Lesson 1

Painless was designed and developed specifically for elasticsearch

- It is fast and secure
- It has a groovy like syntax
- It support all java data types
- It exposes many java classes(eg. MATH) and methods

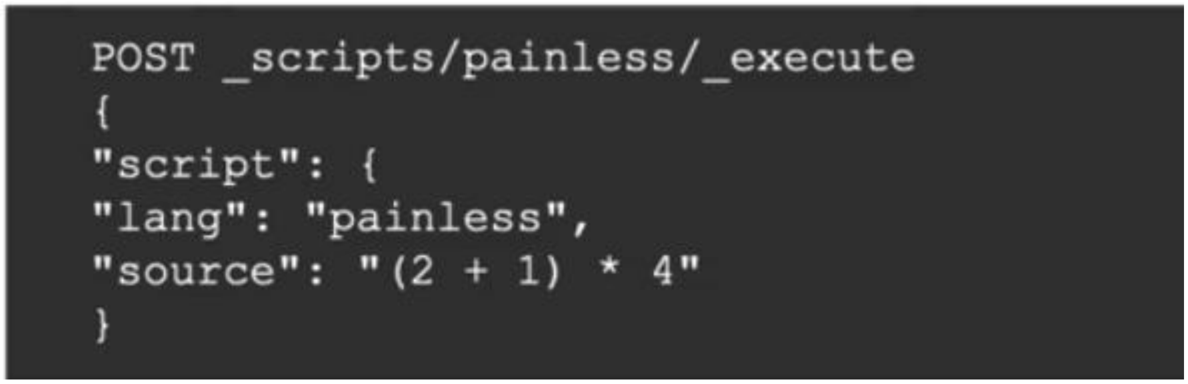
As of Elasticsearch 6.0, painless is the only language supported Other languages, including Groovy, Javascript, and Python are no longer available

Basics to Painless scripting

- In this lessonyou will learn to write basic scripting using Painless:
- Scripting Syntax
- Single-Line Expression
- Script parameters
- Statements and blocks
- Primitive data types
- Variables
- Conditionals
- Methods

Getting Started

- We can Start writing and running scripts using the _scripts API with the _execute end-point

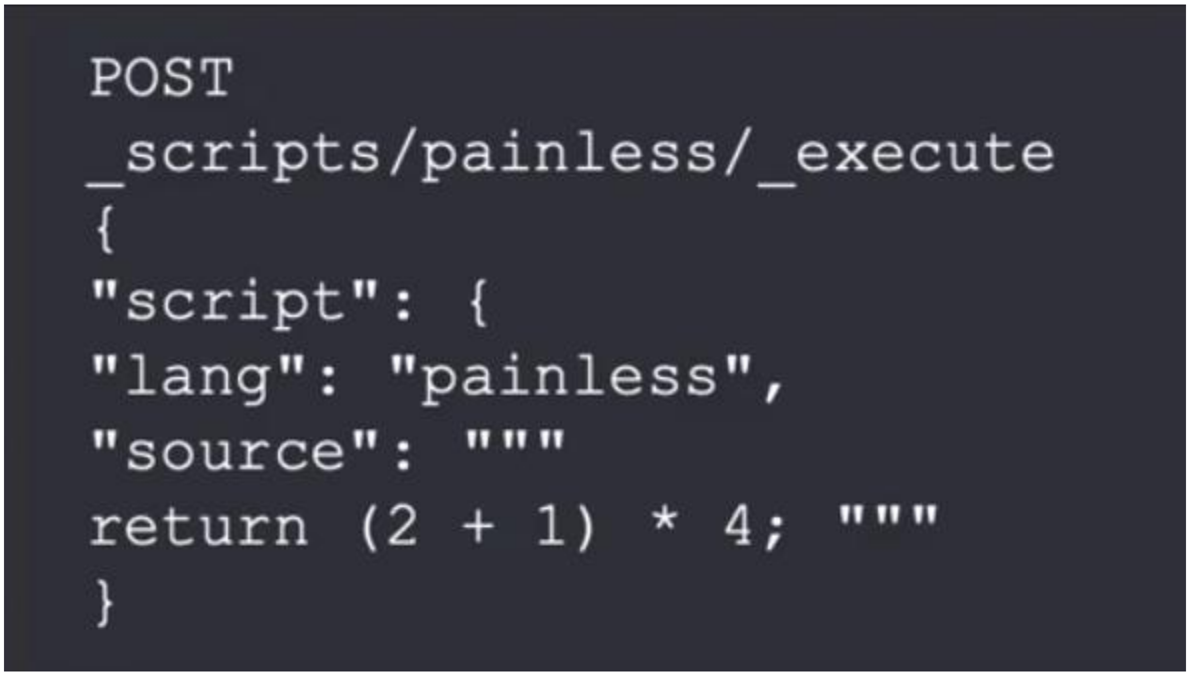


```
POST _scripts/painless/_execute
{
"script": {
"lang": "painless",
"source": "(2 + 1) * 4"
}
```

