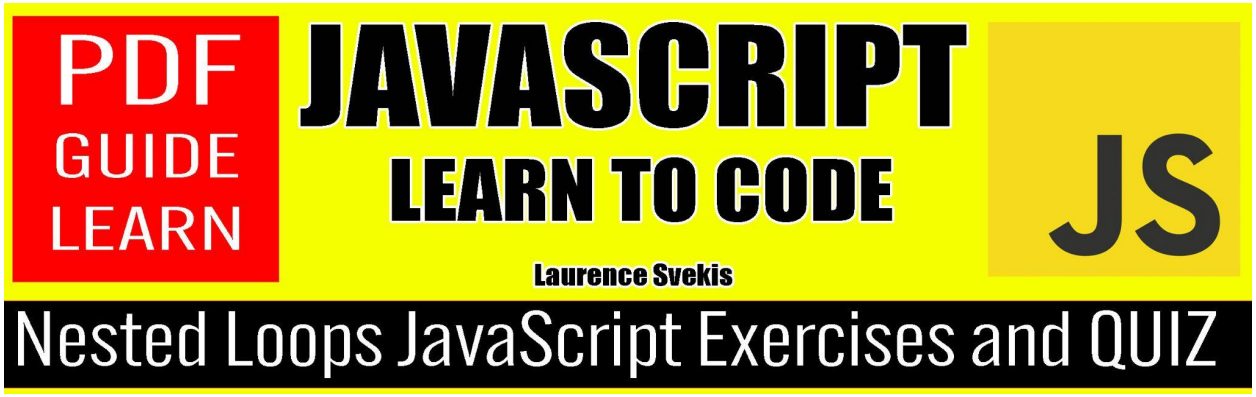
Nested Loops in JavaScript



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Nested Loops in JavaScript

Nested loops are loops within loops, allowing for more complex iterations through data structures like arrays or matrices. This concept is crucial for handling multidimensional data and performing operations on each element.

Structure of Nested Loops:

```
for (let i = 0; i < outerLength; i++) {
    for (let j = 0; j < innerLength; j++) {
        // Code to be executed for each combination of i and j
    }
}
```

Here's a breakdown:

1. The outer loop (controlled by the variable i) runs from its starting point to the specified condition (outerLength).
2. The inner loop (controlled by the variable j) runs completely for each iteration of the outer loop, from its starting point to its condition (innerLength).
3. The inner loop completes its full cycle for each iteration of the outer loop.

Example 1: Multiplication Table

```
// Displaying a multiplication table for numbers 1 to 5
for (let i = 1; i <= 5; i++) {
    for (let j = 1; j <= 10; j++) {
        console.log(`${i} * ${j} = ${i * j}`);
    }
    console.log('\n'); // Adding a newline for better readability
}
```

Example 2: 2D Array Iteration

```
// Iterating through a 2D array
const matrix = [
    [1, 2, 3],
    [4, 5, 6],
    [7, 8, 9]
```

```
];

for (let i = 0; i < matrix.length; i++) {
    for (let j = 0; j < matrix[i].length; j++) {
        console.log(matrix[i][j]);
    }
}
```

Key Points:

Ensure clear understanding of the loop conditions to avoid infinite loops.

Nested loops can be extended to more than two levels based on the complexity of the task.

Be mindful of performance considerations, especially with deeply nested loops.

Nested loops are a powerful tool, enabling you to solve a wide range of problems efficiently. Practice and experimentation are key to mastering this concept!

Coding exercises involving nested loops

Exercise 1: Print a Square

Description: Write a function to print a square pattern of asterisks.

Steps:

1. Define a function printSquare that takes a parameter for the side length.
2. Use nested loops to print a square pattern.

Code Example:

```
function printSquare(sideLength) {
    for (let i = 0; i < sideLength; i++) {
        let row = '';
        for (let j = 0; j < sideLength; j++) {
            row += '* ';
        }
        console.log(row);
    }
}

printSquare(5);
```

Solution:

```
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
```

Exercise 2: Print a Right Triangle

Description: Write a function to print a right triangle pattern of asterisks.

