CSC 337

JavaScript Object Notation (JSON)

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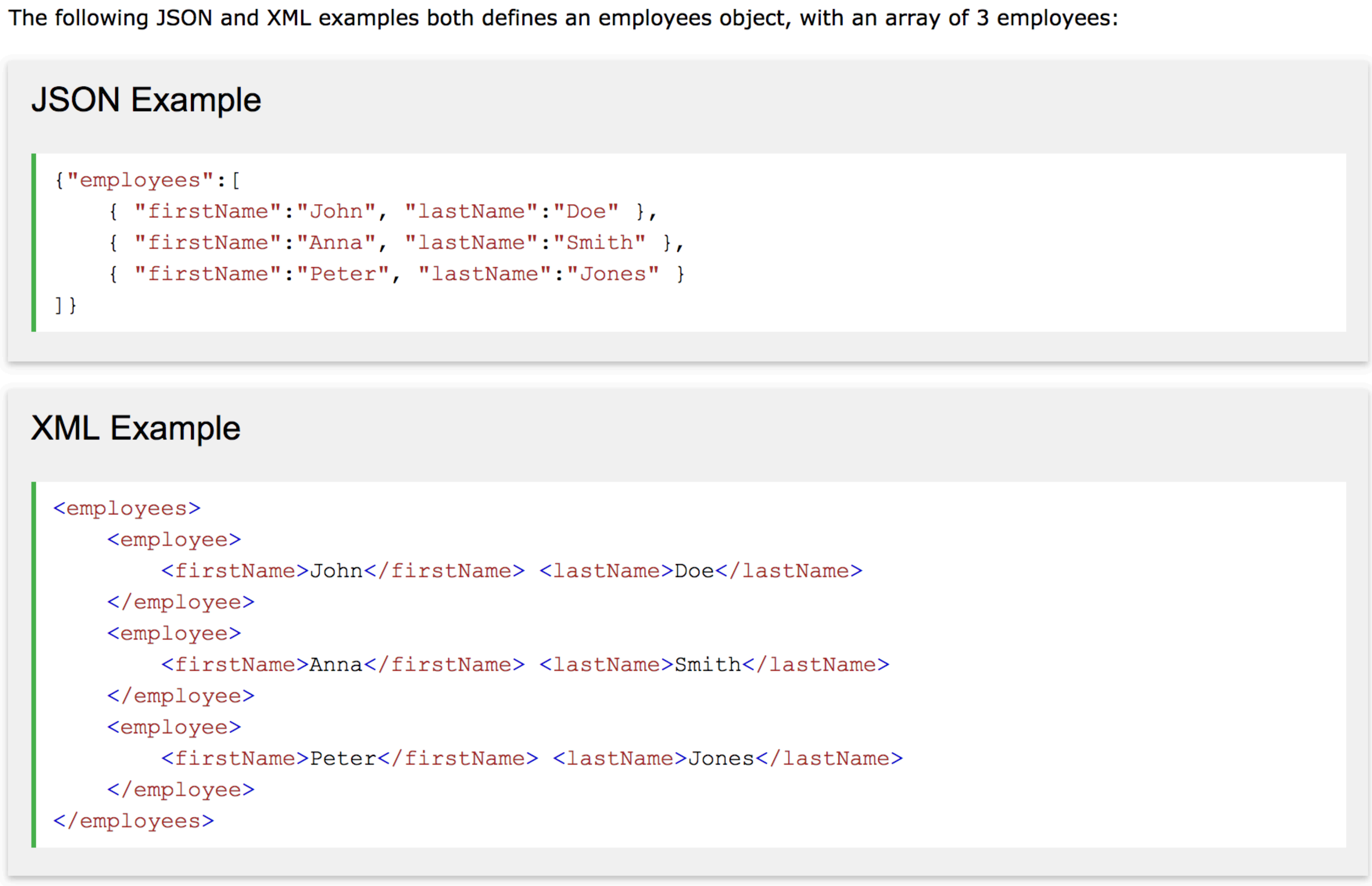
Why JSON over XML? JSON was built to know JS