- The source code in thsi case is simple a single-line numerical expression
- Note the use of JSON to encapsulate script - everything in Elasticsearcch is in JSON

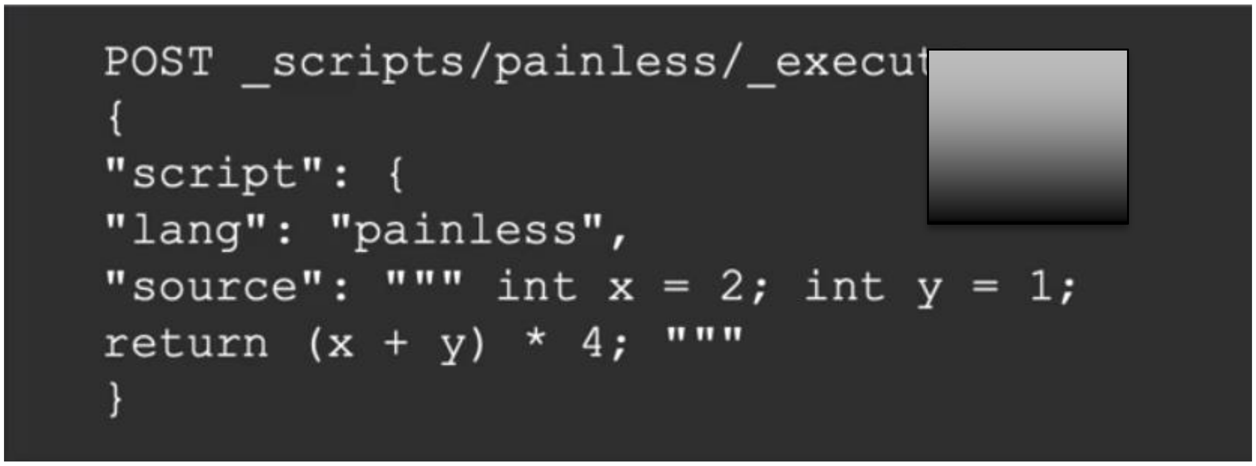
Basics of Painless Scripting

- Writing complex code as an inline expression is not vey practical
- We can write blocks of code using “”” as the block delimiter. Using a code block, the previous script would now be:



```
POST
_scripts/painless/_execute
{
"script": {
"lang": "painless",
"source": """
return (2 + 1) * 4; """
}
```

- Variables in painless can be declared by specifying their type, name, and initial value

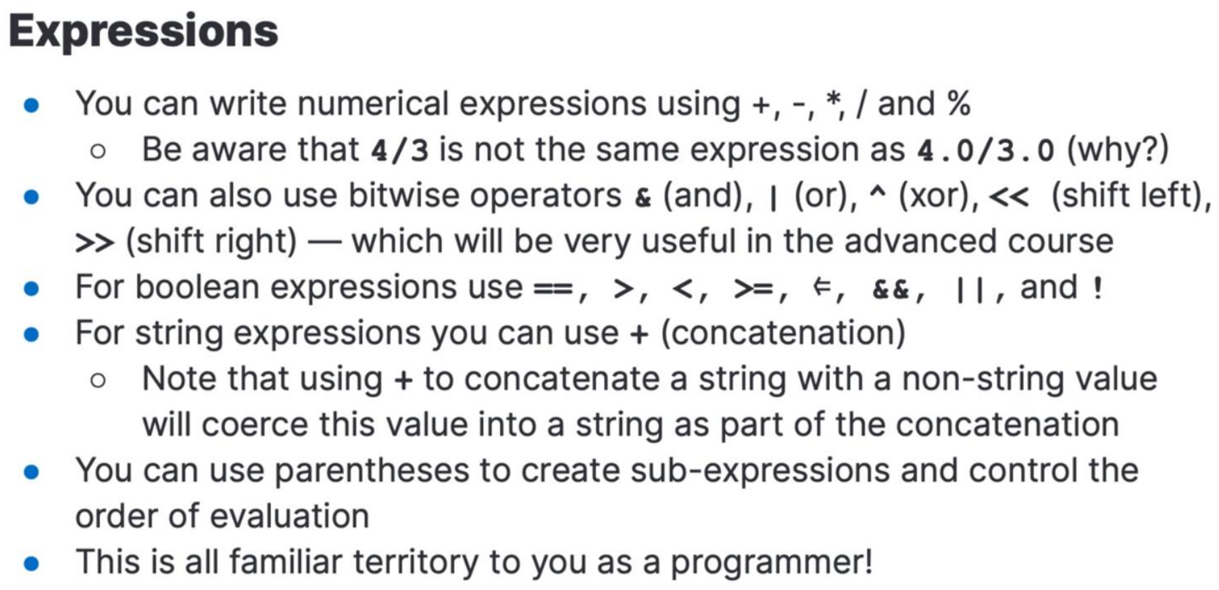


```
POST _scripts/painless/_execut
{
"script": {
"lang": "painless",
"source": """ int x = 2; int y = 1;
return (x + y) * 4; """
}
```

