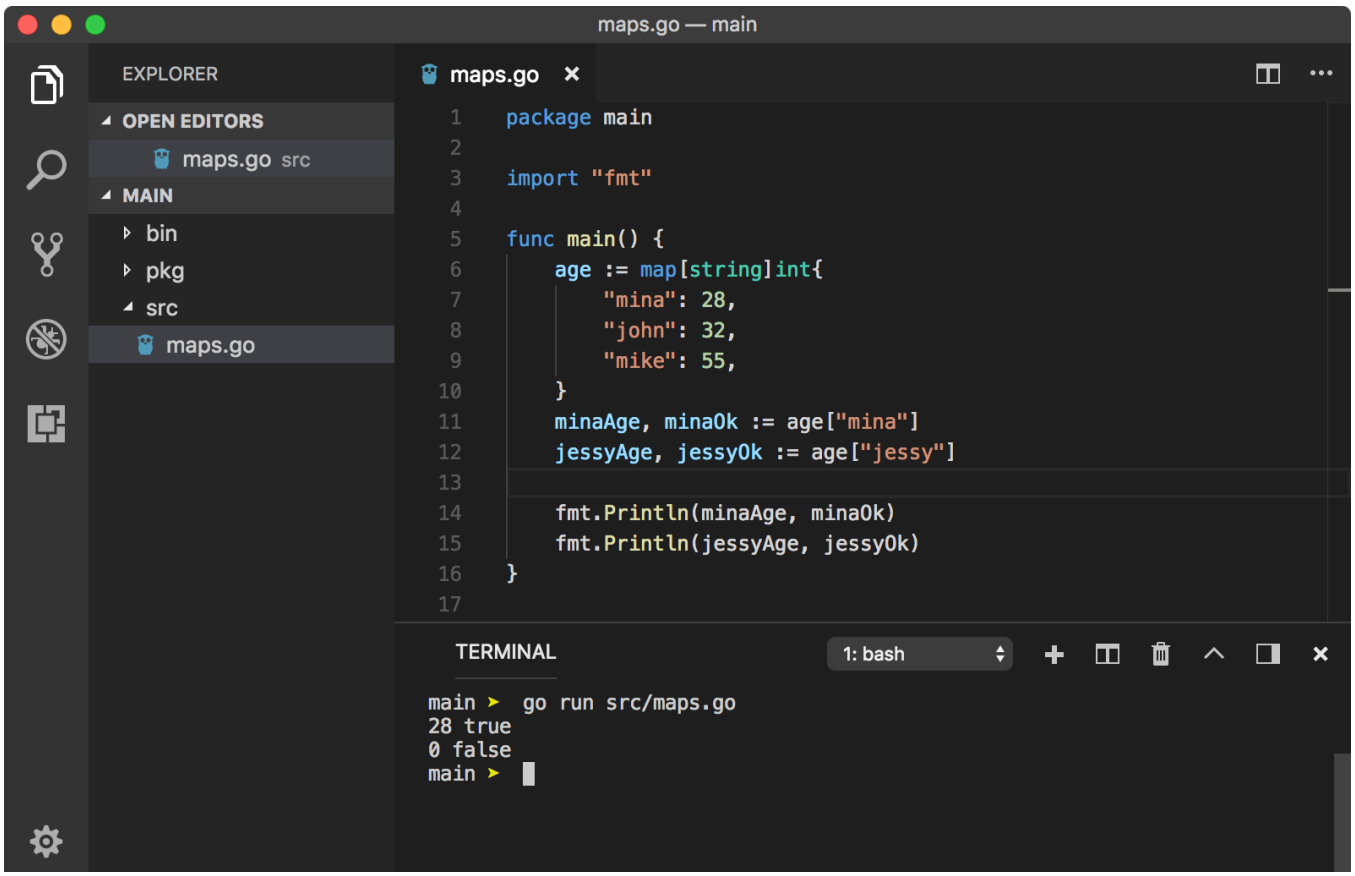
https://play.golang.org/p/fq6i39u8AeF

`28` is correct because that's the age of `mina` but since `jessy` is not in the map, go will return `0` as it's a `zero-value` of data type `int`.