The following JSON and XML examples both defines an employees object, with an array of 3 employees:

JSON Example

```
{"employees":[
    { "firstName":"John", "lastName":"Doe" },
    { "firstName":"Anna", "lastName":"Smith" },
    { "firstName":"Peter", "lastName":"Jones" }
]}
```

XML Example

```
<employees>
    <employee>
        <firstName>John</firstName> <lastName>Doe</lastName>
    </employee>
    <employee>
        <firstName>Anna</firstName> <lastName>Smith</lastName>
    </employee>
    <employee>
        <firstName>Peter</firstName> <lastName>Jones</lastName>
    </employee>
</employees>
```

JSON

- **J**ava**S**cript **O**bject **N**otation
- Data-interchange format
- Lightweight
- Replacement for XML
- It's just a string with some special formatting
- Based on JavaScript
    - but JSON has nothing to do with JavaScript

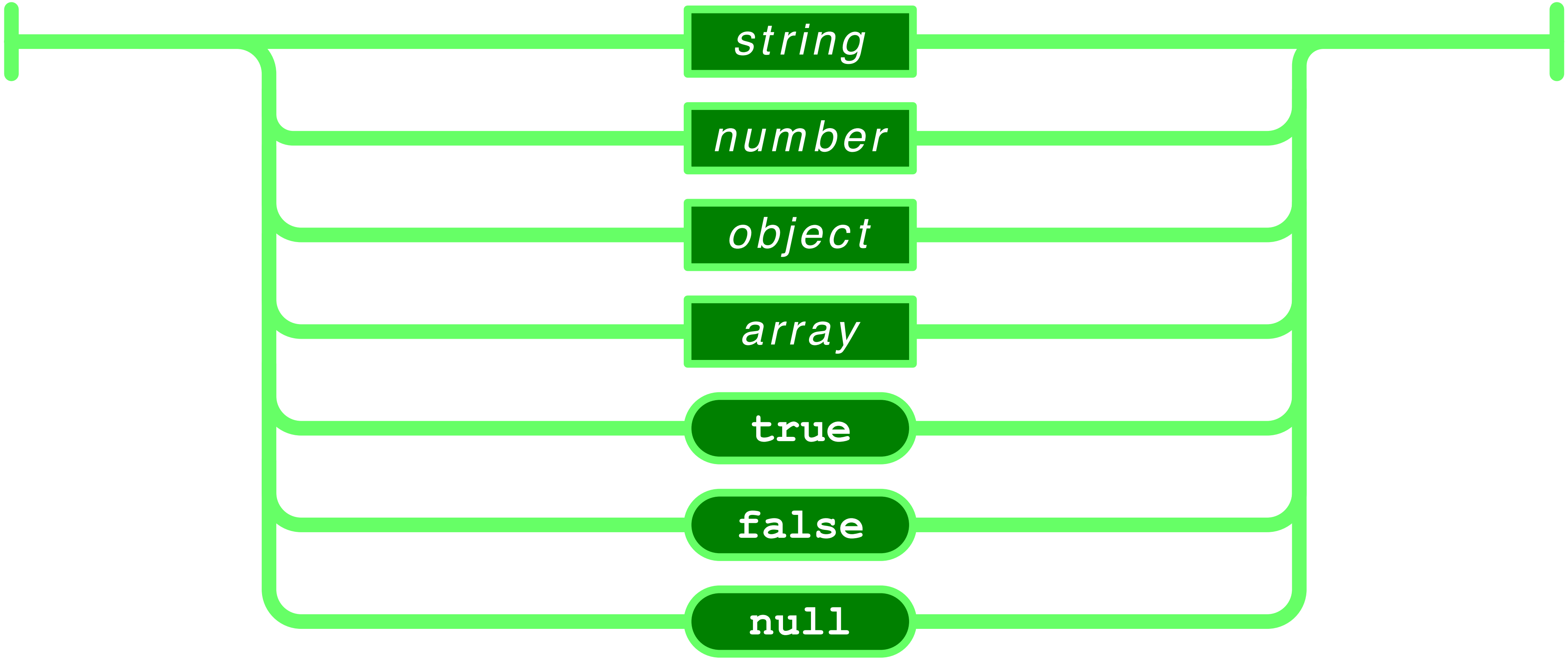
Characteristics

- Language Independent
  - Again, just a big string with special chars like `{ } , ' " : [ ]`
- Text-based
- Light-weight
- Easy to encode inside a `<?php` block
  - PHP has a method for this: `json_encode($array);`
- Easy to parse inside a <script> of .js file
  - JS method: `var array = JSON.parse(xhttp.responseText);`

JSON is not

- JSON is not a style like CSS
- JSON is not a markup language like HTML
- JSON is not a programming language like JavaScript or PHP
- JSON is not a general serialization format as seen in Java

JSON Values



Literal Values in JSON

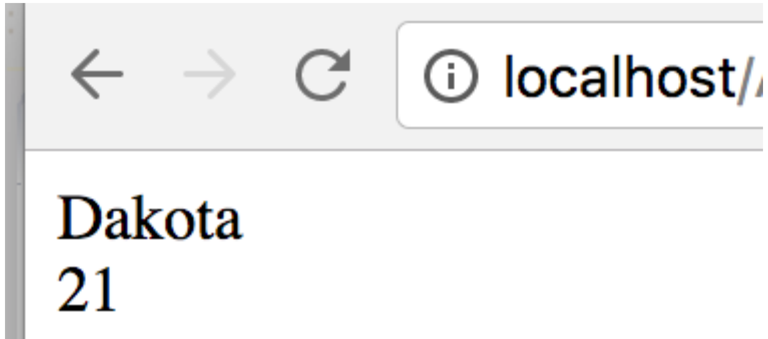
- number: `1   -2   4.56`
- string: `"need double quotes"`
- object: `{ "name":"Dakota",  "age": 20 }`
- null: `null`
- boolean: `true   false`
- arrays: `[1, 2, 3]`
- arrays of objects

```
{ "students" :
     [
       {"name":"Li", "age": 21},