Data types

- Painless has the same data tyes as Java, including
- Primitive types: byte, char, short, int, long, float, double and boolean
- Object wrappers for primitive types: Integer, Long, Float, Double and Boolean String
- Other data types including Date and other
- Data structures
- Arrays, Lists, Maps abd others

Expressions



Expressions

- You can write numerical expressions using +, -, *, / and %
  - Be aware that **`4/3`** is not the same expression as **`4.0/3.0`** (why?)
- You can also use bitwise operators **&** (and), **|** (or), **^** (xor), **<<** (shift left), **>>** (shift right) — which will be very useful in the advanced course
- For boolean expressions use **`==, >, <, >=, ⇐, &&, ||,`** and **`!`**
- For string expressions you can use **+** (concatenation)
  - Note that using **+** to concatenate a string with a non-string value will coerce this value into a string as part of the concatenation
- You can use parentheses to create sub-expressions and control the order of evaluation
- This is all familiar territory to you as a programmer!

Maps and ArrayLists

In Painless, Maps and ArrayLists are particularly easy to build and use — so let's start working with them

- m = ["a": 1, "b": 2] creates a Map m containing two keys, "a" and "b" with values 1 and 2, respectively
- m.get("a") returns 1, the value of key "a"
- m.put("c": 3) adds a new key "c" to m with a value of 3
- m.remove("a") removes the entry in the Map with a key of "a"
- a = [1, 2] creates an ArrayList a containing two values, 1 and 2, in that order
  a [0] returns 1, while a [1] returns 2
- a.add (3) adds 3 to the end of a

- a.remove(2) removes the element at position 2 from a, shifting the remaining elements to the left

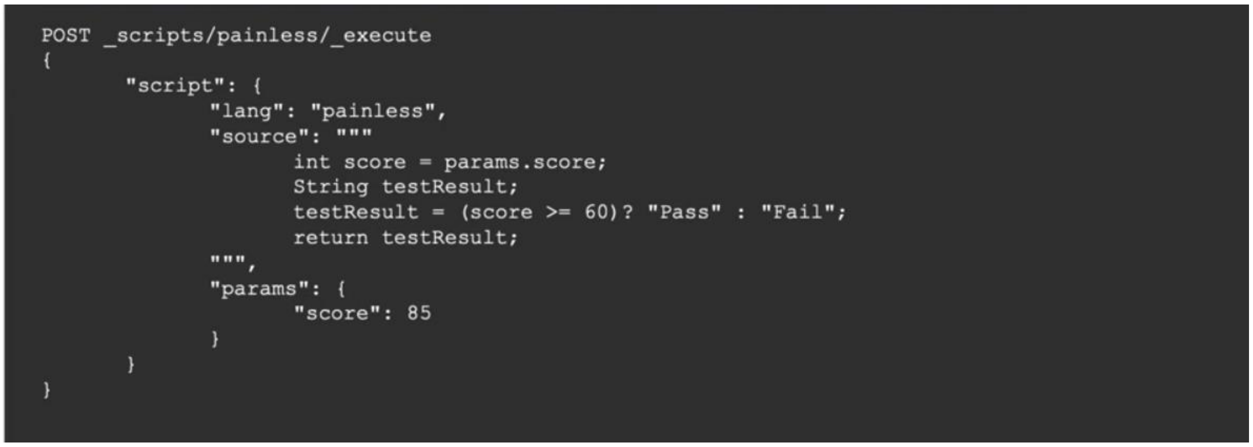
Script Parameters

To make scripts more general and effvient, we can use script parameters

- Value that change from one execution to another should be passed as parameters
- The compiled version of the source will be cached by ES and can be reused with new data