So, to check if a key exists in the map or not, go provide another syntax which returns 2 values.

```
value, ok := m[key]
```

Let's see above example in a new syntax

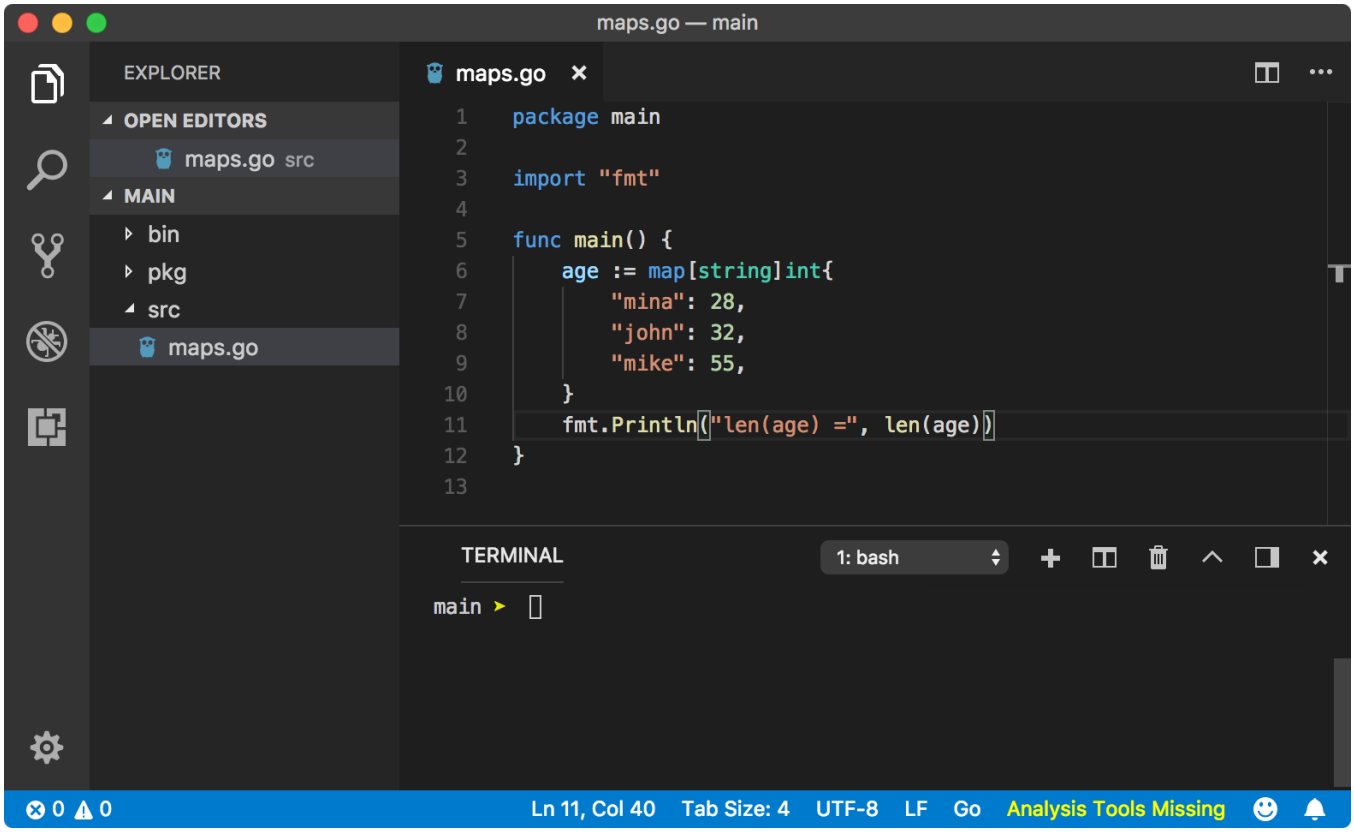


https://play.golang.org/p/YYYT2qdiGue

So, we are getting extra information on whether a key exists or not. If the key exists, the second parameter will be `true` else it will be `false`.