       {"name":"Ty", "age": 19}
     ]
}
```

Important usage! Send a JSON string from server to client. Needed: JSON.parse

```
<?php
  echo '{ "name":"Dakota",  "age":21 }';
?>
```

```
<script>

     . . .
    ajax.onreadystatechange = function() {
       if (ajax.readyState == 4 && ajax.status == 200) {
           var student = JSON.parse(ajax.responseText);
           document.write(student.name + '<br>');
           document.write(student.age + '<br>');
     }
   . . .
</script>
```



```
Dakota
21
```

JSON Arrays

- Square brackets hold **arrays** (JSON has no indexed arrays)

  [1, 2, 3]

- JSON array are very much like JavaScript arrays
  - JSON arrays can't store as many different types as JS array

```
<?php
$array = [123, 'a string', true && false];
echo json_encode($array);
?>

<input type="button" value="Click me" onclick="aFunction()"> <br>
<div id="tochange"> Should see an array here on click </div>
<script>
function aFunction() {
var ajax = new XMLHttpRequest();
  ajax.open("GET", "array.php", true);
  ajax.send();
  ajax.onreadystatechange = function () {
    if (ajax.readyState == 4 && ajax.status == 200) {
      var array = JSON.parse(ajax.responseText);
      for(i = 0; i < array.length; i++)
          document.write(array[i] + "<br>");
     }
  }; // End anonymous function
}
```

Code demo

- Write a service that send back an array of string or and array of integers depending
  - Need isset and $_GET[]

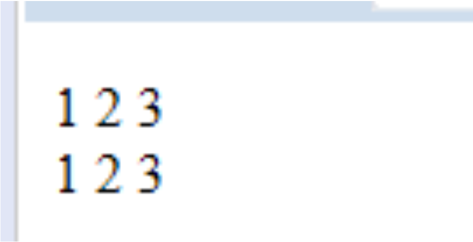
JSON Objects

- A JSON object is an unordered set of name/value pairs
- A colon exist between the name and the value
- Data is separated by commas
- Curly braces hold **objects**

```
{ "name": "Chris Miller",  "age":20,  "year": "Sophomore" }
```