Conditional Statements
Painless supports if and if-else conditional statements

The conditional operator
Instead of using an if-statement to set the value of a variable, we can use the conditional operator ?



```
POST _scripts/painless/_execute
{
       "script": {
              "lang": "painless",
              "source": """
                     int score = params.score;
                     String testResult;
                     testResult = (score >= 60)? "Pass" : "Fail";
                     return testResult;
              """,
              "params": {
                     "score": 85
              }
       }
}
```

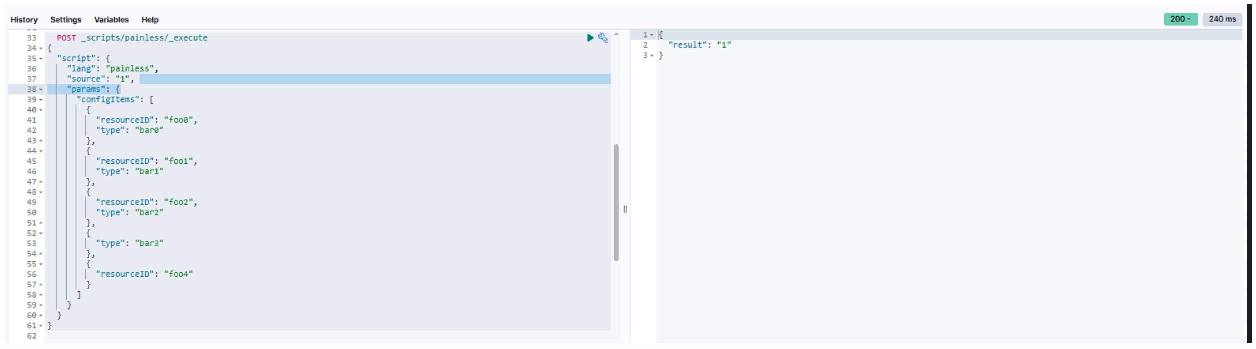
Loops
- Paineless supports for, while, do-while and for-each loop
- In the do-while, the condition is evaluated at the end of each iteration - which means it will be run atleast once

Methods

- Methods and functions(methods that return value) are supported inside painless scripts
- This script contains a function that find the area of a circle of radius “r”
- Method allow us to write reusable painless code
- Unfortunately, methods cannot be saved outside a script amd must be copy-pasted from script to script

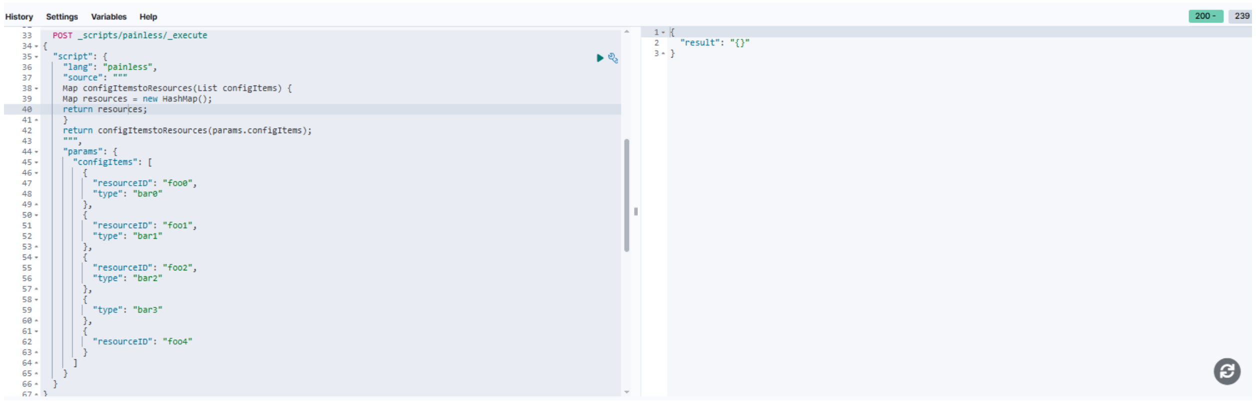
Scripts can be stored in the cluster state and later on invoked by id and with new parameter values

Solved Problem



```
POST _scripts/painless/_execute
{
  "script": {
    "lang": "painless",
    "source": "1",
    "params": {
      "configItems": [
        {
          "resourceID": "foo0",
          "type": "bar0"
        },
        {
          "resourceID": "foo1",
          "type": "bar1"
        },
        {
          "resourceID": "foo2",
          "type": "bar2"
        },
        {
          "type": "bar3"
        },
        {
          "resourceID": "foo4"
        }
      ]
    }
  }
}
```