☛ Length of `map`

We can find out how many elements contained in a `map` using `len` function, which we saw in `array` and `slice`.



https://play.golang.org/p/94LOJeBXfq7

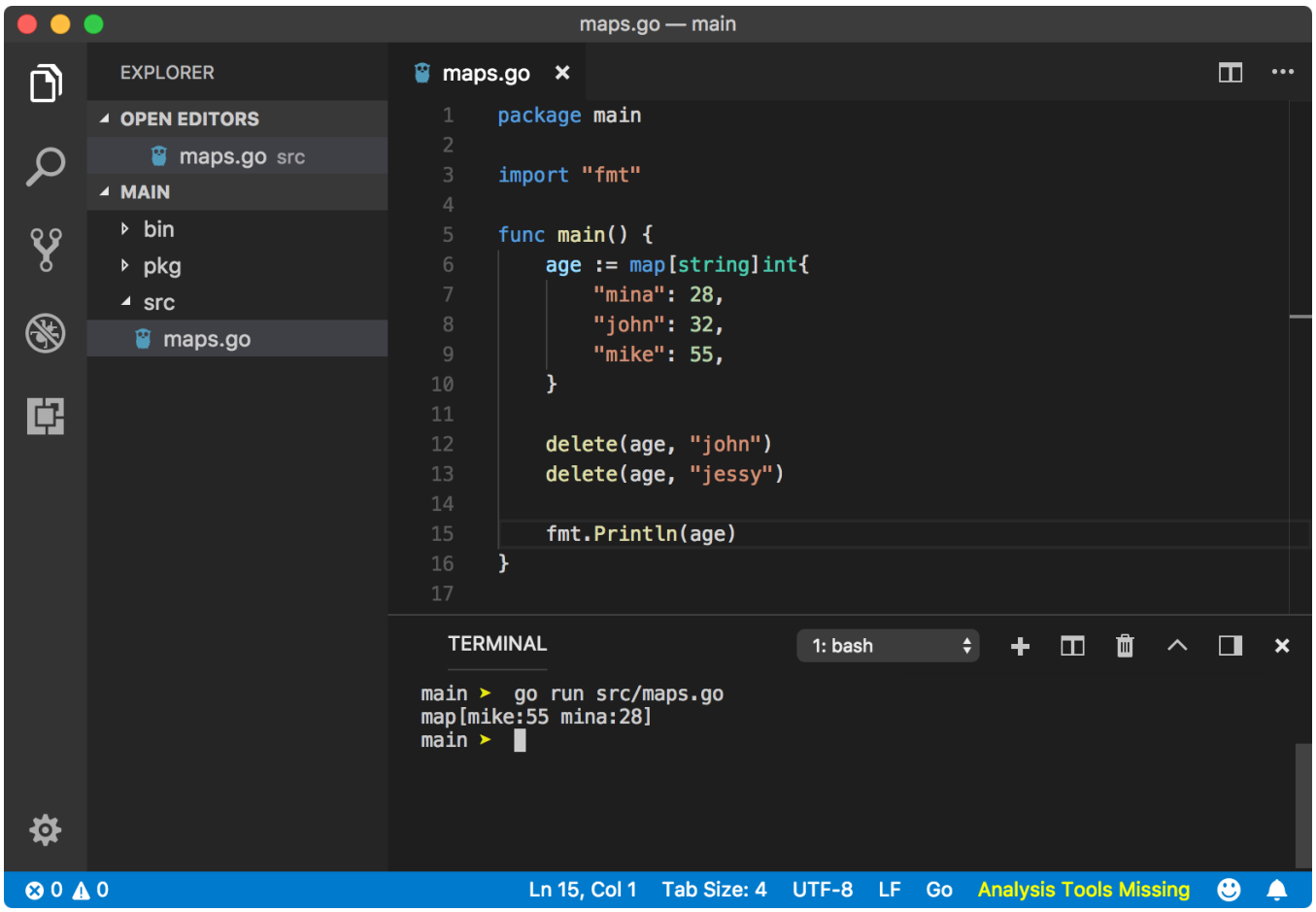
> *There is nothing like capacity in `map` because go completely takes control of internal data structure of `map`. Hence don't try to use `cap` function on `map`.*

☛ Delete `map` element

Unlike `slice` where you need to use a **hack** to delete an element, go provide easier function `delete` to delete `map` element. Syntax of a delete function is as following

```
func delete(m map[Type]Type1, key Type)
```

`delete` function demands the first argument to be a `map` and second argument to be a `key` value.