JSON objects look like JavaScript objects

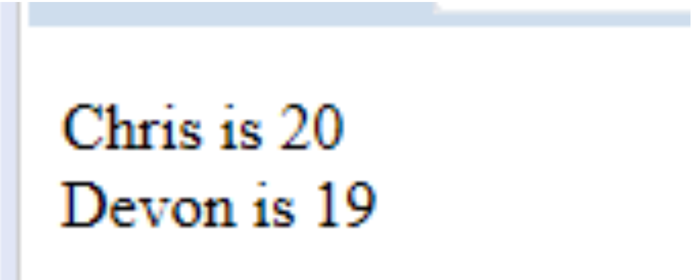
```
<script>
var array = [1,2,3];
for (i = 0; i < 3; i++ )
   document.write(array[i] + " ");

document.write("<br>");

var string = '[1,2,3]';
// Convert a JSON string to JavaScript
var JSarr = JSON.parse(string);
for (i = 0; i < 3; i++ )
   document.write(JSarr[i] + " ");
</script>
```



```
1 2 3
1 2 3
```

Array of objects; the same code in JS and JSON

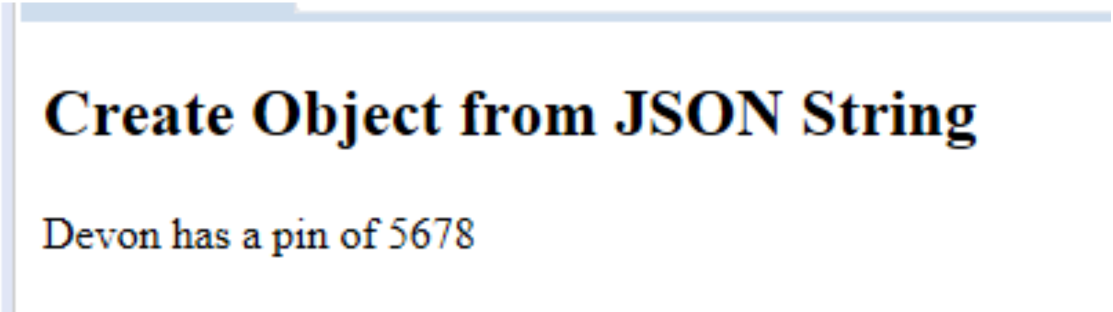
```
<script>
// Strings like this will be echoed from a PHP script on the server
var string = '{ "student": [ ' +
                  '{"name": "Chris",  "age":20},' +
                  '{"name": "Devon", "age":19}' +
                           ']
              }'
var JSref = JSON.parse(string);
for (i = 0; i < 3; i++ ) {
  document.write(JSref.student[i].name + " is " + JSref.student[i].age );
  document.write("<br>");
}
</script>
```



```
Chris is 20
Devon is 19
```

JSON data converted to JS to change the DOM

```
<h2>Create Object from JSON String</h2>
<p id="demo"></p>
<script>
// Store an array of objects:
var JSON_arrayOfObjects = '{"accounts":[' +
                                          '{"ID":"Casey", "pin":"1234" },' +
                                          '{"ID":"Devon", "pin":"5678" },' +
                                          '{"ID":"Lindsay", "pin":"9999"}' +
                                      ']' +
                          '}';
ref = JSON.parse(JSON_arrayOfObjects);
document.getElementById("demo").innerHTML =
    ref.accounts[1].ID + " has a pin of " + ref.accounts[1].pin;
</script>
```