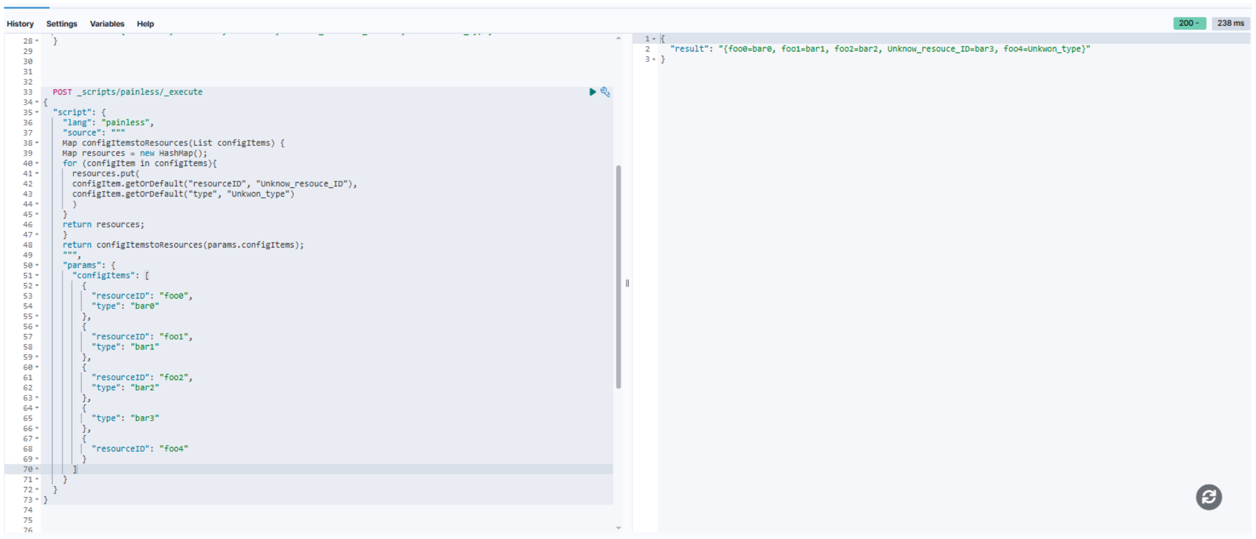
```
{
  "result": "1"
}
```



```
POST _scripts/painless/_execute
{
  "script": {
    "lang": "painless",
    "source": """
    Map configItemstoResources(List configItems) {
    Map resources = new HashMap();
    return resources;
    }
    return configItemstoResources(params.configItems);
    """,
    "params": {
      "configItems": [
        {
          "resourceID": "foo0",
          "type": "bar0"
        },
        {
          "resourceID": "foo1",
          "type": "bar1"
        },
        {
          "resourceID": "foo2",
          "type": "bar2"
        },
        {
          "type": "bar3"
        },
        {
          "resourceID": "foo4"
        }
      ]
    }
  }
}
```

```
{
  "result": "{}"
}
```