https://play.golang.org/p/i_M0xZ6jleP

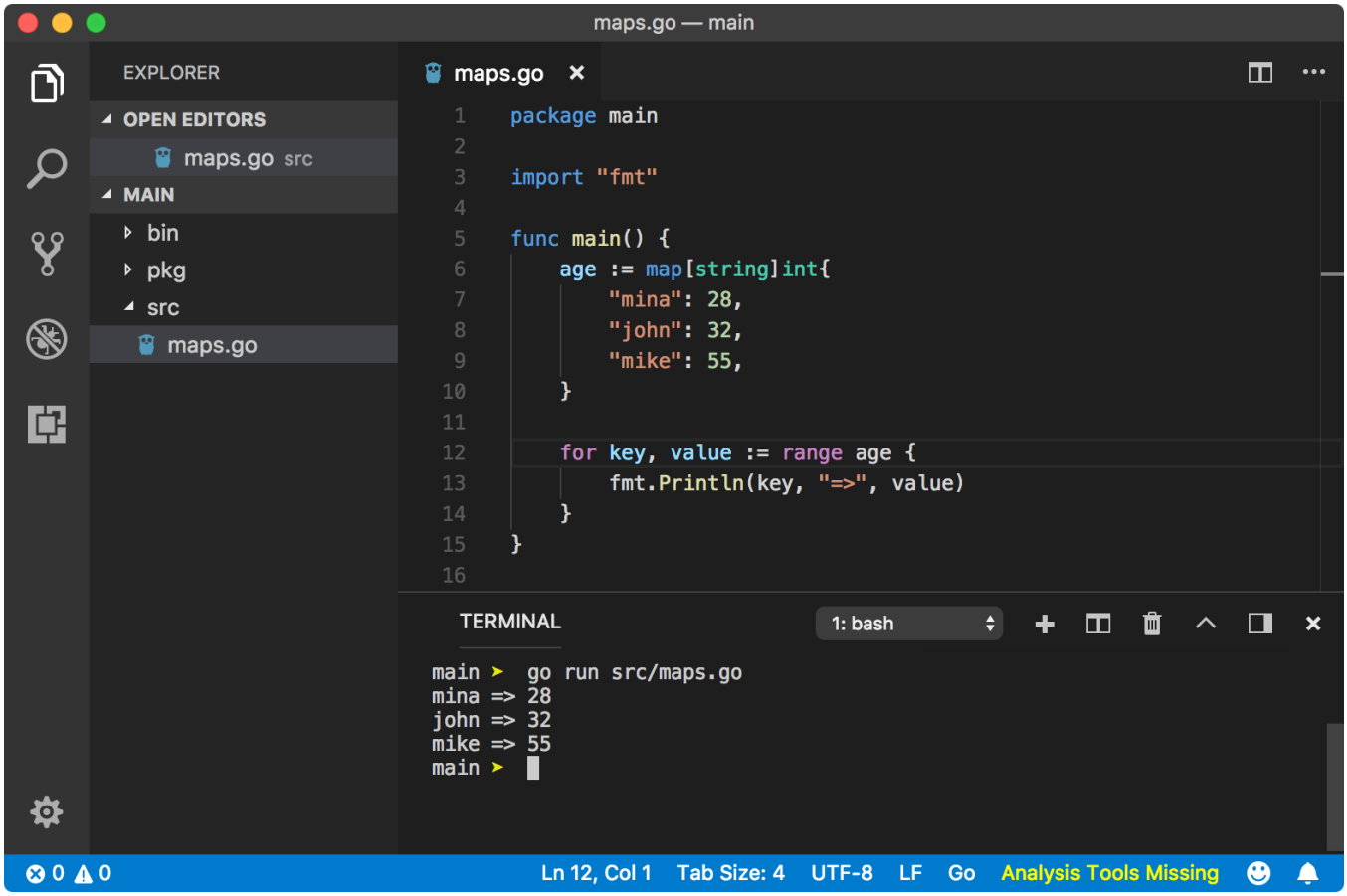
> *If the key does not exist in the map, like `jessy` in above example, go will not throw an error while executing `delete` function.*

☛ maps comparison

Like `slice`, a map can be only compared with `nil`. If you are thinking to iterate over a map and match each element, you are in grave trouble. But if you are in dire need to compare two maps, use `reflect` package's `DeepEqual` function (https://golang.org/pkg/reflect/).

