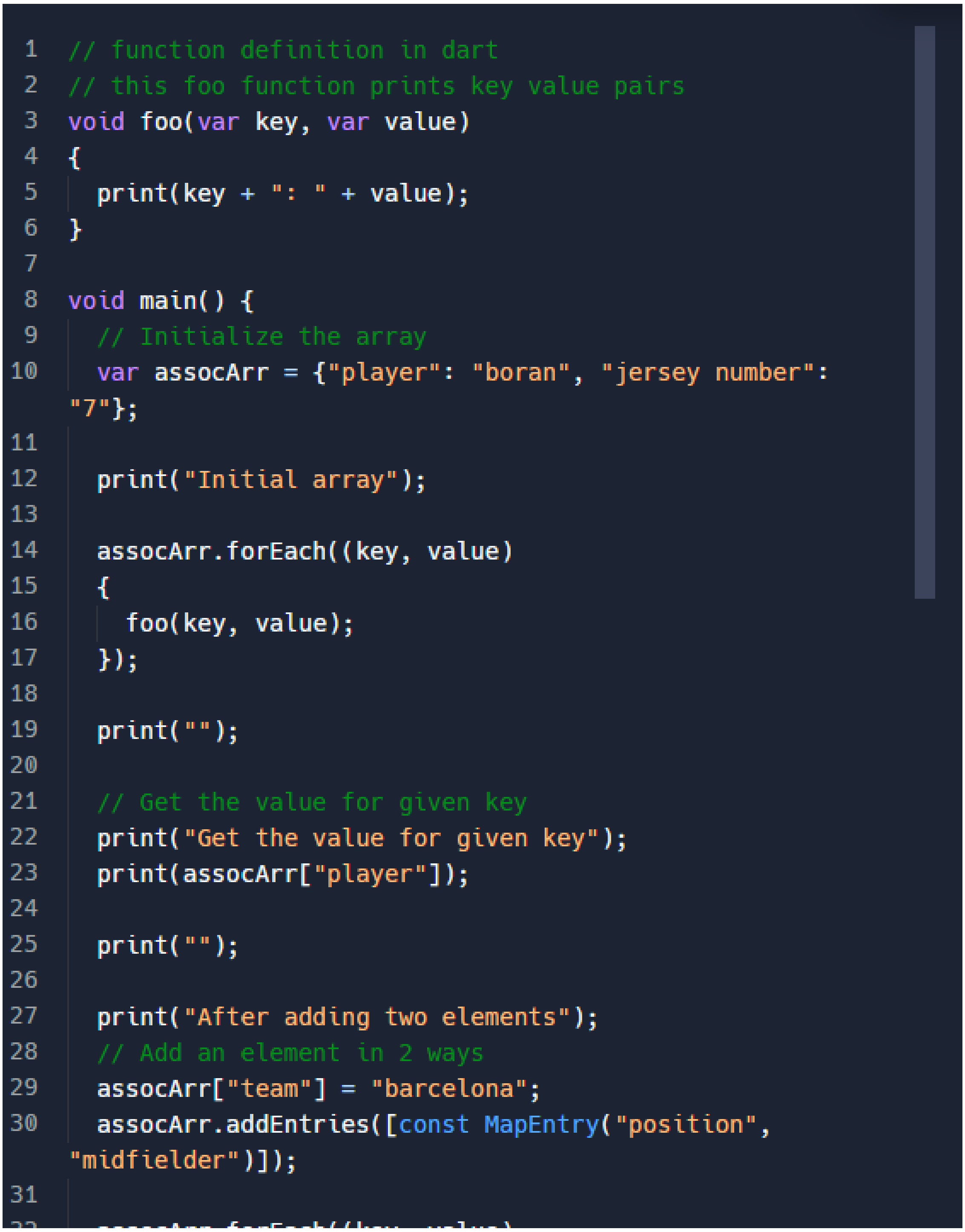
Utku Boran Torun / CS315-01 / 21901898

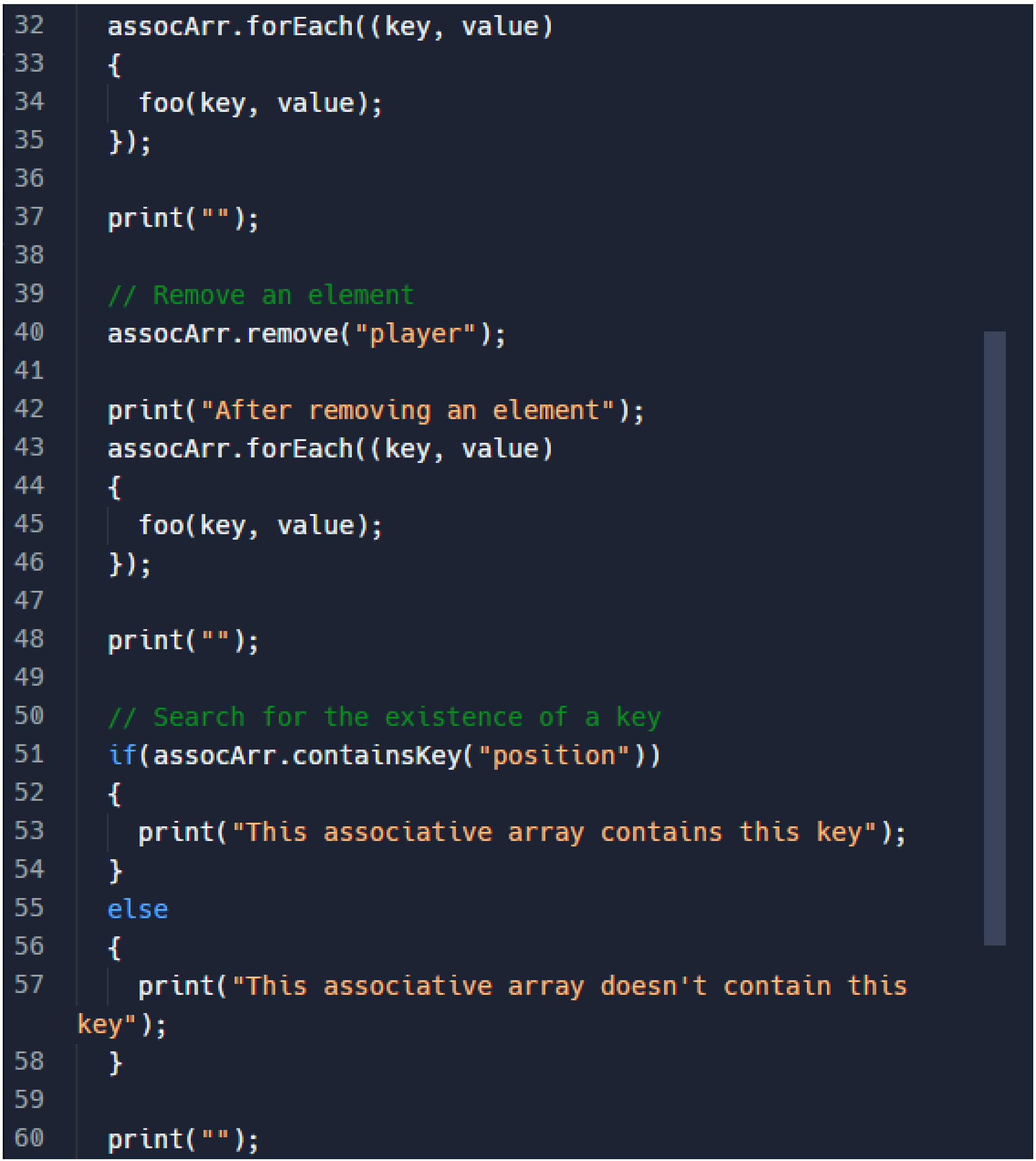
Dart

From my expriences, Dart is the most readable and writable language among other languages after Pyhton. Associative arrays in Dart called Map. For the initialization of the array, it is writable and convenient. It a is bit similar to Java from my point of view, and since Java was the first programming language that I learned, I get used to it quicker compared to other languages.

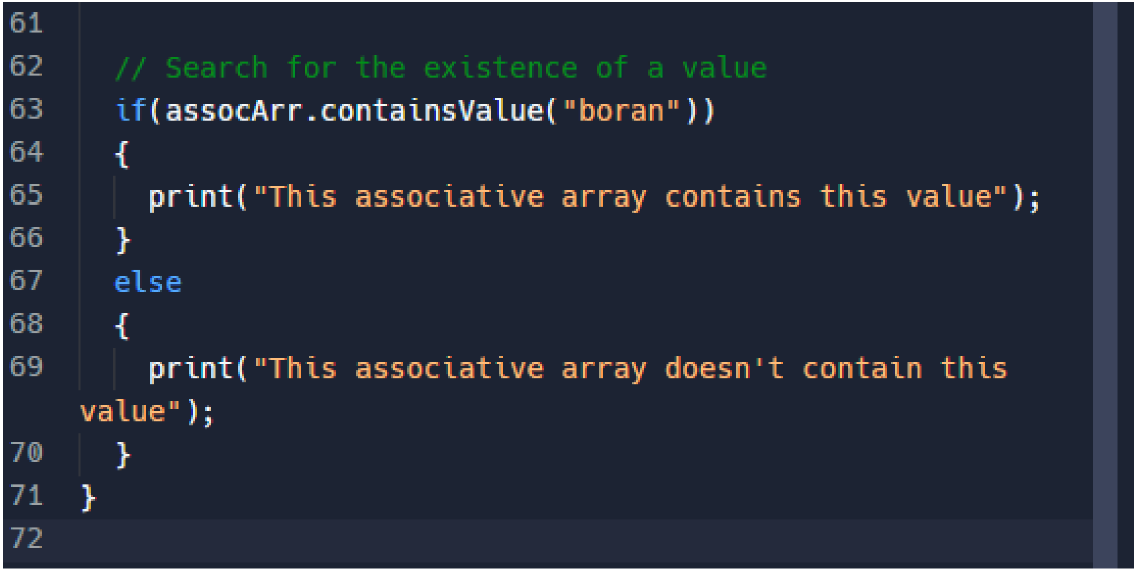
Code Segment



```
// function definition in dart
// this foo function prints key value pairs
void foo(var key, var value)
{
  print(key + ": " + value);
}

void main() {
  // Initialize the array
  var assocArr = {"player": "boran", "jersey number": "7"};

  print("Initial array");

  assocArr.forEach((key, value)
  {
    foo(key, value);
  });

  print("");

  // Get the value for given key
  print("Get the value for given key");
  print(assocArr["player"]);

  print("");

  print("After adding two elements");
  // Add an element in 2 ways
  assocArr["team"] = "barcelona";
  assocArr.addEntries([const MapEntry("position", "midfielder")]);

  assocArr.forEach((key, value)
```