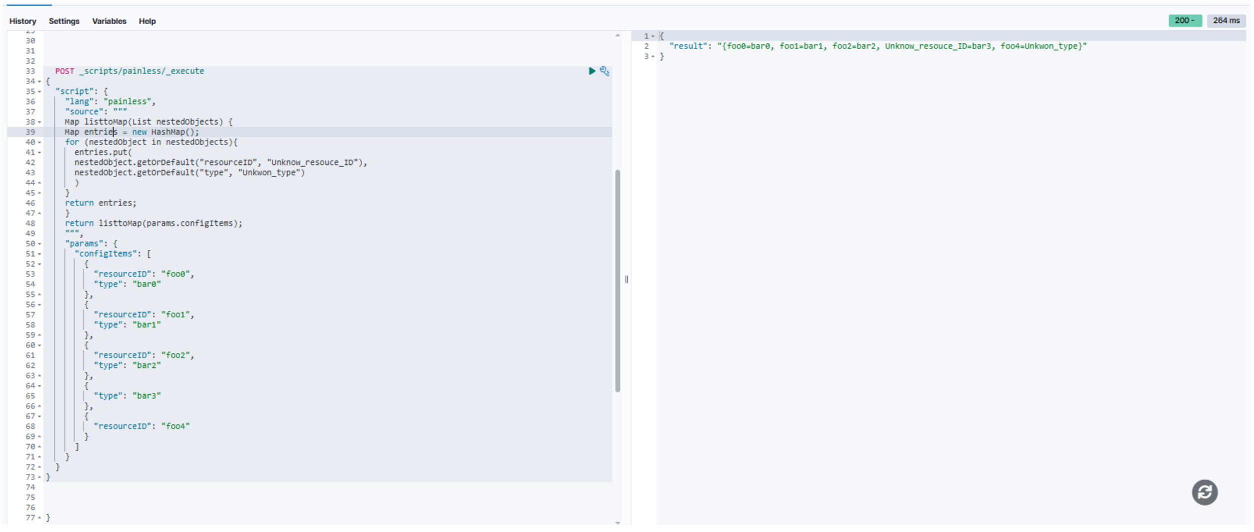
```
 POST _scripts/painless/_execute
{
  "script": {
    "lang": "painless",
    "source": """
    Map configItemstoResources(List configItems) {
    Map resources = new HashMap();
    for (configItem in configItems){
      resources.put(
      configItem.getOrDefault("resourceID", "Unknow_resouce_ID"),
      configItem.getOrDefault("type", "Unkwon_type")
      )
    }
    return resources;
    }
    return configItemstoResources(params.configItems);
    """,
    "params": {
      "configItems": [
        {
          "resourceID": "foo0",
          "type": "bar0"
        },
        {
          "resourceID": "foo1",
          "type": "bar1"
        },
        {
          "resourceID": "foo2",
          "type": "bar2"
        },
        {
          "type": "bar3"
        },
        {
          "resourceID": "foo4"
        }
      ]
    }
  }
}
```



```
 }




POST _scripts/painless/_execute
{
 "script": {
  "lang": "painless",
  "source": """
  Map configItemstoResources(List configItems) {
  Map resources = new HashMap();
  for (configItem in configItems){
    resources.put(
    configItem.getOrDefault("resourceID", "Unknow_resouce_ID"),
    configItem.getOrDefault("type", "Unkwon_type")
    )
  }
  return resources;
  }
  return configItemstoResources(params.configItems);
  """,
  "params": {
    "configItems": [
      {
        "resourceID": "foo0",
        "type": "bar0"
      },
      {
        "resourceID": "foo1",
        "type": "bar1"
      },
      {
        "resourceID": "foo2",
        "type": "bar2"
      },
      {
        "type": "bar3"
      },
      {
        "resourceID": "foo4"
      }
    ]
  }
 }
}
```

```
{
  "result": "{foo0=bar0, foo1=bar1, foo2=bar2, Unknow_resouce_ID=bar3, foo4=Unkwon_type}"
}
```

```
{
  "error": {
    "root_cause": [
      {
        "type": "script_exception",
        "reason": "compile error",
        "script_stack": [
          """... dObjects){
      entries.put(
      nestedObject ...""",
          "                              ^---- HERE"
        ],
        "script": """
    Map listtoMap(List nestedObjects) {
    Map entreis = new HashMap();
    for (nestedObject in nestedObjects){
      entries.put(
      nestedObject.getOrDefault("resourceID", "Unknow_resouce_ID"),
      nestedObject.getOrDefault("type", "Unkwon_type")
      )
    }
    return entries;
    }
    return listtoMap(params.configItems);
    """,
        "lang": "painless",
        "position": {
          "offset": 132,
          "start": 107,
          "end": 157
        }
      }
    ],
    "type": "script_exception",
    "reason": "compile error",
    "script_stack": [
      """... dObjects){
      entries.put(
      nestedObject ...""",
      "                              ^---- HERE"
    ],
    "script": """
    Map listtoMap(List nestedObjects) {
    Map entreis = new HashMap();
    for (nestedObject in nestedObjects){
      entries.put(
      nestedObject.getOrDefault("resourceID", "Unknow_resouce_ID"),
      nestedObject.getOrDefault("type", "Unkwon_type")
      )
    }
    return entries;
    }
    return listtoMap(params.configItems);
    """,
    "lang": "painless",
    "position": {
      "offset": 132,
      "start": 107,
      "end": 157
    },
    "caused_by": {
      "type": "illegal_argument_exception",
      "reason": "cannot resolve symbol [entries]"
    }
  },
  "status": 400
}
```