☛ map iteration

Since there are no index values in `map`, you can't use simple `for` loop with incrementing `index` value until it hits the end. You need to use `for range` to do it.



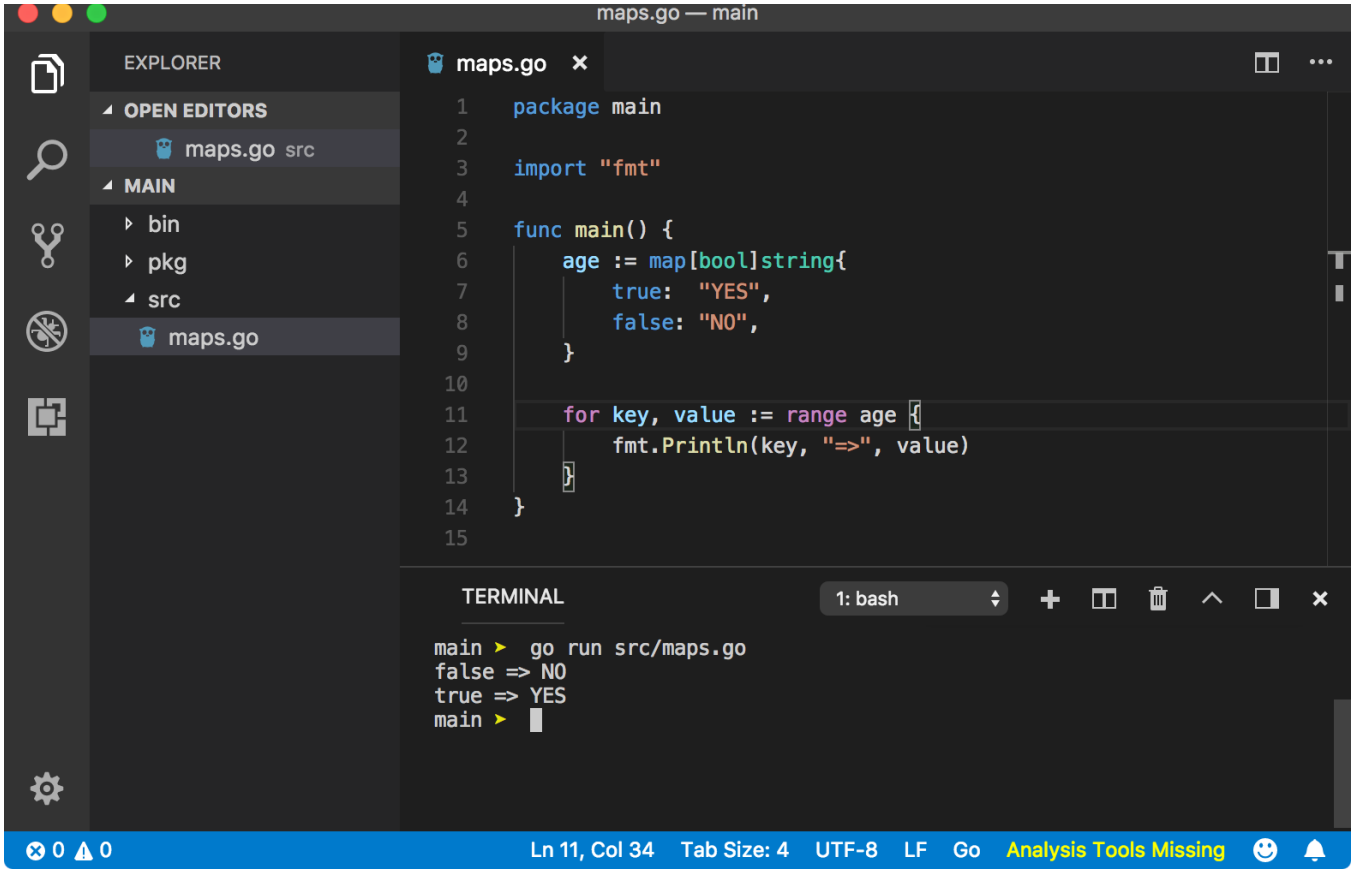
https://play.golang.org/p/MbLYk17Zu6C

`range` in `for` loop will return `key` and `value` of map element. You can also use `_` (blank identifier) to ignore either `key` or `value` in case you don't need it, just like `array` and `slice`.