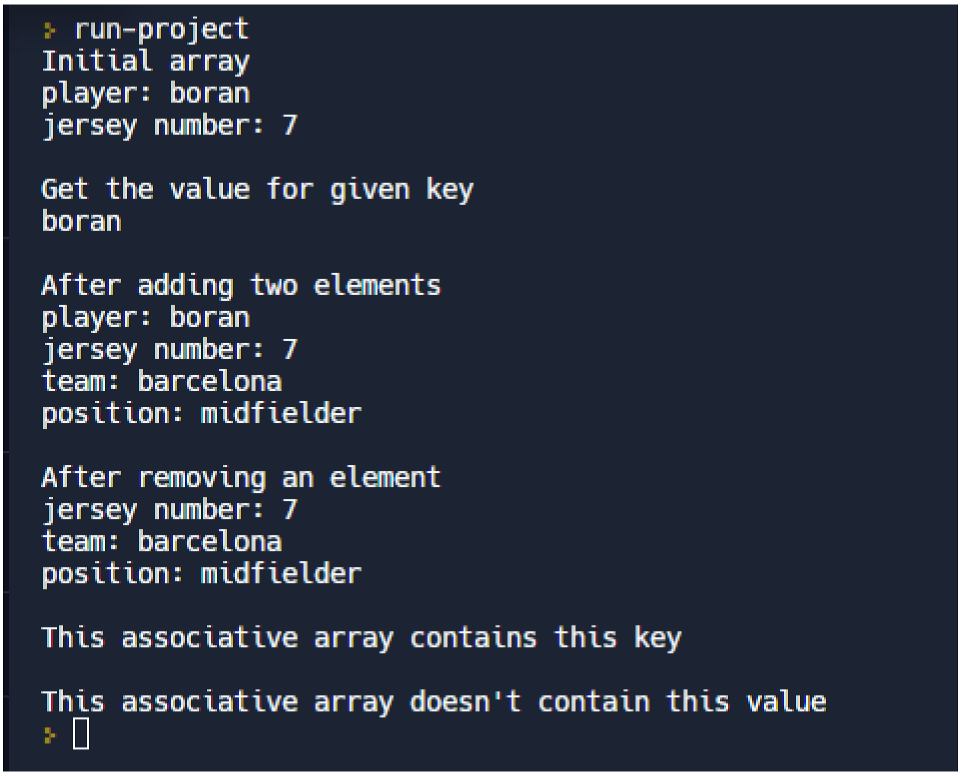


```
    assocArr.forEach((key, value)
    {
        foo(key, value);
    });

    print("");

    // Remove an element
    assocArr.remove("player");

    print("After removing an element");
    assocArr.forEach((key, value)
    {
        foo(key, value);
    });

    print("");

    // Search for the existence of a key
    if(assocArr.containsKey("position"))
    {
        print("This associative array contains this key");
    }
    else
    {
        print("This associative array doesn't contain this
key");
    }

    print("");
```



```

    // Search for the existence of a value
    if(assocArr.containsValue("boran"))
    {
        print("This associative array contains this value");
    }
    else
    {
        print("This associative array doesn't contain this
value");
    }
}

```

Result Of the Execution



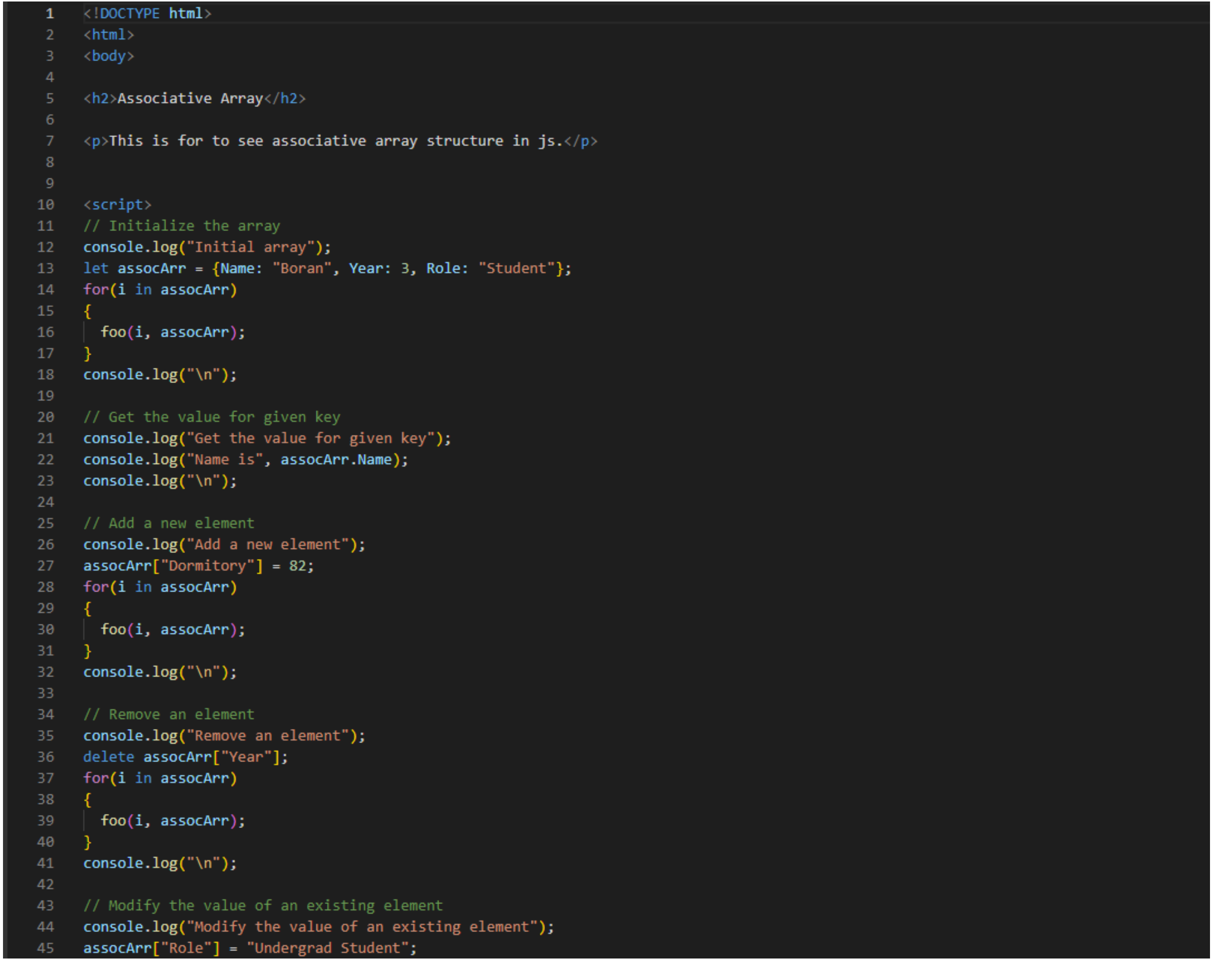
```
> run-project
Initial array
player: boran
jersey number: 7

Get the value for given key
boran

After adding two elements
player: boran
jersey number: 7
team: barcelona
position: midfielder

After removing an element
jersey number: 7
team: barcelona
position: midfielder

This associative array contains this key

This associative array doesn't contain this value
> 
```

This code creates associative array (map) in Dart. Then it prints the initial array with the function foo() in the for loop. Then it prints the value of a given key. After this, it adds two elements to the map and prints the map in the same way. After these operations, it removes an element and prints the map again. Then, it checks whether the given key and given value is in the map and prints the result according to the content of it.

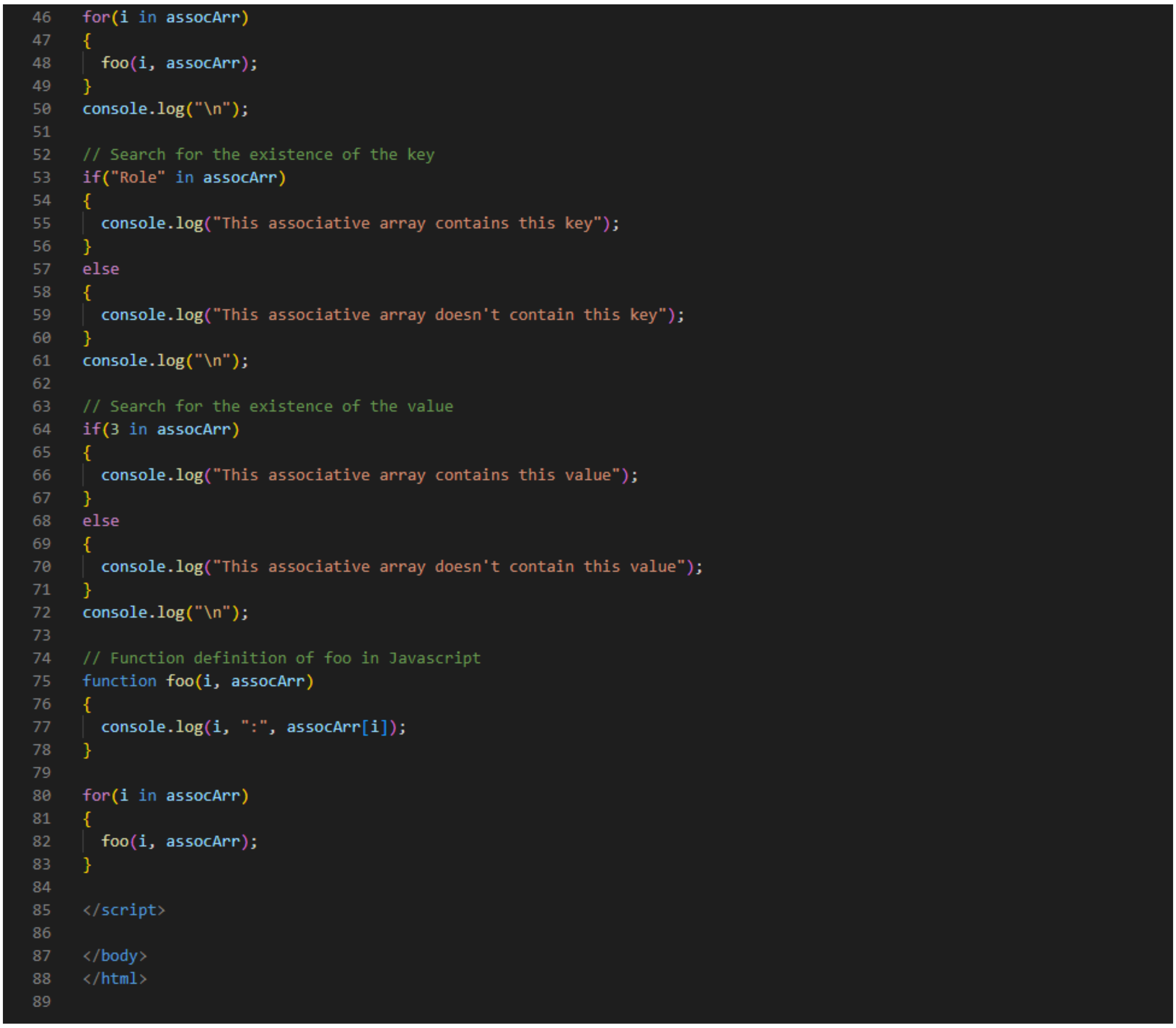
Javascript

Before this homework, I had no expriences about Javascript. In terms of writability and readability Javascript was good about associative arrays. While creating and adding a new element it was intiuitive. I did not have much difficulty, but it is the best language after the Dart in terms of associative array structure.