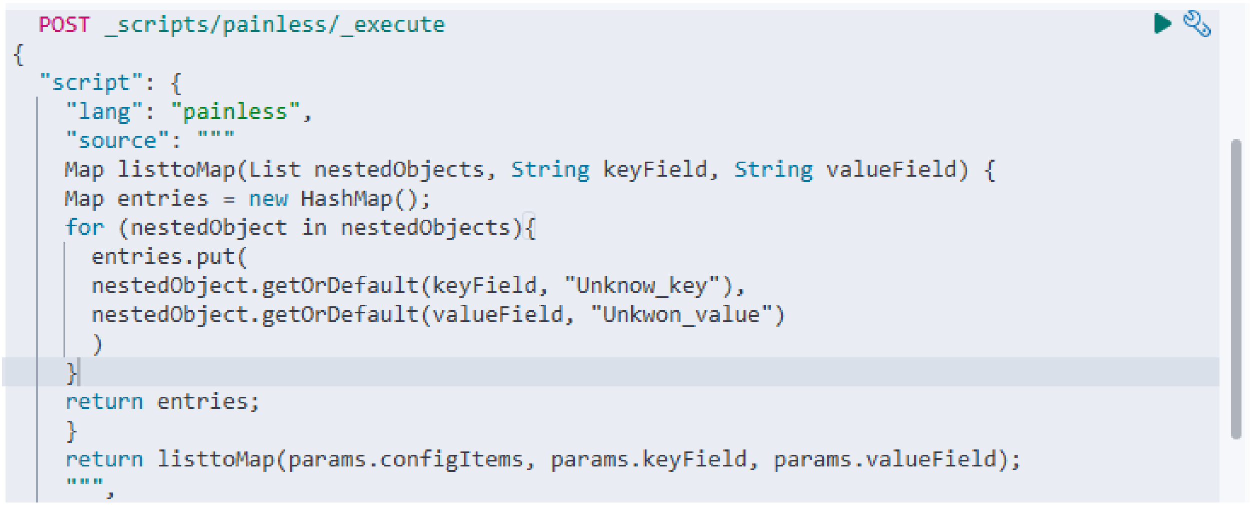
```
POST _scripts/painless/_execute
{
  "script": {
    "lang": "painless",
    "source": """
    Map listtoMap(List nestedObjects) {
    Map entries = new HashMap();
    for (nestedObject in nestedObjects){
      entries.put(
      nestedObject.getOrDefault("resourceID", "Unknow_resouce_ID"),
      nestedObject.getOrDefault("type", "Unkwon_type")
      )
    }
    return entries;
    }
    return listtoMap(params.configItems);
    """,
    "params": {
      "configItems": [
        {
          "resourceID": "foo0",
          "type": "bar0"
        },
        {
          "resourceID": "foo1",
          "type": "bar1"
        },
        {
          "resourceID": "foo2",
          "type": "bar2"
        },
        {
          "type": "bar3"
        },
        {
          "resourceID": "foo4"
        }
      ]
    }
  }
}



}
```

```
{
  "result": "{foo0=bar0, foo1=bar1, foo2=bar2, Unknow_resouce_ID=bar3, foo4=Unkwon_type}"
}
```