> *Order of retrieval of elements in map is random when used in `for` iteration. Hence there is no guarantee that each time, they will be in order. That explains why we can't compare two maps.*

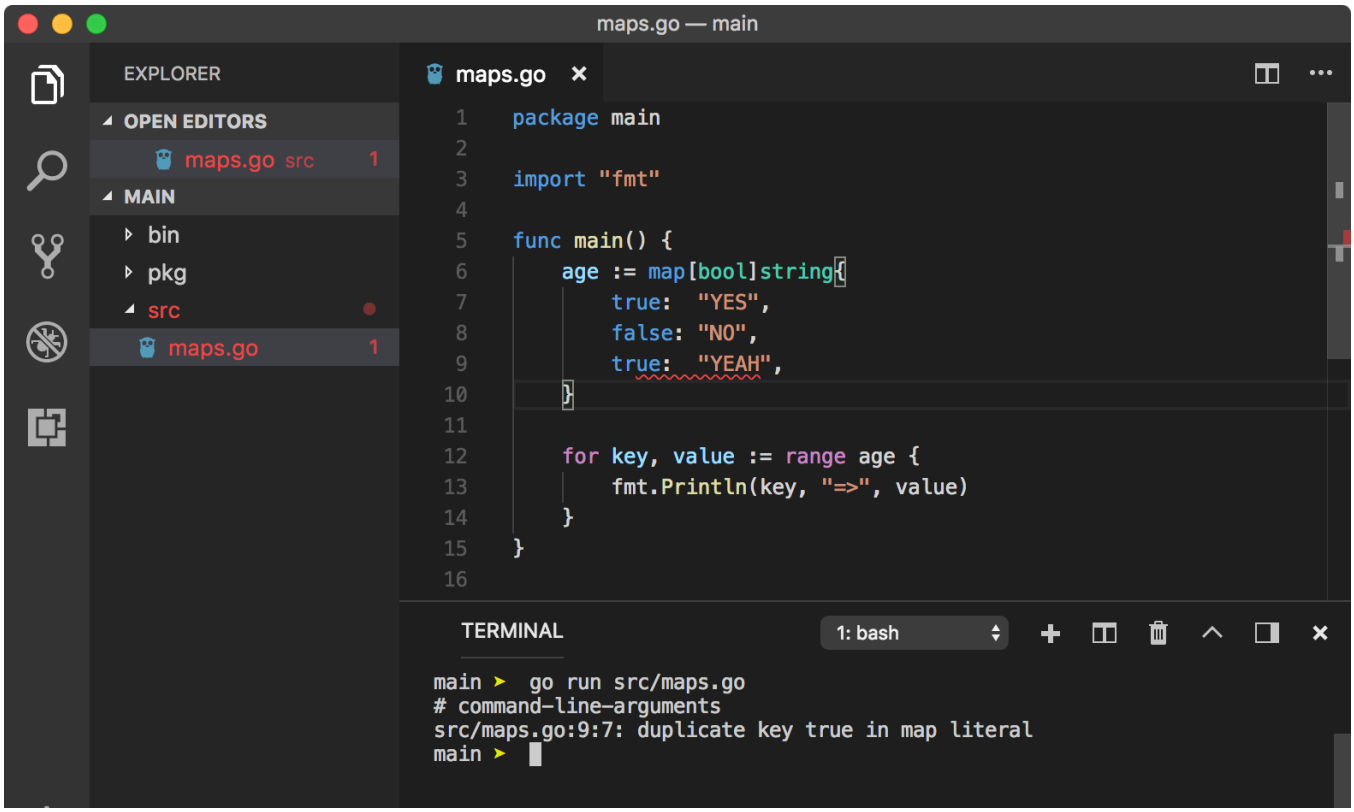
☛ `map` with other data types

It's not necessary that only string types should be the keys of a map. All **comparable types** such as boolean, integer, float, complex, string etc. can also be keys. This should be very obvious, but `boolean` just blows my mind because `boolean` can only represent 2 values, either `true` or `false`. Let's see what happens where we can use it.



https://play.golang.org/p/NbeIj54VdFS

I guess we found ourselves a use case for `boolean` key values. But what if we add duplicate keys.