Code Segment

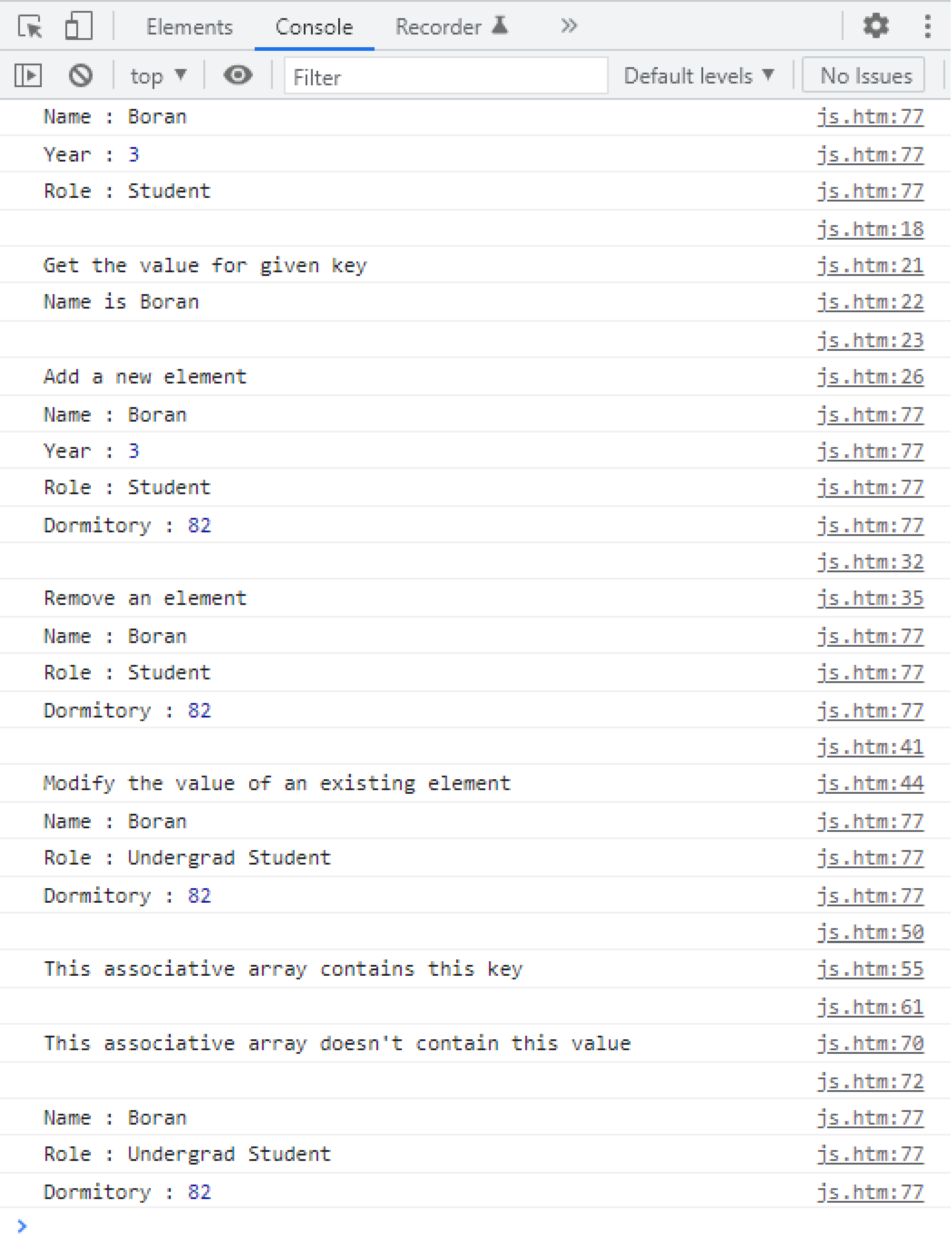


```
<!DOCTYPE html>
<html>
<body>

<h2>Associative Array</h2>

<p>This is for to see associative array structure in js.</p>


<script>
// Initialize the array
console.log("Initial array");
let assocArr = {Name: "Boran", Year: 3, Role: "Student"};
for(i in assocArr)
{
  foo(i, assocArr);
}
console.log("\n");

// Get the value for given key
console.log("Get the value for given key");
console.log("Name is", assocArr.Name);
console.log("\n");

// Add a new element
console.log("Add a new element");
assocArr["Dormitory"] = 82;
for(i in assocArr)
{
  foo(i, assocArr);
}
console.log("\n");

// Remove an element
console.log("Remove an element");
delete assocArr["Year"];
for(i in assocArr)
{
  foo(i, assocArr);
}
console.log("\n");

// Modify the value of an existing element
console.log("Modify the value of an existing element");
assocArr["Role"] = "Undergrad Student";
```



```
for(i in assocArr)
{
  foo(i, assocArr);
}
console.log("\n");

// Search for the existence of the key
if("Role" in assocArr)
{
  console.log("This associative array contains this key");
}
else
{
  console.log("This associative array doesn't contain this key");
}
console.log("\n");

// Search for the existence of the value
if(3 in assocArr)
{
  console.log("This associative array contains this value");
}
else
{
  console.log("This associative array doesn't contain this value");
}
console.log("\n");

// Function definition of foo in Javascript
function foo(i, assocArr)
{
  console.log(i, ":", assocArr[i]);
}

for(i in assocArr)
{
  foo(i, assocArr);
}

</script>

</body>
</html>

```

Result Of The Execution



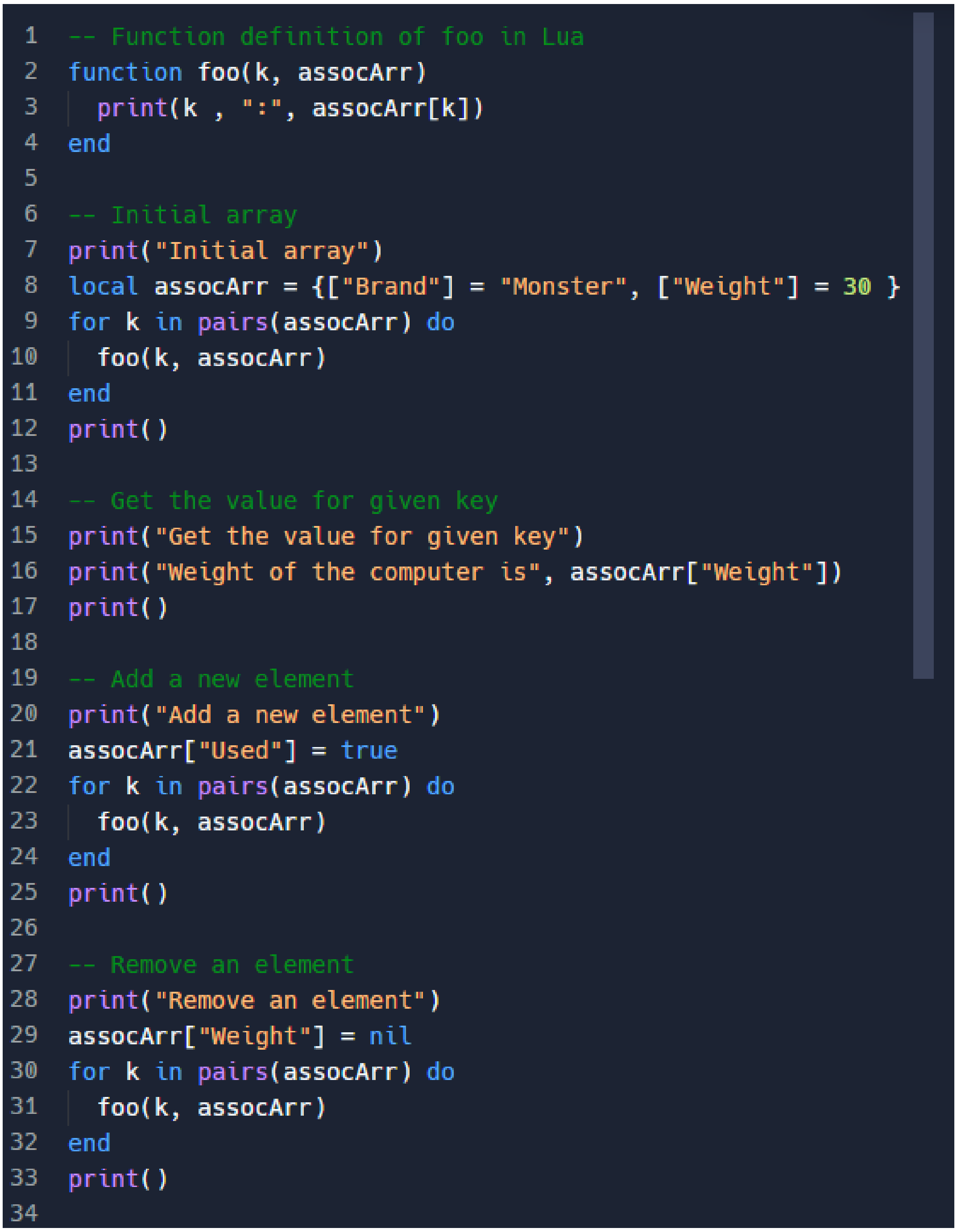
```
Name : Boran                                     js.htm:77
Year : 3                                         js.htm:77
Role : Student                                   js.htm:77
                                                 js.htm:18
Get the value for given key                      js.htm:21
Name is Boran                                    js.htm:22
                                                 js.htm:23
Add a new element                                js.htm:26
Name : Boran                                     js.htm:77
Year : 3                                         js.htm:77
Role : Student                                   js.htm:77
Dormitory : 82                                   js.htm:77
                                                 js.htm:32
Remove an element                                js.htm:35
Name : Boran                                     js.htm:77
Role : Student                                   js.htm:77
Dormitory : 82                                   js.htm:77
                                                 js.htm:41
Modify the value of an existing element          js.htm:44
Name : Boran                                     js.htm:77
Role : Undergrad Student                         js.htm:77
Dormitory : 82                                   js.htm:77
                                                 js.htm:50
This associative array contains this key         js.htm:55
                                                 js.htm:61
This associative array doesn't contain this value js.htm:70
                                                 js.htm:72
Name : Boran                                     js.htm:77
Role : Undergrad Student                         js.htm:77
Dormitory : 82                                   js.htm:77
>
```

This code creates associative array in Javascript. Then it prints the initial array with the function foo() in the for loop. Then it prints the value of a given key, after this it adds a new element to the array and prints the array in the same way. After these operations it removes an element and prints the array again. Then it checks whether given key and given value is in the array and prints the result according to the content of it.