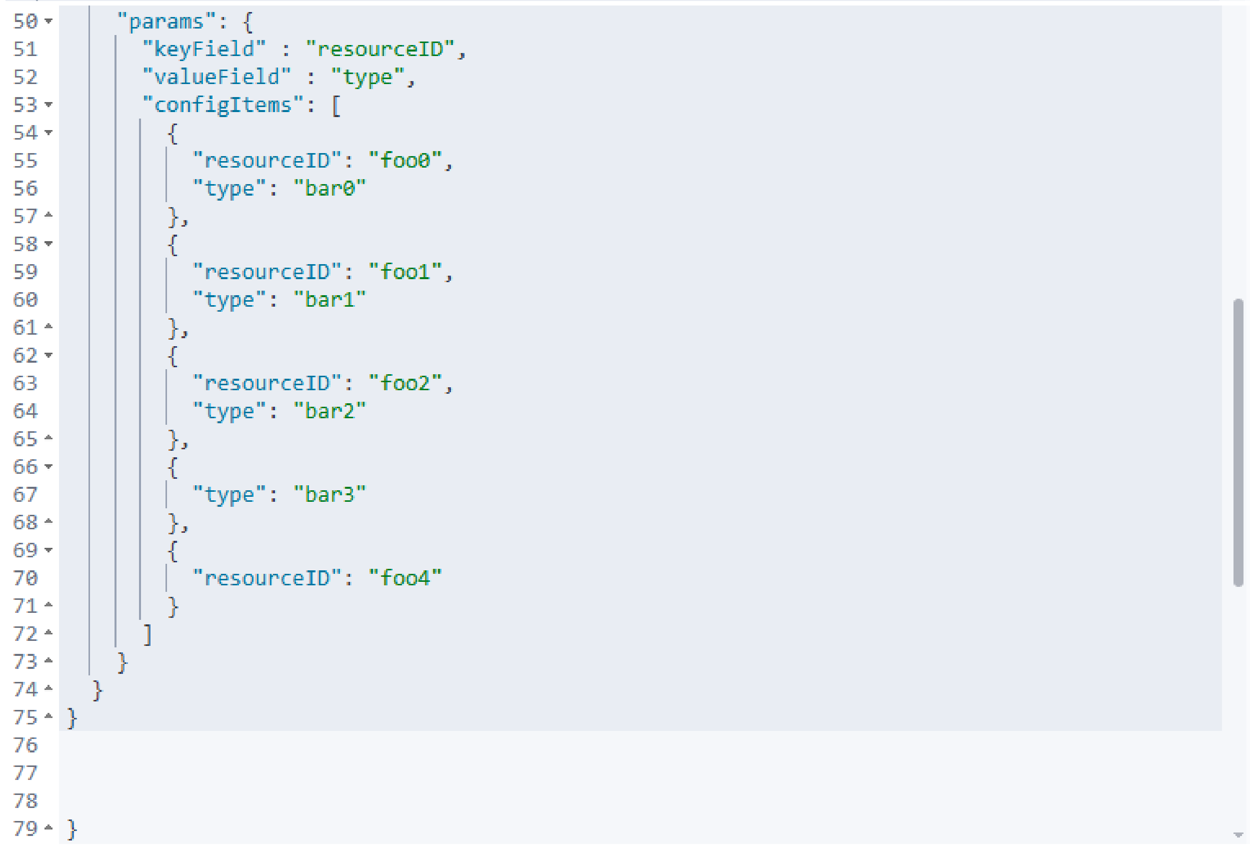
FINAL CODE OF PROBEM

```
 POST _scripts/painless/_execute
{
  "script": {
    "lang": "painless",
    "source": """
    Map listtoMap(List nestedObjects, String keyField, String valueField) {
    Map entries = new HashMap();
    for (nestedObject in nestedObjects){
      entries.put(
      nestedObject.getOrDefault(keyField, "Unknow_key"),
      nestedObject.getOrDefault(valueField, "Unkwon_value")
      )
    }
    return entries;
    }
    return listtoMap(params.configItems, params.keyField, params.valueField);
    """,
    "params": {
      "keyField" : "resourceID",
      "valueField" : "type",
      "configItems": [
        {
          "resourceID": "foo0",
          "type": "bar0"
        },
        {
          "resourceID": "foo1",
          "type": "bar1"
        },
        {
          "resourceID": "foo2",
          "type": "bar2"
        },
        {
          "type": "bar3"
        },
        {
          "resourceID": "foo4"
        }
      ]
    }
  }
}
```

}

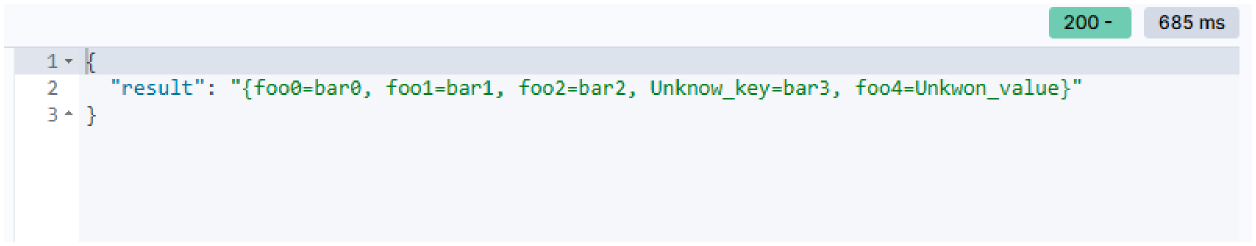


```
  POST _scripts/painless/_execute
{
  "script": {
    "lang": "painless",
    "source": """
    Map listtoMap(List nestedObjects, String keyField, String valueField) {
    Map entries = new HashMap();
    for (nestedObject in nestedObjects){
      entries.put(
      nestedObject.getOrDefault(keyField, "Unknow_key"),
      nestedObject.getOrDefault(valueField, "Unkwon_value")
      )
    }
    return entries;
    }
    return listtoMap(params.configItems, params.keyField, params.valueField);
    """,
```



```
    "params": {
      "keyField" : "resourceID",
      "valueField" : "type",
      "configItems": [
        {
          "resourceID": "foo0",
          "type": "bar0"
        },
        {
          "resourceID": "foo1",
          "type": "bar1"
        },
        {
          "resourceID": "foo2",
          "type": "bar2"
        },
        {
          "type": "bar3"
        },
        {
          "resourceID": "foo4"
        }
      ]
    }
  }
}



}
```

OUTPUT



```
{
  "result": "{foo0=bar0, foo1=bar1, foo2=bar2, Unknow_key=bar3, foo4=Unkwon_value}"
}
```