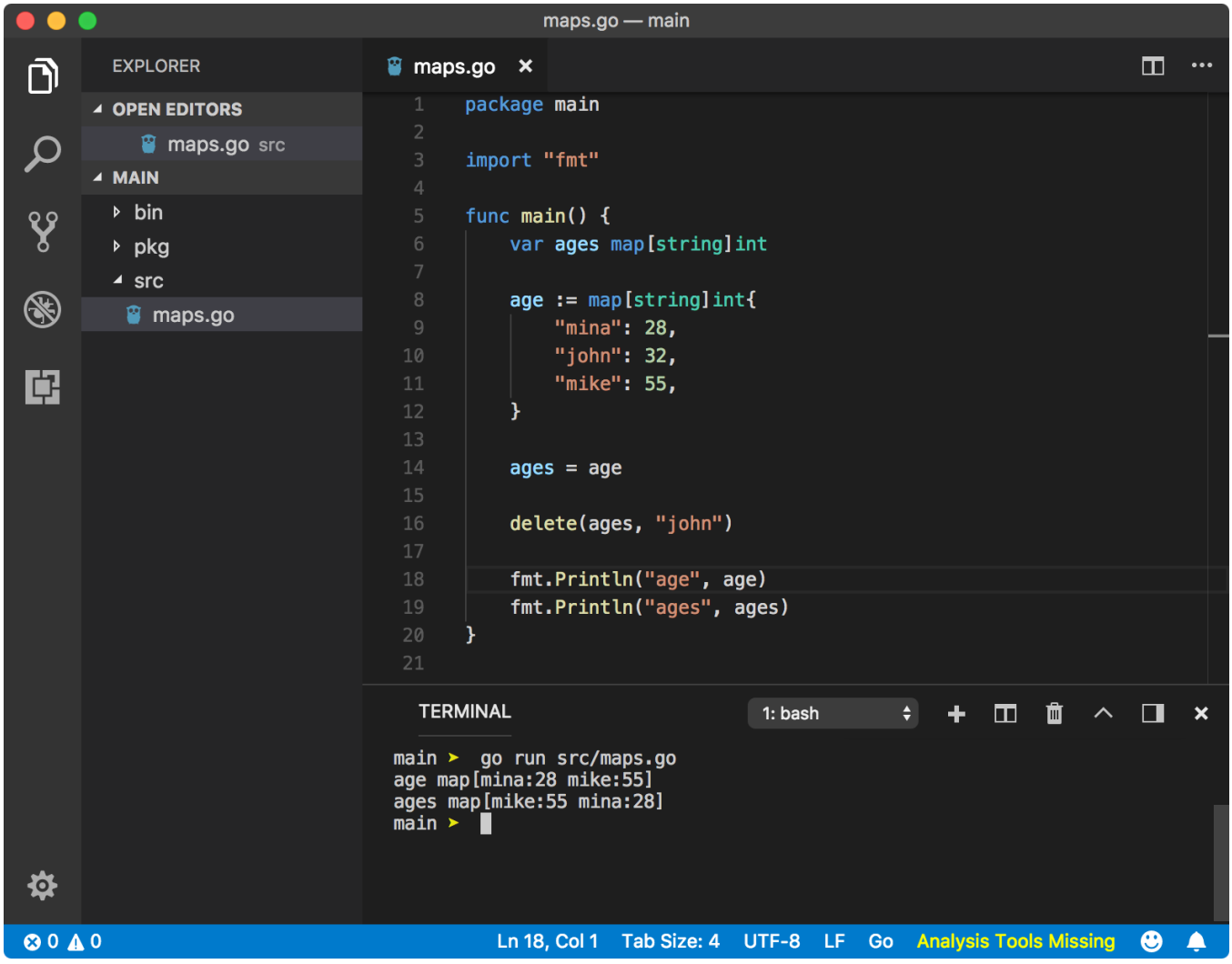


https://play.golang.org/p/sOC6TpettrK

This proves that we are not allowed to add duplicate keys in a map.

