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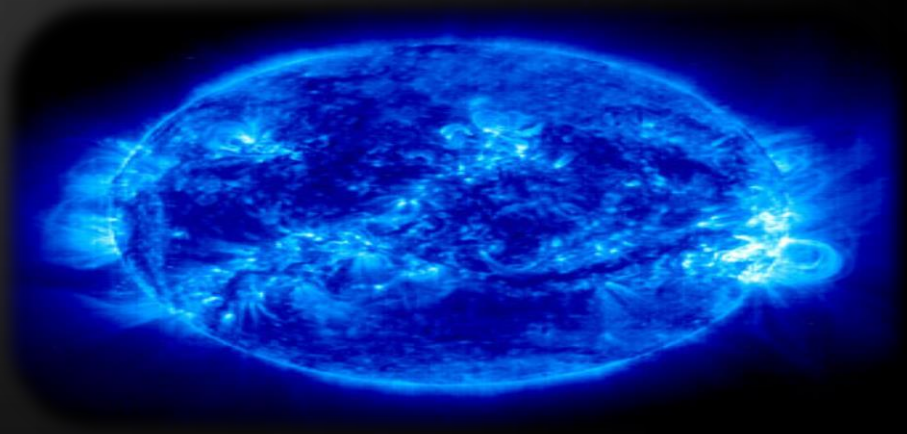
Operators and Expressions

Performing Simple Calculations with JavaScript



JavaScript Fundamentals

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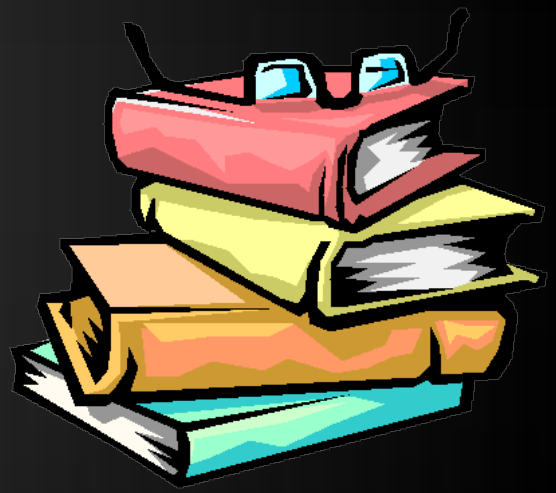

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Operators in JavaScript

Arithmetic, Logical, Comparison, Assignment, Etc.

What is an Operator?

- Operator is an operation performed over data at runtime
  - Takes one or more arguments (operands)
  - Produces a new value
- Operators have precedence
  - Precedence defines which will be evaluated first
- Expressions are sequences of operators and operands that are evaluated to a single value

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Operators in JavaScript

- Operators in JavaScript :
  - Unary – take one operand
  - Binary – take two operands
  - Ternary (? :) – takes three operands
- Except for the assignment operators, all binary operators are left-associative
- The assignment operators and the conditional operator (? :) are right-associative

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Categories of Operators in JS

Category	Operators
Arithmetic	+ - * / % ++ --
Logical	&& || ^ !
Binary	& | ^ ~ << >>
Comparison	== != < > <= >= === !==
Assignment	= += -= *= /= %= &= |= ^= <<= >>=
String concatenation	+
Other	. [] () ?: new

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Arithmetic Operators

Arithmetic Operators

- Arithmetic operators +, -, *, / are the same as in math
- Division operator / returns number or `Infinity` or `NaN`
- Remainder operator % returns the remainder from division of numbers
  - Even on real (floating-point) numbers
- The special addition operator ++ increments a variable

Arithmetic Operators – Example

```
var squarePerimeter = 17;
var squareSide = squarePerimeter / 4.25;
var squareArea = squareSide * squareSide;
console.log(squareSide); // 4.25
console.log(squareArea); // 18.0625

var a = 5;
var b = 4;
console.log( a + b ); // 9
console.log( a + b++ ); // 9
console.log( a + b ); // 10
console.log( a + (++b) ); // 11
console.log( a + b ); // 11


console.log(12 / 3); // 4
console.log(11 / 3); // 3.6666666666666665
```

Arithmetic Operators – Example (2)

```
console.log(11 % 3);   // 2
console.log(11 % -3);  // 2
console.log(-11 % 3);  // -2

console.log(1.5 / 0.0);  // Infinity
console.log(-1.5 / 0.0); // -Infinity
console.log(0.0 / 0.0);  // NaN

var x = 0;
console.log(5 / x);
```

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Arithmetic Operators

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Logical Operators

Logical Operators

- Logical operators take boolean operands and return boolean result
- Operator `!` turns `true` to `false` and `false` to `true`
- Behavior of the operators `&&`, `||` and `^` (`1 == true`, `0 == false`):

Operation	||	||	||	||	&&	&&	&&	&&	^	^	^	^
Operand1	0	0	1	1	0	0	1	1	0	0	1	1
Operand2	0	1	0	1	0	1	0	1	0	1	0	1
Result	0	1	1	1	0	0	0	1	0	1	1	0