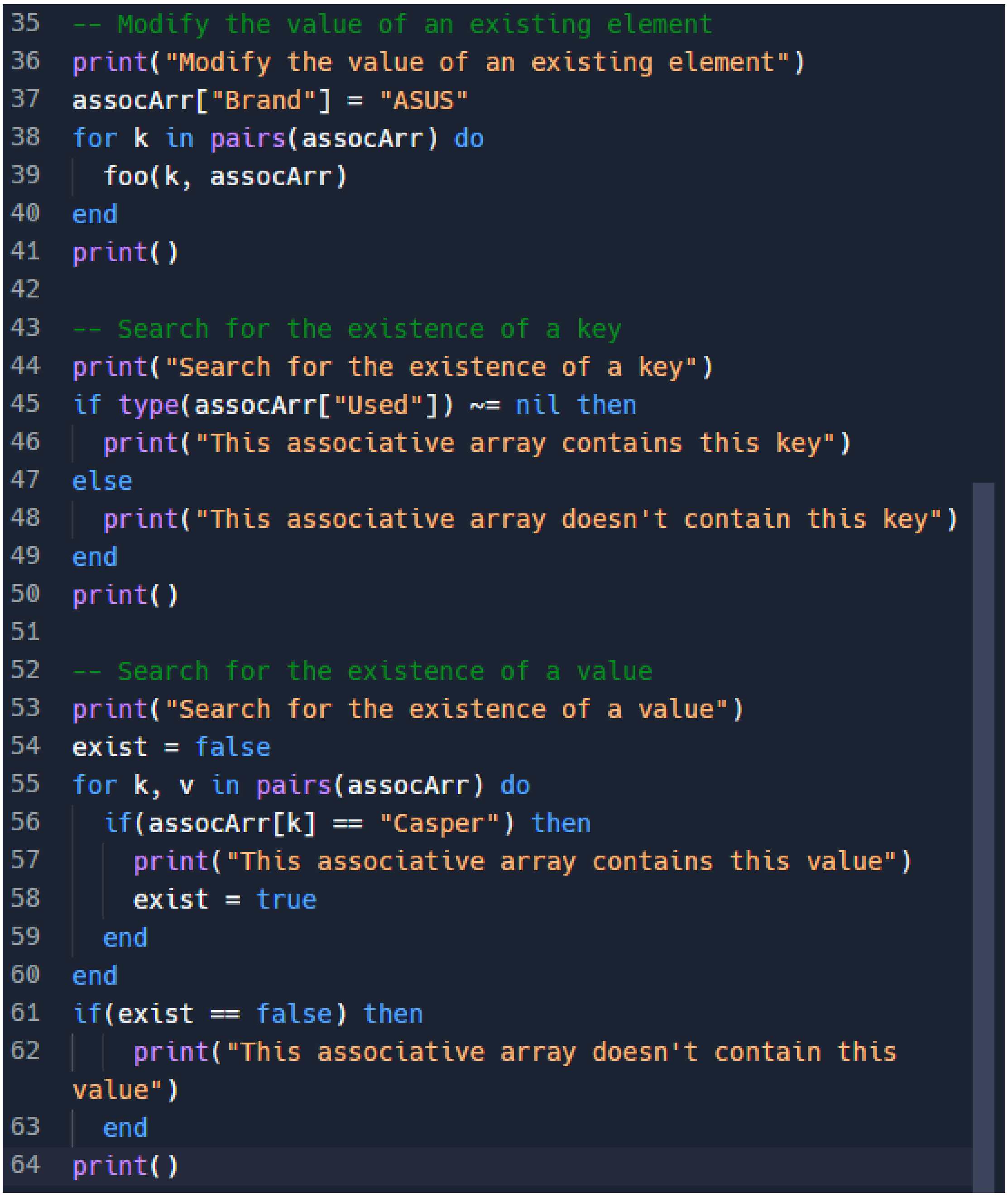
Lua

I did not have any experiences in Lua as well. In terms of readability, Lua is good, on the other hand in terms of writability, it was one of the worst expreinces I’ve had. The d ocumentation and information about this language is quite limited. Associative array in Lua is called Table. Initialization of the Table was very easy and intiuitive. Adding new element was very similar to the other languages. The most interesting part was removing the element and checking whether the key exists in the Table, in order to do these operations, we need to use the reserved word ‘nil’. If I need to use associative arrays in the future, Lua won’t be my first choice.

Code Segment

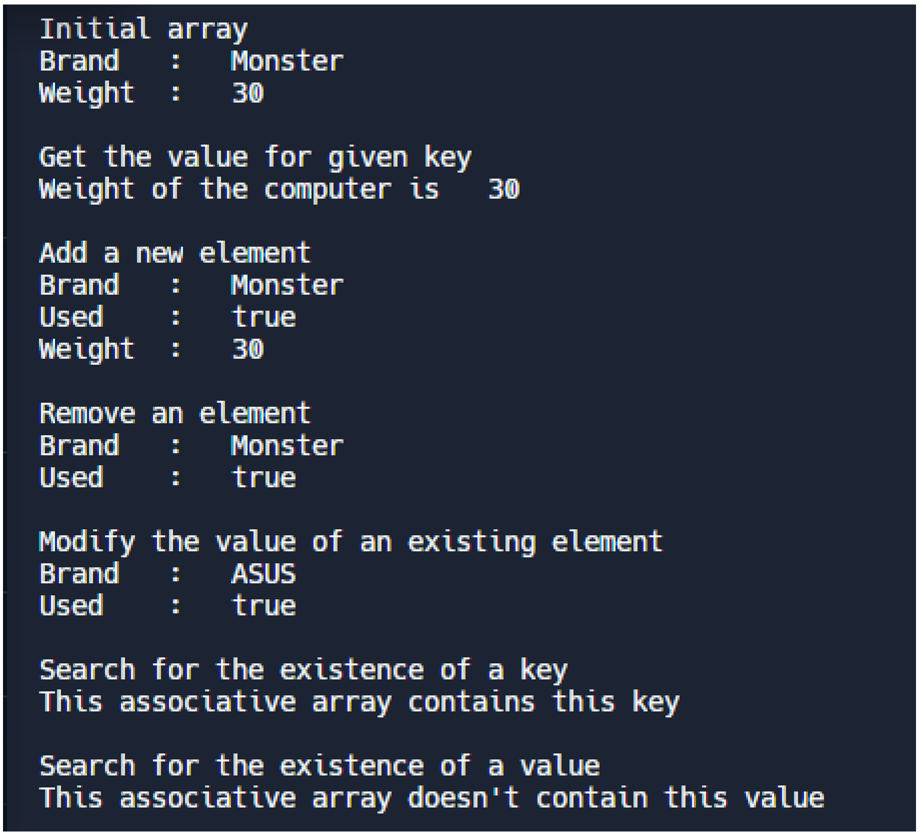


```lua
-- Function definition of foo in Lua
function foo(k, assocArr)
  print(k , ":", assocArr[k])
end

-- Initial array
print("Initial array")
local assocArr = {["Brand"] = "Monster", ["Weight"] = 30 }
for k in pairs(assocArr) do
  foo(k, assocArr)
end
print()

-- Get the value for given key
print("Get the value for given key")
print("Weight of the computer is", assocArr["Weight"])
print()

-- Add a new element
print("Add a new element")
assocArr["Used"] = true
for k in pairs(assocArr) do
  foo(k, assocArr)
end
print()

-- Remove an element
print("Remove an element")
assocArr["Weight"] = nil
for k in pairs(assocArr) do
  foo(k, assocArr)
end
print()

```



```lua
-- Modify the value of an existing element
print("Modify the value of an existing element")
assocArr["Brand"] = "ASUS"
for k in pairs(assocArr) do
  foo(k, assocArr)
end
print()

-- Search for the existence of a key
print("Search for the existence of a key")
if type(assocArr["Used"]) ~= nil then
  print("This associative array contains this key")
else
  print("This associative array doesn't contain this key")
end
print()

-- Search for the existence of a value
print("Search for the existence of a value")
exist = false
for k, v in pairs(assocArr) do
  if(assocArr[k] == "Casper") then
    print("This associative array contains this value")
    exist = true
  end
end
if(exist == false) then
    print("This associative array doesn't contain this value")
  end
print()
```

Result Of the Execution



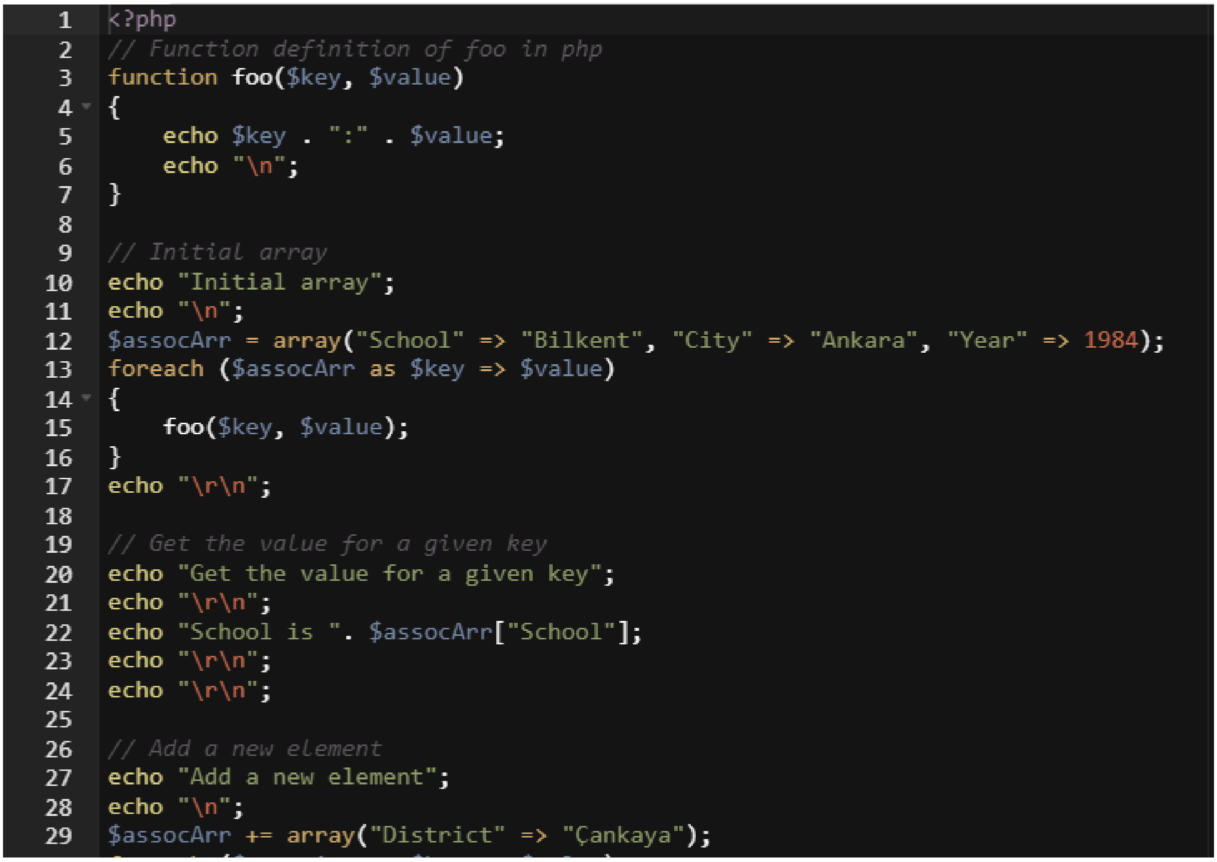
```
Initial array
Brand   :   Monster
Weight  :   30

Get the value for given key
Weight of the computer is   30

Add a new element
Brand   :   Monster
Used    :   true
Weight  :   30

Remove an element
Brand   :   Monster
Used    :   true

Modify the value of an existing element
Brand   :   ASUS
Used    :   true

Search for the existence of a key
This associative array contains this key

Search for the existence of a value
This associative array doesn't contain this value
```

This code creates associative array (table) in Lua. Then it prints the initial array (table) with the function foo() in the for loop. Then it prints the value of a given key. After this, it adds a new element to the table and prints the table in the same way. After these operations, it removes an element and prints the table again. Then, it checks whether given key and given value is in the table and prints the result according to the content of it.