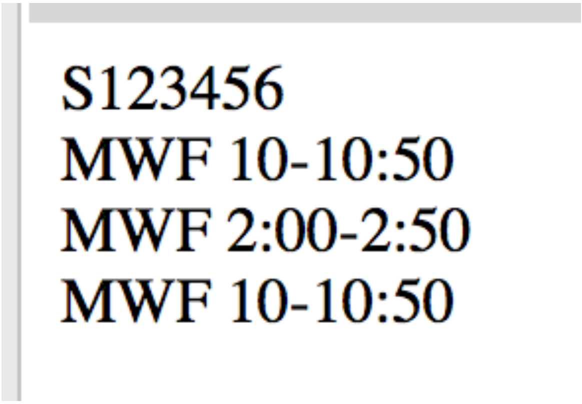
Create Object from JSON String

Devon has a pin of 5678

Javascript objects look like JSON objects

- One way to create a JavaScript Object, use { }

```
// Store an JS object with a JS object inside it:
var JSObject = { "id":'S123456',
            "inner": {
                            "CSC127A": 'MWF 10-10:50',
                     "CSC337": 'MWF 2:00-2:50',
                    "CSC335": 'MWF 10-10:50'
                  }
         };

document.write(JSObject.id + '<br>');
document.write(JSObject.inner.CSC127A + '<br>');
document.write(JSObject.inner.CSC337 + '<br>');
document.write(JSObject.inner.CSC335 + '<br>');
```



```
S123456
MWF 10-10:50
MWF 2:00-2:50
MWF 10-10:50
```

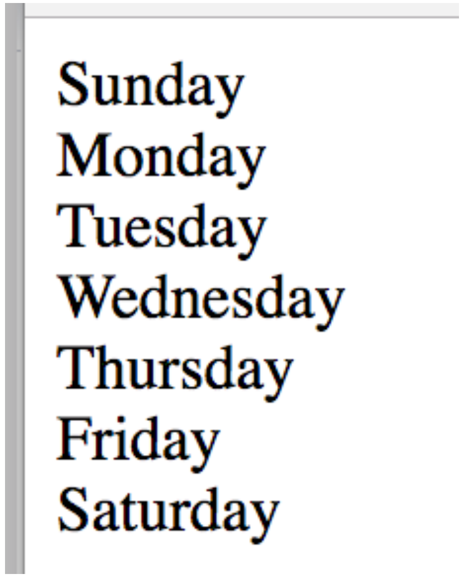
JSON Arrays

- Arrays are ordered sequences of values
- Arrays are wrapped in `[ ]`
- separates values with `,`
- JSON does not have indexed arrays

JSON arrays in PHP as a string sent to AJAX

```
<?php
echo '["Sunday", "Monday", "Tuesday", "Wednesday",
       "Thursday", "Friday", "Saturday"]';
?>
```

```
ajax.onreadystatechange = function() {
  if (ajax.readyState == 4 && ajax.status == 200) {
    var array = JSON.parse(ajax.responseText);
    for(index = 0; index < array.length; index++) {
       document.write(array[index] + '<br>');
    }
  }
}
```



```
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
```

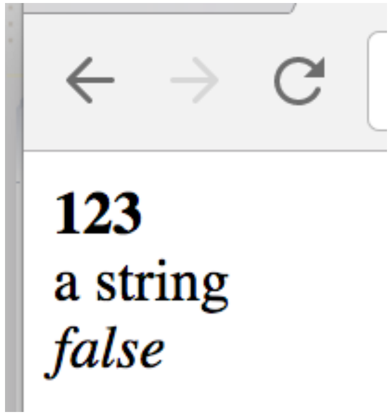
json_encode

- When exchanging data between a browser and a server, the data can only be echoed as text, JSON for example. We will use json_encode

```
<?php
  $array = [123, 'a string', true && false];
  echo json_encode($array);
?>
```

- We convert any JSON received from the server into JS objects

```
 ajax.onreadystatechange = function() {
   if (ajax.readyState == 4 && ajax.status == 200) {
      var array = JSON.parse(ajax.responseText);
      document.write('<b>' + array[0] + '</b>' + '<br>');
      document.write(array[1] + '<br>');
      document.write('<i>' + array[2] + '</i>');
   }
}
```



123
a string
false