☛ Maps are referenced type

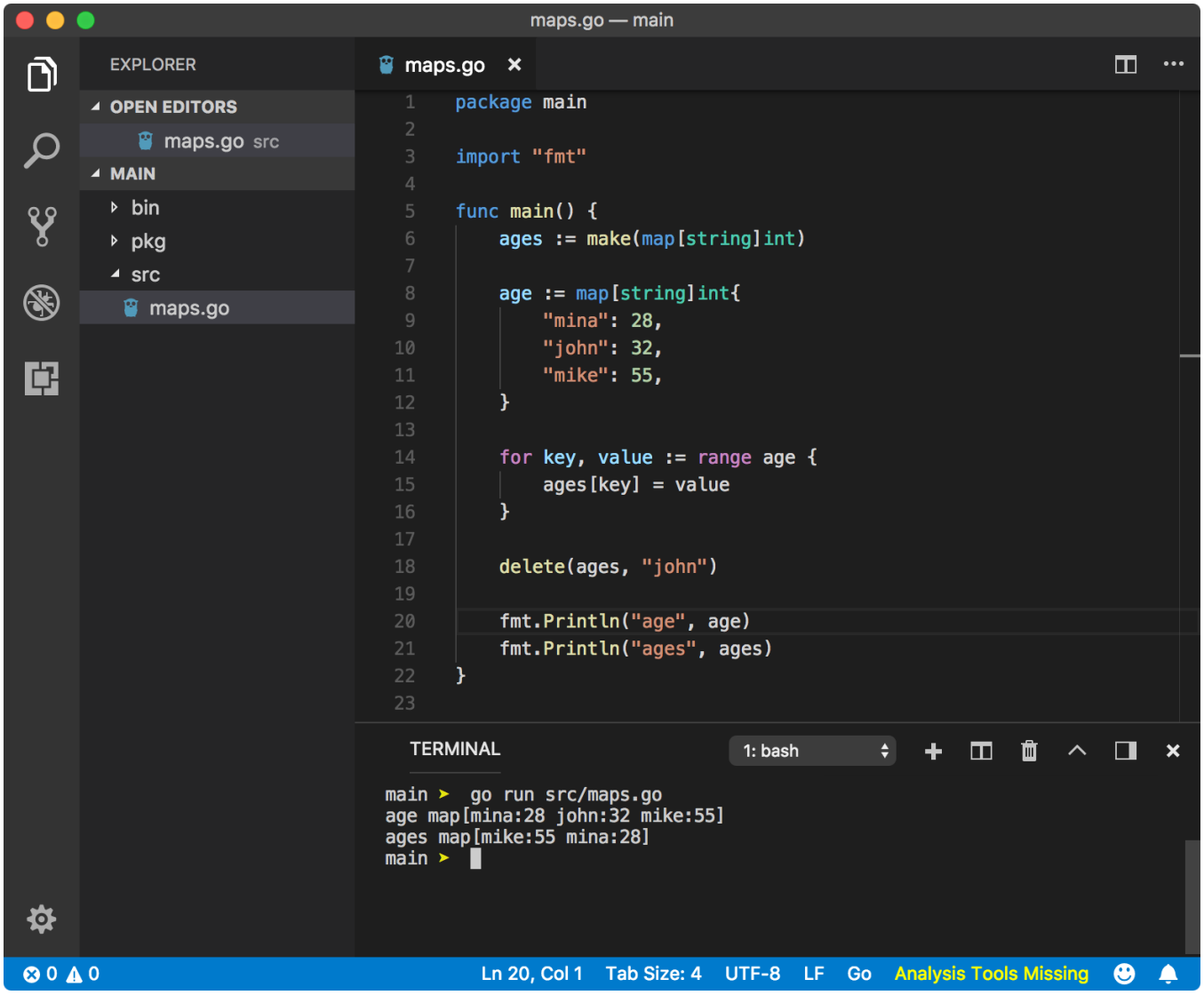
Like `slice`, map references an internal data structure. When you copy a map to a new map, the internal data structure is not copied, just referenced.



https://play.golang.org/p/n-U1AF4jy8M

As expected, `ages` map now has two elements because we deleted one element. Not only that, but we got same change in `age` map as well. This proves that, **don't mess with maps**.

To copy a map, you need to use `for` loop.



https://play.golang.org/p/uqwruAyVym4

In the above case, we haven't copied map but used map **keys** and **values** to store in a different map which implements its own underlying data structure.

> *Since `map` references internal data structure, `map` passed as function parameter share same internal data structure just like `slice`. Hence, make sure to follow same guidelines as explained in `slices` lesson.*