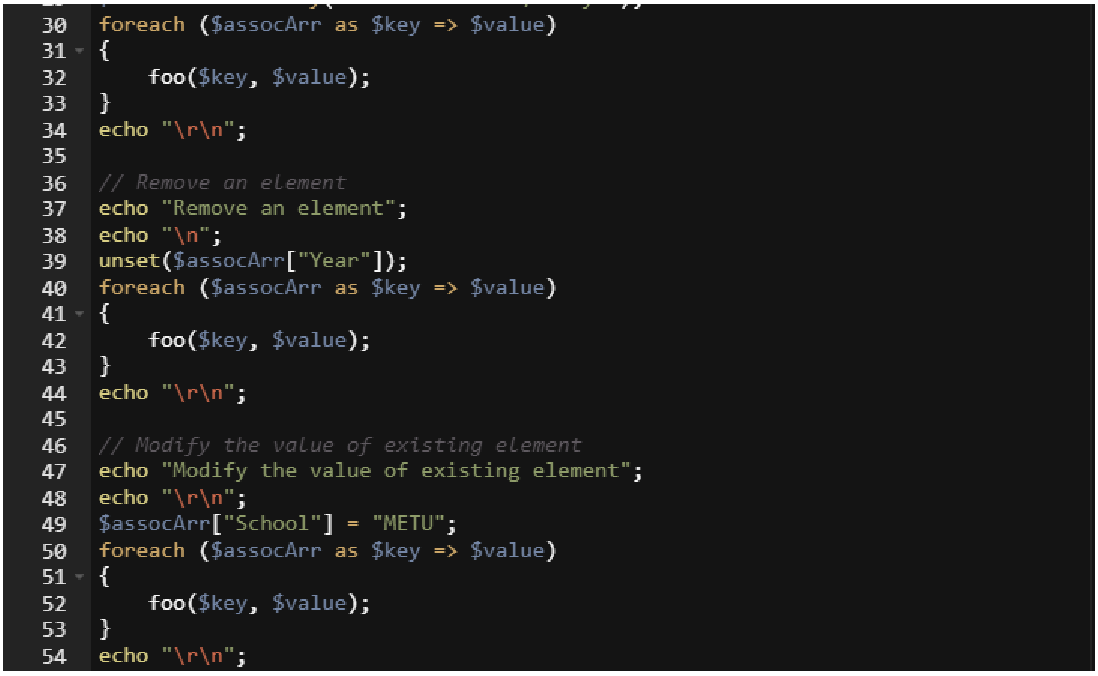
PHP

As with most of the other languages in this homework, I did not have any experience in PHP. It was totally new to me. In terms of readability and writability, I think PHP is good. Even I did not have any experience in this language, it was not hard to write it. The big problem was that this language's output differs from one compiler to another compiler, and this made putting new line between output harder. If I need to use associative arrays, I may choose PHP after the Dart.

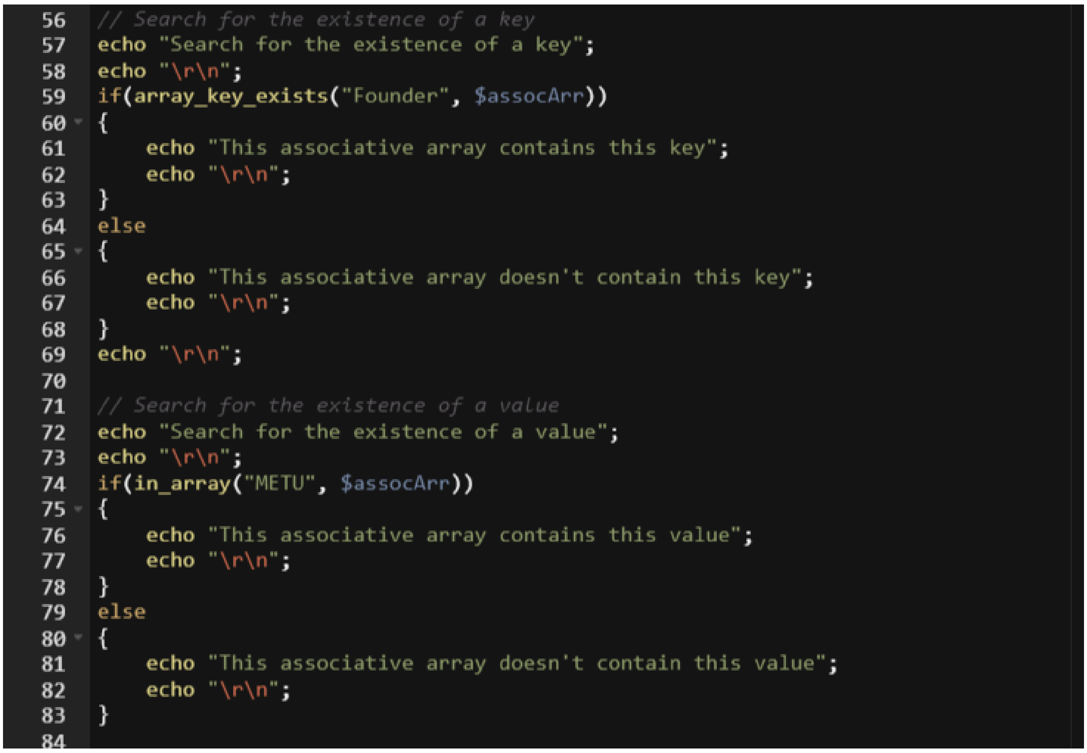
Code Segment



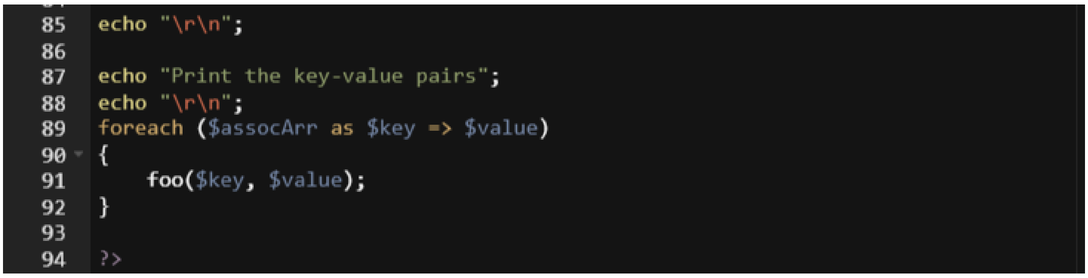
```php
<?php
// Function definition of foo in php
function foo($key, $value)
{
    echo $key . ":" . $value;
    echo "\n";
}

// Initial array
echo "Initial array";
echo "\n";
$assocArr = array("School" => "Bilkent", "City" => "Ankara", "Year" => 1984);
foreach ($assocArr as $key => $value)
{
    foo($key, $value);
}
echo "\r\n";

// Get the value for a given key
echo "Get the value for a given key";
echo "\r\n";
echo "School is ". $assocArr["School"];
echo "\r\n";
echo "\r\n";

// Add a new element
echo "Add a new element";
echo "\n";
$assocArr += array("District" => "Çankaya");
```



```php
foreach ($assocArr as $key => $value)
{
    foo($key, $value);
}
echo "\r\n";

// Remove an element
echo "Remove an element";
echo "\n";
unset($assocArr["Year"]);
foreach ($assocArr as $key => $value)
{
    foo($key, $value);
}
echo "\r\n";

// Modify the value of existing element
echo "Modify the value of existing element";
echo "\r\n";
$assocArr["School"] = "METU";
foreach ($assocArr as $key => $value)
{
    foo($key, $value);
}
echo "\r\n";
```

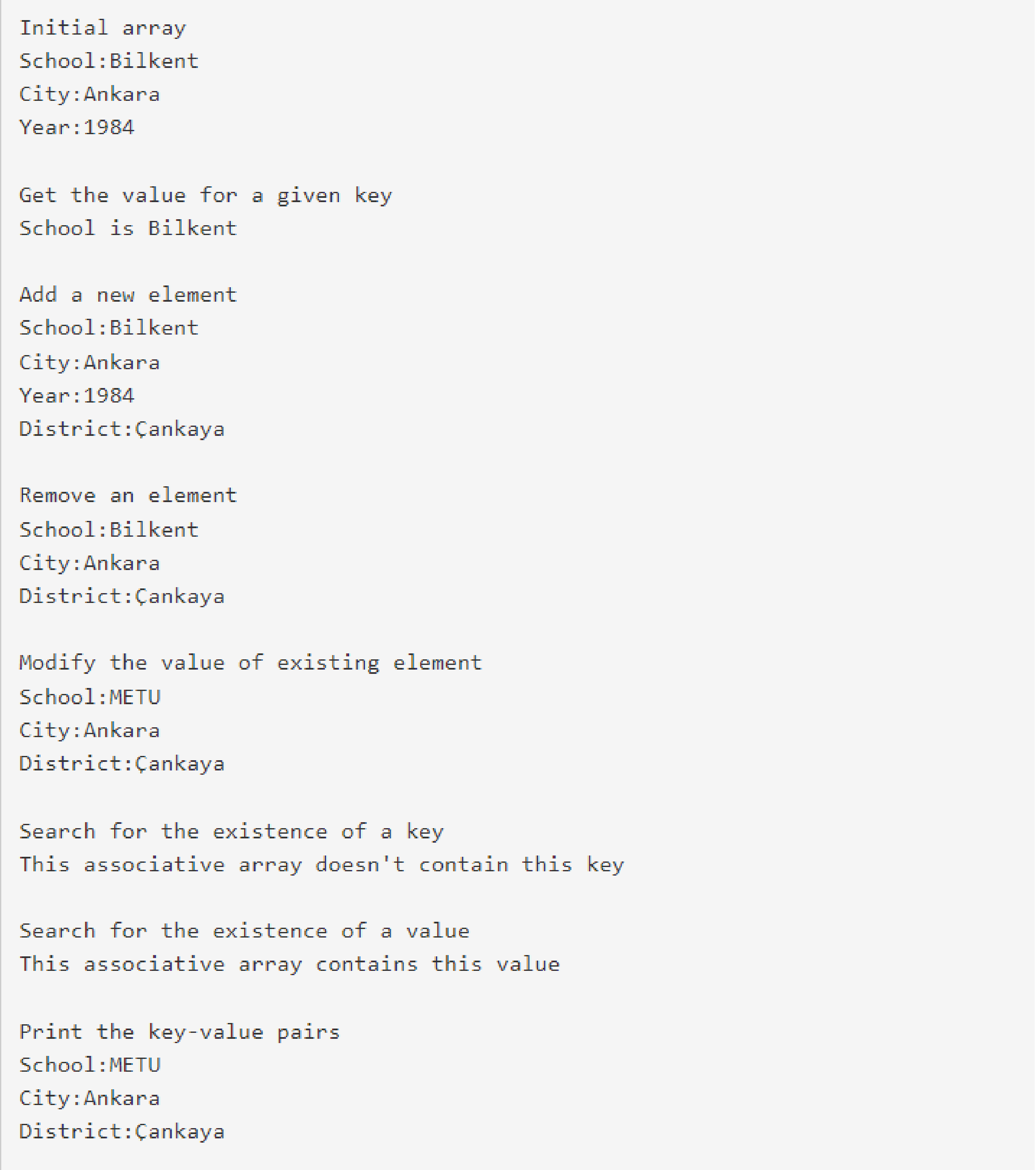


```php
// Search for the existence of a key
echo "Search for the existence of a key";
echo "\r\n";
if(array_key_exists("Founder", $assocArr))
{
    echo "This associative array contains this key";
    echo "\r\n";
}
else
{
    echo "This associative array doesn't contain this key";
    echo "\r\n";
}
echo "\r\n";

// Search for the existence of a value
echo "Search for the existence of a value";
echo "\r\n";
if(in_array("METU", $assocArr))
{
    echo "This associative array contains this value";
    echo "\r\n";
}
else
{
    echo "This associative array doesn't contain this value";
    echo "\r\n";
}