Steps:

1. Define a function printRightTriangle that takes a parameter for the triangle's height.
2. Use nested loops to print a right triangle pattern.

Code Example:

```
function printRightTriangle(height) {
    for (let i = 0; i < height; i++) {
        let row = '';
        for (let j = 0; j <= i; j++) {
            row += '* ';
        }
        console.log(row);
    }
}
```

printRightTriangle(5);

Solution:

```
*
* *
* * *
* * * *
* * * * *
```

Exercise 3: Print an Upside-Down Right Triangle

Description: Write a function to print an upside-down right triangle pattern of asterisks.

Steps:

1. Define a function printUpsideDownTriangle that takes a parameter for the triangle's height.
2. Use nested loops to print an upside-down right triangle pattern.

Code Example:

```
function printUpsideDownTriangle(height) {
    for (let i = height; i > 0; i--) {
        let row = '';
        for (let j = 0; j < i; j++) {
            row += '* ';
```

```
        }
        console.log(row);
    }
}

printUpsideDownTriangle(5);
```

Solution:

```
* * * * *
* * * *
* * *
* *
*
```

Exercise 4: Print a Hollow Square

Description: Write a function to print a hollow square pattern of asterisks.

Steps:

1. Define a function printHollowSquare that takes a parameter for the side length.
2. Use nested loops to print a hollow square pattern.

Code Example:

```
function printHollowSquare(sideLength) {
    for (let i = 0; i < sideLength; i++) {
```

```
        let row = '';
        for (let j = 0; j < sideLength; j++) {
            if (i === 0 || i === sideLength - 1 || j === 0 || j === 
sideLength - 1) {
                row += '* ';
            } else {
                row += '  ';
            }
        }
        console.log(row);
    }
}

printHollowSquare(5);
```

Solution:

```
* * * * *
*     *
*     *
*     *
* * * * *
```

Exercise 5: Print a Number Triangle

Description: Write a function to print a number triangle pattern.

Steps:

1. Define a function printNumberTriangle that takes a parameter for the triangle's height.
2. Use nested loops to print a number triangle pattern.

Code Example:

```
function printNumberTriangle(height) {
    let number = 1;
    for (let i = 0; i < height; i++) {
        let row = '';
        for (let j = 0; j <= i; j++) {
            row += number++ + ' ';
        }
        console.log(row);
    }
}

printNumberTriangle(4);
```

Solution:

```
1
2 3
4 5 6
7 8 9 10
```

Exercise 6: Print a Diamond

Description: Write a function to print a diamond pattern of asterisks.

Steps:

1. Define a function printDiamond that takes a parameter for the diamond's height.
2. Use nested loops to print a diamond pattern.

Code Example:

```
function printDiamond(height) {
    for (let i = 0; i < height; i++) {
        let row = '';
        for (let j = 0; j < height - i; j++) {
            row += ' ';
        }
        for (let k = 0; k <= i * 2; k++) {
            row += '*';
        }
        console.log(row);
    }
    for (let i = height - 2; i >= 0; i--) {
        let row = '';
        for (let j = 0; j < height - i; j++) {
```

```
            row += ' ';
        }
        for (let k = 0; k <= i * 2; k++) {
            row += '*';
        }
        console.log(row);
    }
}

printDiamond(5);
```

Solution:

```
    *
   ***
  *****
 *******
*********
 *******
  *****
   ***
    *
```

Exercise 7: Print Pascal's Triangle

Description: Write a function to print Pascal's Triangle.

Steps:

1. Define a function printPascalsTriangle that takes a parameter for the number of rows.
2. Use nested loops to calculate and print Pascal's Triangle.

Code Example:

```
function printPascalsTriangle(rows) {
    for (let i = 0; i < rows; i++) {
        let row = '';
        let coefficient = 1;
        for (let j = 0; j <= i; j++) {
            row += coefficient + ' ';
            coefficient = coefficient * (i - j) / (j + 1);
        }
        console.log(row);
    }
}

printPascalsTriangle(5);
```

Solution:

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

1 4 6 4 1

Exercise 8: Print Hollow Pyramid

Description: Write a function to print a hollow pyramid pattern of asterisks.

Steps:

1. Define a function printHollowPyramid that takes a parameter for the pyramid's height.
2. Use nested loops to print a hollow pyramid pattern.

Code Example:

```
function printHollowPyramid(height) {
    for (let i = 0; i < height; i++) {
        let row = '';
        for (let j = 0; j < height - i; j++) {
            row += ' ';
        }
        for (let k = 0; k <= i * 2; k++) {
            if (k === 0 || k === i * 2 || i === height - 1) {
                row += '*';
            } else {
                row += ' ';
            }
        }
```

```
        console.log(row);
    }
}

printHollowPyramid(5);
```

Solution:

```
    *
   * *
  *   *
 *     *
*********
```

Exercise 9: Print Half Pyramid Using Numbers

Description: Write a function to print a half pyramid pattern using numbers.

Steps:

1. Define a function printHalfPyramidNumbers that takes a parameter for the pyramid's height.
2. Use nested loops to print a half pyramid pattern using numbers.

Code Example:

```
function printHalfPyramidNumbers(height) {
    for (let i = 1; i <= height; i++) {
        let row = '';
        for (let j = 1; j <= i; j++) {
            row += j + ' ';
        }
        console.log(row);
    }
}

printHalfPyramidNumbers(4);
```

Solution:

```
1
1 2
1 2 3
1 2 3 4
```

Exercise 10: Print Inverted Half Pyramid

Description: Write a function to print an inverted half pyramid pattern of asterisks.

Steps:

1. Define a function printInvertedHalfPyramid that takes a parameter for the pyramid's height.
2. Use nested loops to print an inverted half pyramid pattern.

Code Example:

```
function printInvertedHalfPyramid(height) {
    for (let i = height; i >= 1; i--) {
        let row = '';
        for (let j = 1; j <= i; j++) {
            row += '* ';
        }
        console.log(row);
    }
}

printInvertedHalfPyramid(5);
```

Solution:

```
* * * * *
* * * *
* * *
* *
*
```

JavaScript Quiz Questions

1. **Question: What is a nested loop in JavaScript?**
   a. A) A loop with a complex condition
   b. B) A loop inside another loop
   c. C) A loop with no conditions
2. **Question: Why would you use nested loops in JavaScript?**
   a. A) To simplify code
   b. B) To make the code more readable
   c. C) To handle multidimensional data and perform operations on each element
3. **Question: How is the structure of nested loops in JavaScript?**
   a. A) Single loop with multiple conditions
   b. B) Multiple loops written sequentially
   c. C) A loop inside another loop
4. **Question: What is the role of the outer loop in nested loops?**
   a. A) It runs completely for each iteration of the inner loop
   b. B) It handles conditions for both loops
   c. C) It runs independently of the inner loop
5. **Question: How is a square pattern of asterisks printed using nested loops?**
   a. A) Using a single loop
   b. B) Using an inner loop for rows and another for columns

c. C) Using separate loops for each row and column

6. **Question: Which loop is used to iterate through rows in a nested loop?**

a. A) Outer loop
b. B) Inner loop
c. C) Both loops together

7. **Question: How do you print a right triangle pattern of asterisks using nested loops?**

a. **A) Using a single loop**
b. B) Using an inner loop for rows and another for columns
c. C) Using separate loops for each row and column

8. **Question: What is the output of a right triangle pattern with a height of 4?**

a. A) `****`
b. B) `*`
c. C) `*`

9. **Question: How do you print an upside-down right triangle pattern of asterisks?**

a. A) Using a single loop
b. B) Using an inner loop for rows and another for columns
c. C) Using separate loops for each row and column

10. Question: What is the output of an upside-down right triangle pattern with a height of 3?

a. A) ***
b. B) *
c. C) * * *

11. Question: How do you print a hollow square pattern of asterisks using nested loops?

a. A) Using a single loop
b. B) Using an inner loop for rows and another for columns
c. C) Using separate loops for each row and column

12. Question: What is the output of a hollow square pattern with a side length of 5?

a. A) *****
b. B) * *
c. C) * * *

13. Question: How do you print a number triangle pattern using nested loops?

a. A) Using a single loop
b. B) Using an inner loop for rows and another for columns
c. C) Using separate loops for each row and column