```



```php
echo "\r\n";

echo "Print the key-value pairs";
echo "\r\n";
foreach ($assocArr as $key => $value)
{
    foo($key, $value);
}

?>
```

Result Of The Execution



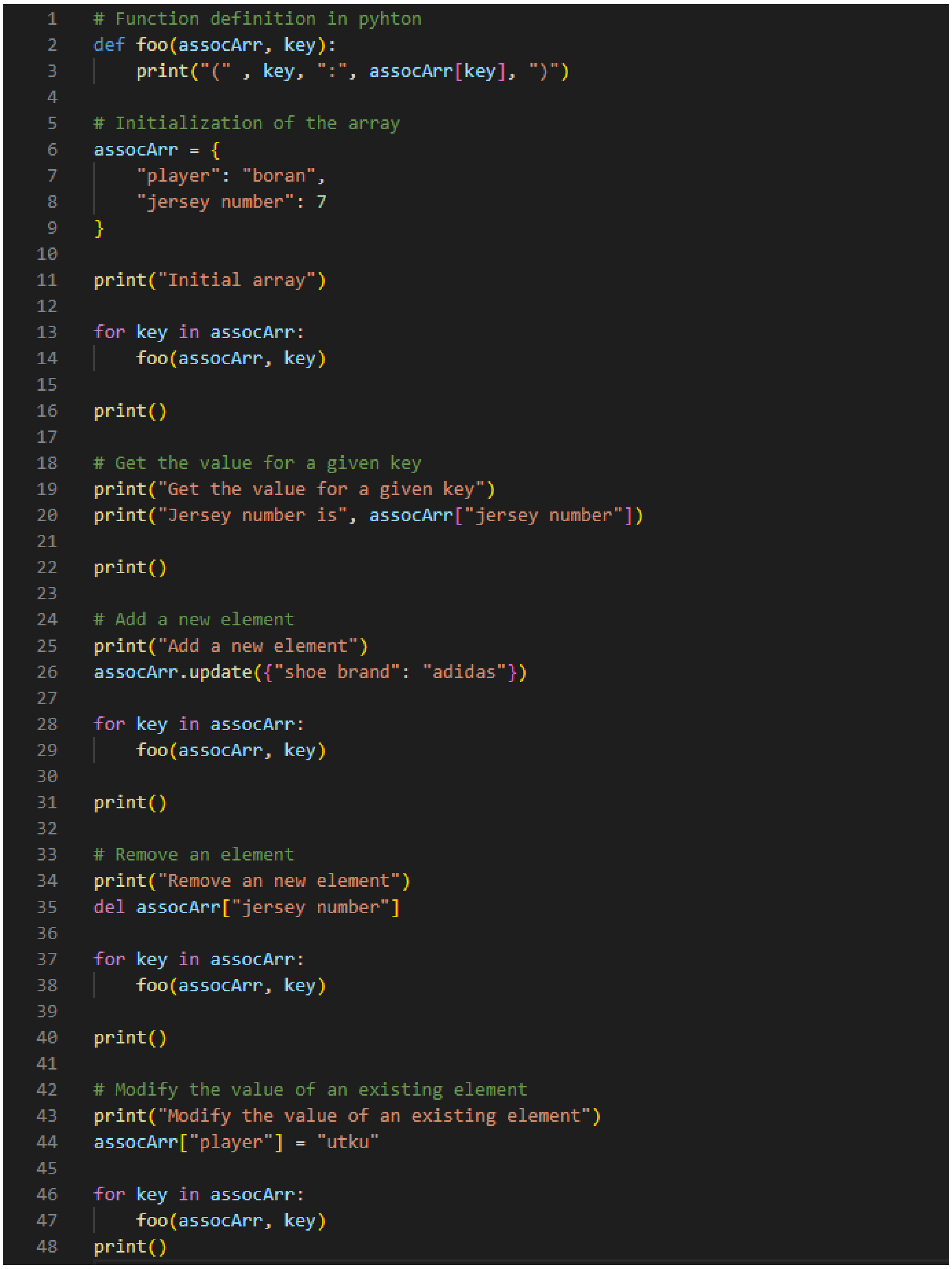
```
Initial array
School:Bilkent
City:Ankara
Year:1984

Get the value for a given key
School is Bilkent

Add a new element
School:Bilkent
City:Ankara
Year:1984
District:Çankaya

Remove an element
School:Bilkent
City:Ankara
District:Çankaya

Modify the value of existing element
School:METU
City:Ankara
District:Çankaya

Search for the existence of a key
This associative array doesn't contain this key

Search for the existence of a value
This associative array contains this value

Print the key-value pairs
School:METU
City:Ankara
District:Çankaya
```

This code creates associative array in PHP. Then it prints the initial array with the function foo() in the for loop. Then it prints the value of a given key. After this, it adds a new element to the array and prints the array in the same way. After these operations, it removes an element and prints the array again. Then, it checks whether the given key and given value is in the array and prints the result according to the its content.

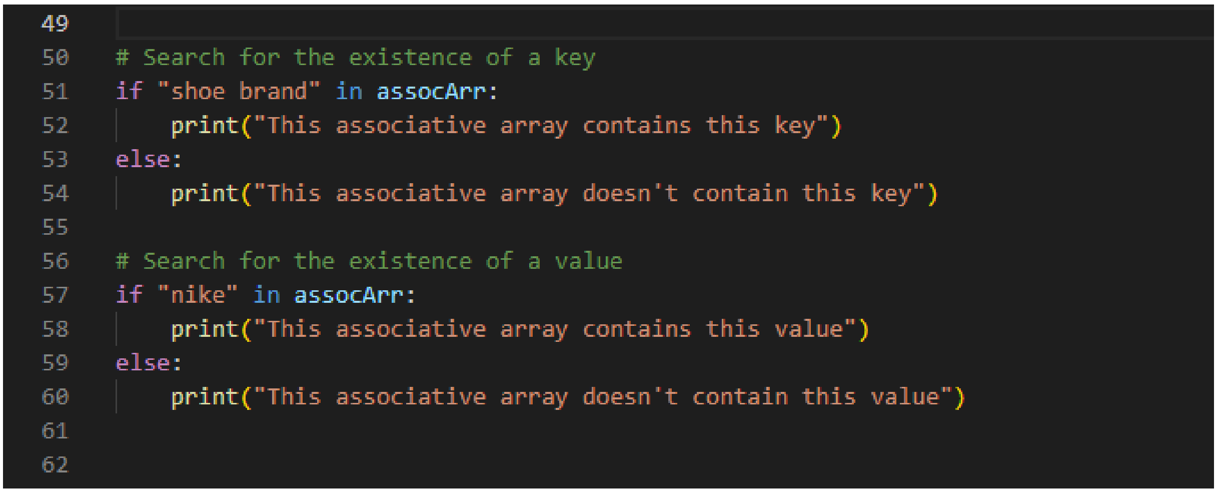
Python

I had experience in Python before, but it was not about associative arrays. In terms of readability and writability, Pyhton was one the best among other languages. It was so intiuitive to do operations even that I did not know associative array structure in Python. The only problem that I had was about searching for the existence of key and value in the array. I did not expect to have the same method to find both of them. In this homework, I can say that, Python is the best language for associative array operations.

Code Segment

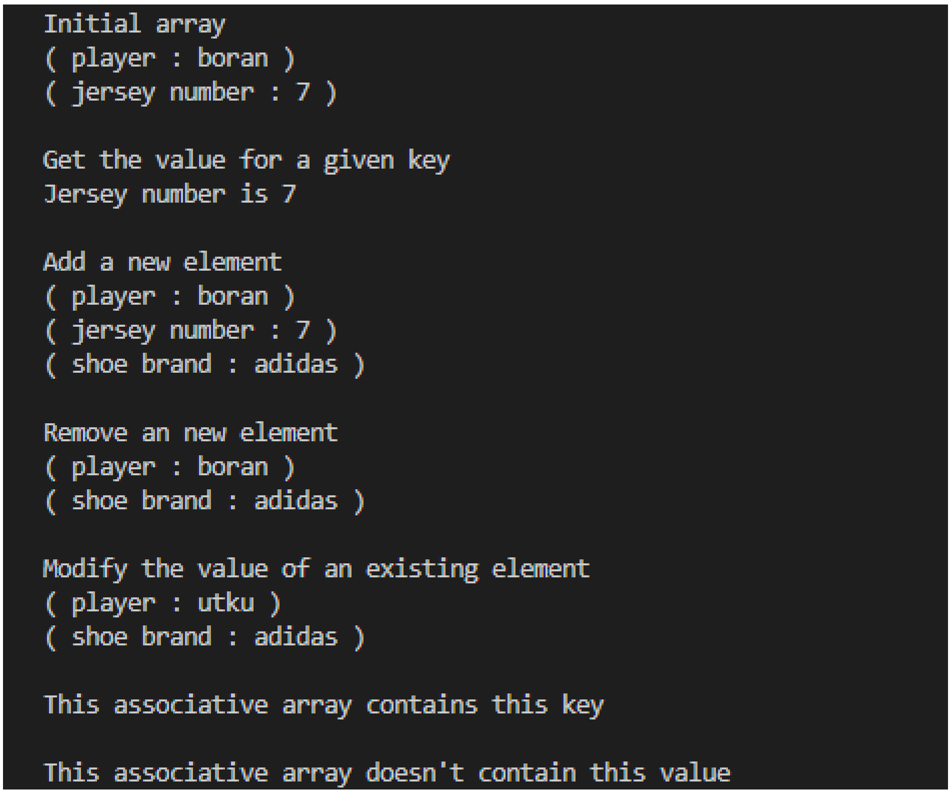


```python
# Function definition in pyhton
def foo(assocArr, key):
    print("(" , key, ":", assocArr[key], ")")

# Initialization of the array
assocArr = {
    "player": "boran",
    "jersey number": 7
}

print("Initial array")

for key in assocArr:
    foo(assocArr, key)

print()

# Get the value for a given key
print("Get the value for a given key")
print("Jersey number is", assocArr["jersey number"])

print()

# Add a new element
print("Add a new element")
assocArr.update({"shoe brand": "adidas"})

for key in assocArr:
    foo(assocArr, key)

print()

# Remove an element
print("Remove an new element")
del assocArr["jersey number"]

for key in assocArr:
    foo(assocArr, key)

print()

# Modify the value of an existing element
print("Modify the value of an existing element")
assocArr["player"] = "utku"

for key in assocArr:
    foo(assocArr, key)
print()
```



```python

# Search for the existence of a key
if "shoe brand" in assocArr:
    print("This associative array contains this key")
else:
    print("This associative array doesn't contain this key")

# Search for the existence of a value
if "nike" in assocArr:
    print("This associative array contains this value")
else:
    print("This associative array doesn't contain this value")


```

Result Of The Execution



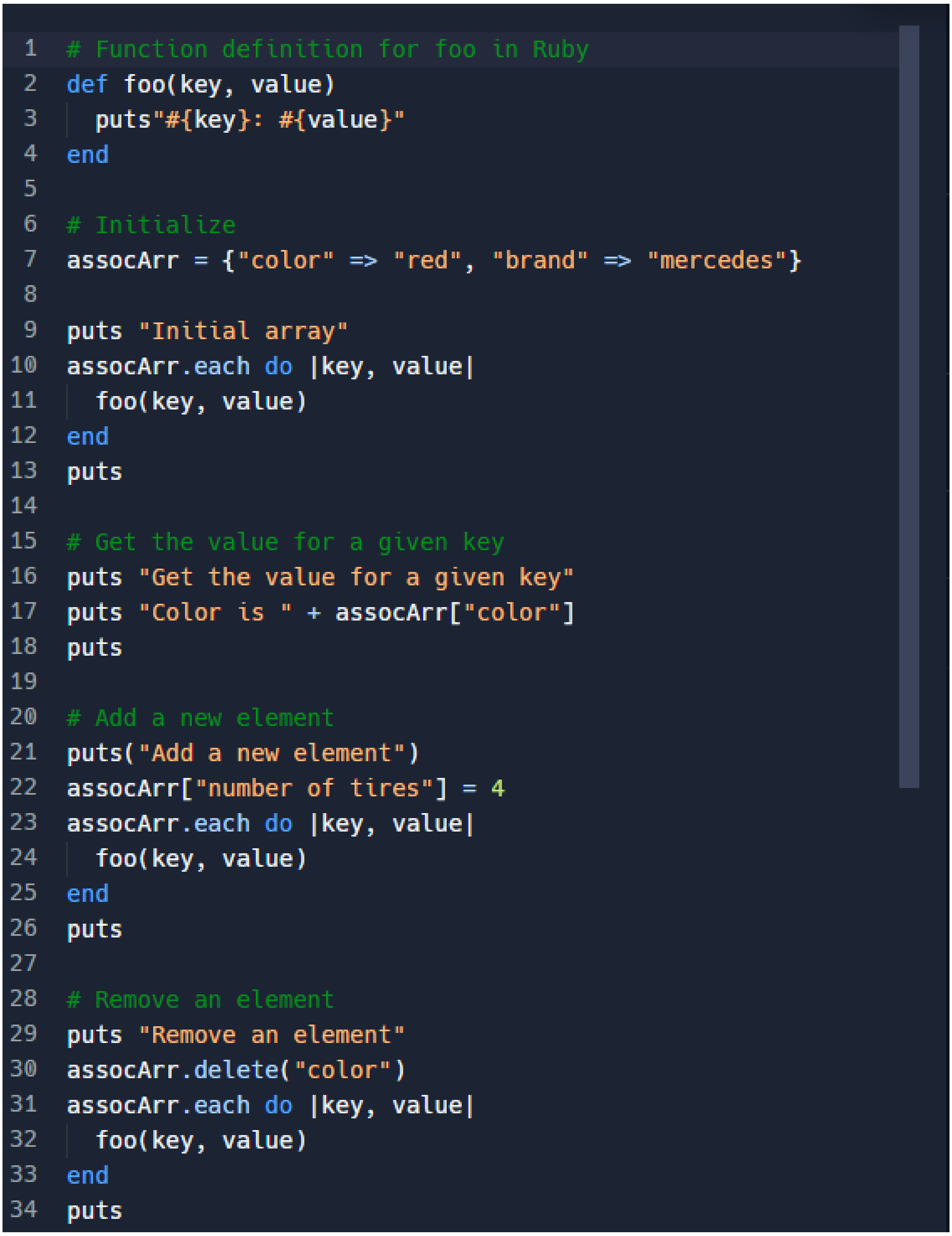
```
Initial array
( player : boran )
( jersey number : 7 )

Get the value for a given key
Jersey number is 7

Add a new element
( player : boran )
( jersey number : 7 )
( shoe brand : adidas )

Remove an new element
( player : boran )
( shoe brand : adidas )

Modify the value of an existing element
( player : utku )
( shoe brand : adidas )

This associative array contains this key

This associative array doesn't contain this value
```

This code creates associative array in Pyhton. Then it prints the initial array with the function foo() in the for loop. Then it prints the value of a given key. After this, it adds a new element to the array and prints the array in the same way. After these operations, it removes an element and prints the array again. Then it checks whether the given key and given value is in the array and prints the result according to the content of it.

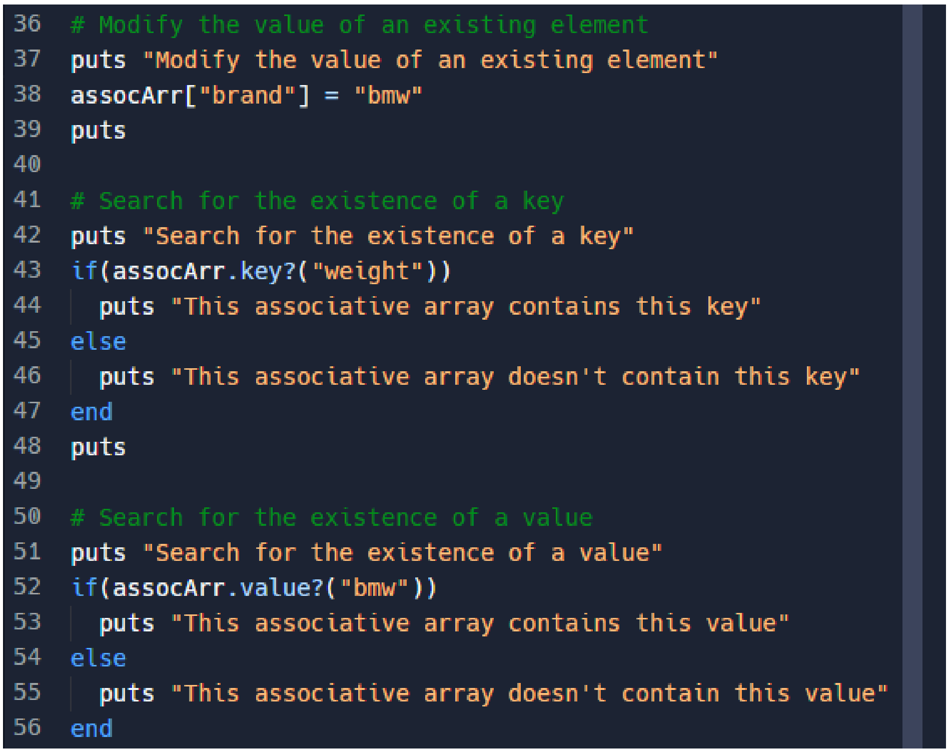
Ruby

I did not have any experience in Ruby as well as other languages in this homework. I coded Python before Ruby, and when I was coding Ruby, I saw Ruby and Python are similar. Due to this, I did have much difficulty coding associative array in Ruby. In terms of readability and writability, Ruby was good. The only problem that I had was, in Ruby for loop is bit different than other languages. If I need to use associative arrays in future, I may use Ruby.

Code Segment

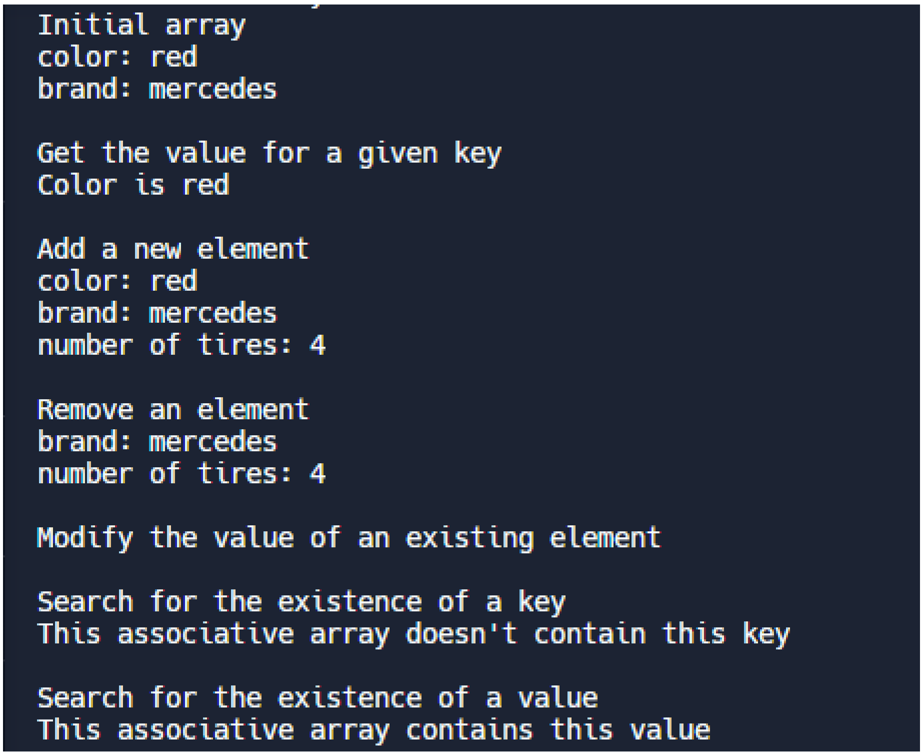


```ruby
# Function definition for foo in Ruby
def foo(key, value)
  puts"#{key}: #{value}"
end

# Initialize
assocArr = {"color" => "red", "brand" => "mercedes"}

puts "Initial array"
assocArr.each do |key, value|
  foo(key, value)
end
puts

# Get the value for a given key
puts "Get the value for a given key"
puts "Color is " + assocArr["color"]
puts

# Add a new element
puts("Add a new element")
assocArr["number of tires"] = 4
assocArr.each do |key, value|
  foo(key, value)
end
puts

# Remove an element
puts "Remove an element"
assocArr.delete("color")
assocArr.each do |key, value|
  foo(key, value)
end
puts
```



```ruby
# Modify the value of an existing element
puts "Modify the value of an existing element"
assocArr["brand"] = "bmw"
puts

# Search for the existence of a key
puts "Search for the existence of a key"
if(assocArr.key?("weight"))
  puts "This associative array contains this key"
else
  puts "This associative array doesn't contain this key"
end
puts

# Search for the existence of a value
puts "Search for the existence of a value"
if(assocArr.value?("bmw"))
  puts "This associative array contains this value"
else
  puts "This associative array doesn't contain this value"
end
```