14. Question: What is the output of a number triangle pattern with a height of 3?

a. A) `1`
b. B) `1 2 3`
c. C) `1 2 3 4`

15. Question: How do you print a diamond pattern of asterisks using nested loops?

a. A) Using a single loop
b. B) Using an inner loop for rows and another for columns
c. C) Using separate loops for each row and column

16. Question: What is the output of a diamond pattern with a height of 5?

a. A) See code example in previous response.
b. B) `*`
c. C) `***`

17. Question: How do you print Pascal's Triangle using nested loops?

a. A) Using a single loop
b. B) Using an inner loop for rows and another for columns
c. C) Using separate loops for each row and column

18. Question: What is the output of Pascal's Triangle with 4 rows?

a. A) See code example in previous response.

b. B) `1 2 1`

c. C) `1 1 1`

19. Question: How do you print a hollow pyramid pattern of asterisks using nested loops?

a. A) Using a single loop

b. B) Using an inner loop for rows and another for columns

c. C) Using separate loops for each row and column

20. Question: What is the output of a hollow pyramid pattern with a height of 4?

a. A) See code example in previous response.

b. B) `*`

c. C) `***`

21. Question: How do you print a half pyramid pattern using numbers?

a. A) Using a single loop

b. B) Using an inner loop for rows and another for columns

c. C) Using separate loops for each row and column

22. Question: What is the output of a half pyramid pattern using numbers with a height of 4?

a. A) See code example in previous response.

b. B) `1`

c. C) `1 2`

23. Question: How do you print an inverted half pyramid pattern of asterisks using nested loops?

a. A) Using a single loop

b. B) Using an inner loop for rows and another for columns

c. C) Using separate loops for each row and column

24. Question: What is the output of an inverted half pyramid pattern with a height of 3?

a. A) See code example in previous response.

b. B) `***`

c. C) `*`

25. Question: How can nested loops be extended to more than two levels?

a. A) Not possible

b. B) By using additional conditions in a single loop

c. C) By adding more loops inside existing loops

26. Question: What should you be mindful of when using nested loops?

a. A) Performance considerations
b. B) Code readability only
c. C) Number of iterations

27. Question: In a nested loop, how is an outer loop related to the inner loop?

a. A) They are independent
b. B) The inner loop is optional
c. C) The outer loop controls the number of iterations for the inner loop

28. Question: What is the role of the inner loop in a nested loop?

a. A) It runs completely for each iteration of the outer loop
b. B) It handles conditions for both loops
c. C) It runs independently of the outer loop

29. Question: How do you handle conditions for nested loops in JavaScript?

a. A) Using only the outer loop
b. B) Using only the inner loop
c. C) Using both the outer and inner loops

30. Question: How do you print a hollow rectangle pattern of asterisks using nested loops?

a. A) Using a single loop

b. B) Using an inner loop for rows and another for columns

c. C) Using separate loops for each row and column

Answers:

1. B) A loop inside another loop
2. C) To handle multidimensional data and perform operations on each element
3. C) A loop inside another loop
4. A) It runs completely for each iteration of the inner loop
5. B) Using an inner loop for rows and another for columns
6. A) Outer loop
7. B) Using an inner loop for rows and another for columns
8. C) `*`
9. B) Using an inner loop for rows and another for columns
10. C) `* * *`
11. B) Using an inner loop for rows and another for columns
12. B) `* *`
13. B) Using an inner loop for rows and another for columns
14. C) `1 2 3 4`
15. B) Using an inner loop for rows and another for columns
16. A) See code example in previous response.
17. C) Using separate loops for each row and column
18. B) `1 2 1`
19. C) `***`
20. A) See code example in previous response.
21. B) Using an inner loop for rows and another for columns
22. C) `1 2 3`
23. B) Using an inner loop for rows and another for columns

24. A) See code example in previous response.
25. C) By adding more loops inside existing loops
26. A) Performance considerations
27. C) The outer loop controls the number of iterations for the inner loop
28. A) It runs completely for each iteration of the outer loop
29. C) Using both the outer and inner loops
30. B) Using an inner loop for rows and another for columns