Result Of The Execution



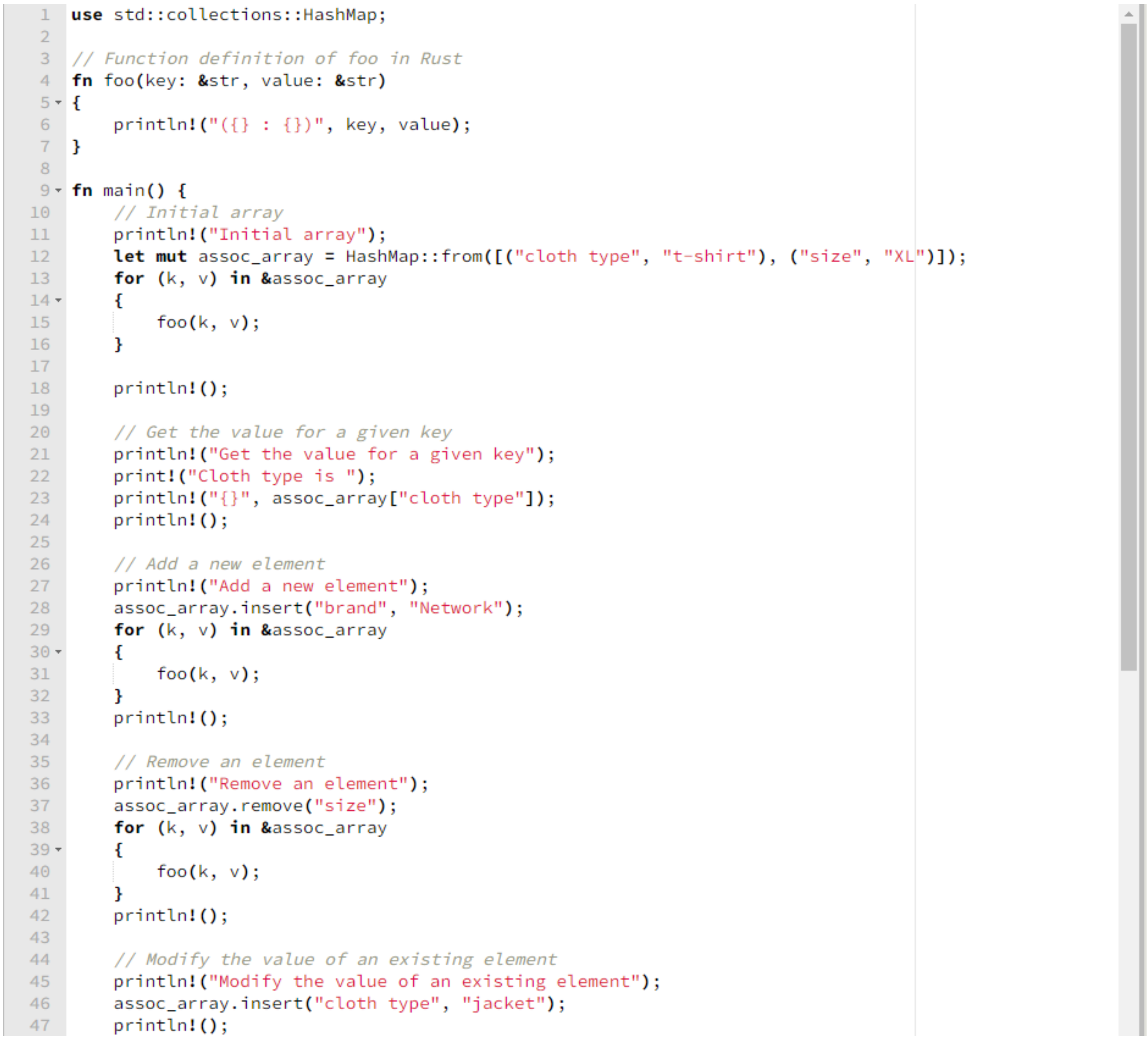
```
Initial array
color: red
brand: mercedes

Get the value for a given key
Color is red

Add a new element
color: red
brand: mercedes
number of tires: 4

Remove an element
brand: mercedes
number of tires: 4

Modify the value of an existing element

Search for the existence of a key
This associative array doesn't contain this key

Search for the existence of a value
This associative array contains this value
```

This code creates associative array in Ruby. Then it prints the initial array with the function foo() in the for (each) loop. Then it prints the value of a given key. After this, it adds a new element to the array and prints the array in the same way. After these operations, it removes an element and prints the array again. Then it checks whether the given key and given value is in the array and prints the result according to the content of it.

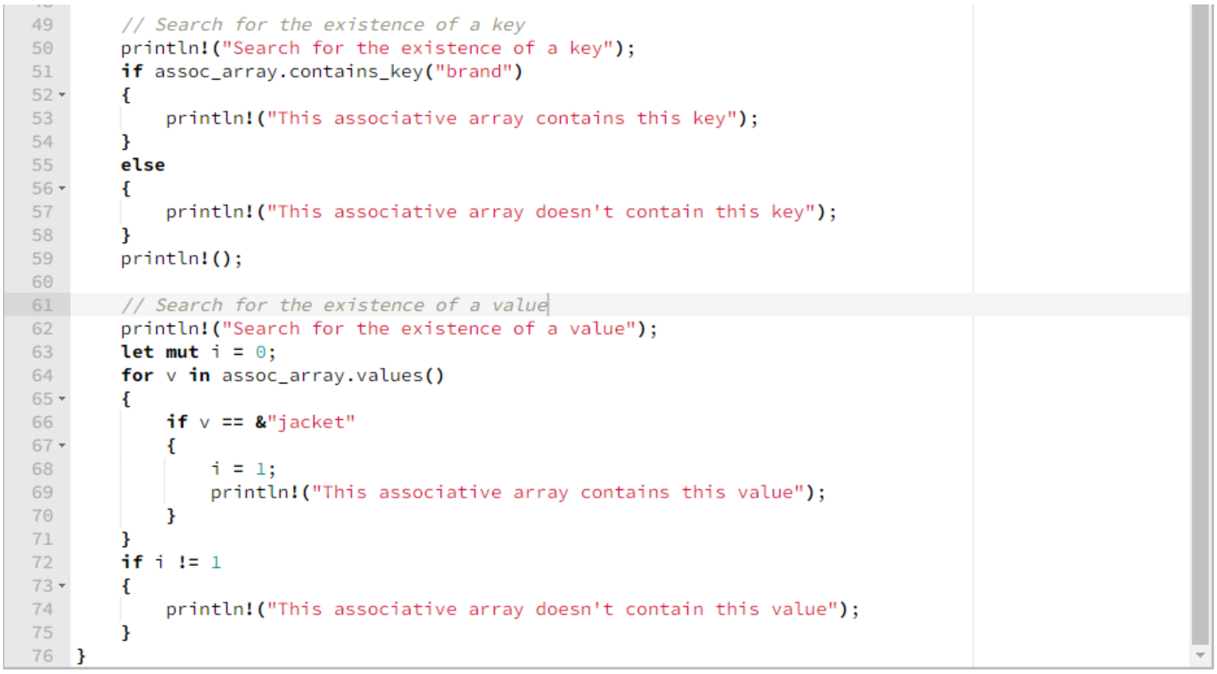
Rust

I did not have any experience in Rust, and it was the worst language to implement associative array among other languages. Associative arrays called HashMap in Rust. In terms of readability and writability, it wasn’t good. It is not similar to any language I’ve faced, including other languages in this homework. If I need to use associative array in the future, Rust definitely won’t be my choice.

Code Segment



```rust
use std::collections::HashMap;

// Function definition of foo in Rust
fn foo(key: &str, value: &str)
{
    println!("({} : {})", key, value);
}

fn main() {
    // Initial array
    println!("Initial array");
    let mut assoc_array = HashMap::from([("cloth type", "t-shirt"), ("size", "XL")]);
    for (k, v) in &assoc_array
    {
        foo(k, v);
    }

    println!();

    // Get the value for a given key
    println!("Get the value for a given key");
    print!("Cloth type is ");
    println!("{}", assoc_array["cloth type"]);
    println!();

    // Add a new element
    println!("Add a new element");
    assoc_array.insert("brand", "Network");
    for (k, v) in &assoc_array
    {
        foo(k, v);
    }
    println!();

    // Remove an element
    println!("Remove an element");
    assoc_array.remove("size");
    for (k, v) in &assoc_array
    {
        foo(k, v);
    }
    println!();

    // Modify the value of an existing element
    println!("Modify the value of an existing element");
    assoc_array.insert("cloth type", "jacket");
    println!();
```



```rust
    // Search for the existence of a key
    println!("Search for the existence of a key");
    if assoc_array.contains_key("brand")
    {
        println!("This associative array contains this key");
    }
    else
    {
        println!("This associative array doesn't contain this key");
    }
    println!();

    // Search for the existence of a value
    println!("Search for the existence of a value");
    let mut i = 0;
    for v in assoc_array.values()
    {
        if v == &"jacket"
        {
            i = 1;
            println!("This associative array contains this value");
        }
    }
    if i != 1
    {
        println!("This associative array doesn't contain this value");
    }
}
```

Result Of The Execution

```
Initial array
(size : XL)
(cloth type : t-shirt)

Get the value for a given key
Cloth type is t-shirt

Add a new element
(size : XL)
(cloth type : t-shirt)
(brand : Network)

Remove an element
(cloth type : t-shirt)
(brand : Network)

Modify the value of an existing element

Search for the existence of a key
This associative array contains this key

Search for the existence of a value
This associative array contains this value
```

This code creates associative array (hash map) in Rust. Then it prints the initial hash map with the function foo() in the for loop. Then it prints the value of a given key. After this, it adds a new element to the hash map and prints the hash map in the same way. After these operations, it removes an element and prints the hash map again. Then it checks whether the given key and given value is in the hash map and prints the result according to the content of it.

Learning Strategy

While doing this homework, I mostly used online sources such as Stackoverflow, W3Schools, GeeksForGeeks, and official websites of the languages. My approach to homework was first understand what associative array is, and then try to complete the task. After I understood the associative arrays, I looked for possible operations with associative arrays. Then I found that associative arrays differ from language to language. For instance, in Dart, associative arrays called Map, on the other hand in Rust they are called HashMap. When I understood the operations, the rest was intuitive for some languages (except Rust). For example, in Ruby, there is an operation .?keys(key). When I saw that, I thought there should be an operation like .?values(value). Online compilers that I have used are,

Dart: https://replit.com/languages/dart

JavaScript: I wrote the code in VSCode and tested it in HTML file.

Lua: https://replit.com/languages/lua

PHP: https://paiza.io/en/projects/new

Pyhton: I wrote the code in VSCode and tested it with Python compiler.

Ruby: https://replit.com/languages/ruby

Rust: https://play.rust-lang.org/