Logical Operators – Example

- Using the logical operators:

```
var a = true;
var b = false;
console.log(a && b); // False
console.log(a || b); // True
console.log(a ^ b); // True
console.log(!b); // True
console.log(b || true); // True
console.log(b && true); // False
console.log(a || true); // True
console.log(a && true); // True
console.log(!a); // False
console.log((5>7) ^ (a==b)); // False
```

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Logical Operators

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Bitwise Operators

Bitwise Operators

- Bitwise operator ~ turns all 0 to 1 and all 1 to 0
  - Like ! for boolean expressions but bit by bit
- The operators |, & and ^ behave like ||, && and ^ for boolean expressions but bit by bit
- The << and >> move the bits (left or right)
- Behavior of the operators |, & and ^:

Operation	|	|	|	|	&	&	&	&	^	^	^	^
Operand1	0	0	1	1	0	0	1	1	0	0	1	1
Operand2	0	1	0	1	0	1	0	1	0	1	0	1
Result	0	1	1	1	0	0	0	1	0	1	1	0

Bitwise Operators (2)

- Bitwise operators are used on integer numbers
- Bitwise operators are applied bit by bit
- Examples:

```
var a = 3;                    // 00000000 00000011
var b = 5;                    // 00000000 00000101
console.log( a | b);          // 00000000 00000111
console.log( a & b);          // 00000000 00000001
console.log( a ^ b);          // 00000000 00000110
console.log(~a & b);          // 00000000 00000100
console.log( true << 1);      // 00000000 00000010
console.log( true >> 1);      // 00000000 00000000
```

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Bitwise Operators

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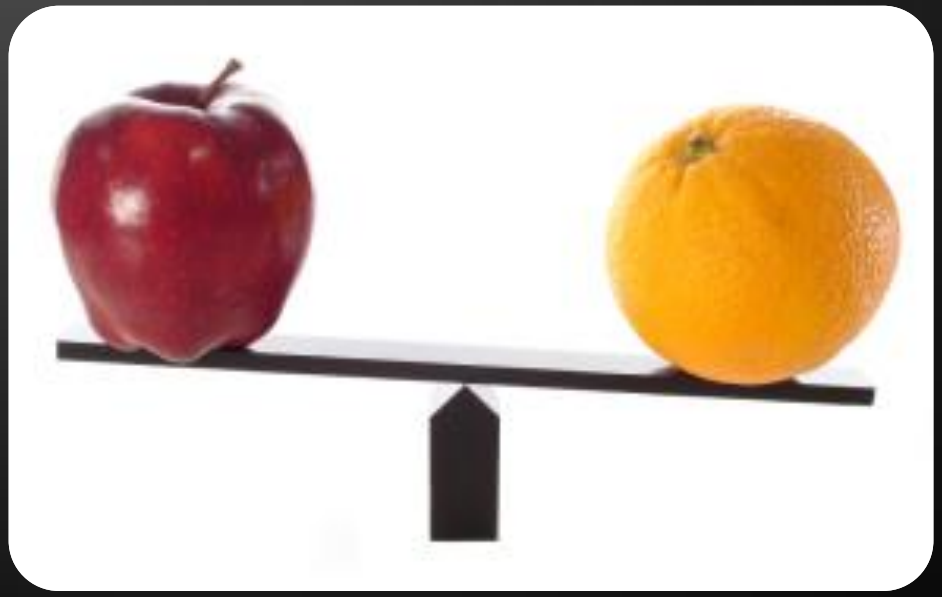
Comparison and Assignment Operators

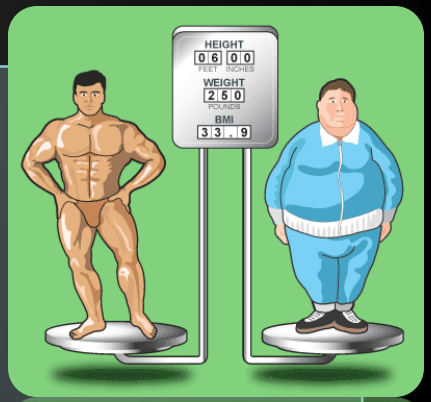


Comparison Operators

- Comparison operators are used to compare variables
  - ==, <, >, >=, <=, !=, ===, !==
- Comparison operators example:

```
var a = 5;
var b = 4;
console.log(a >= b); // True
console.log(a != b); // True
console.log(a == b); // False

console.log(0 == ""); // True
console.log(0 === ""); //False
```



Assignment Operators

- Assignment operators are used to assign a value to a variable
  - =, +=, -=, |=, …
- Assignment operators example:

```
var x = 6;
var y = 4;
console.log(y *= 2); // 8
var z = y = 3; // y=3 and z=3
console.log(z); // 3
console.log(x |= 1); // 7
console.log(x += 3); // 10
console.log(x /= 2); // 5
```

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Comparison and Assignment Operators

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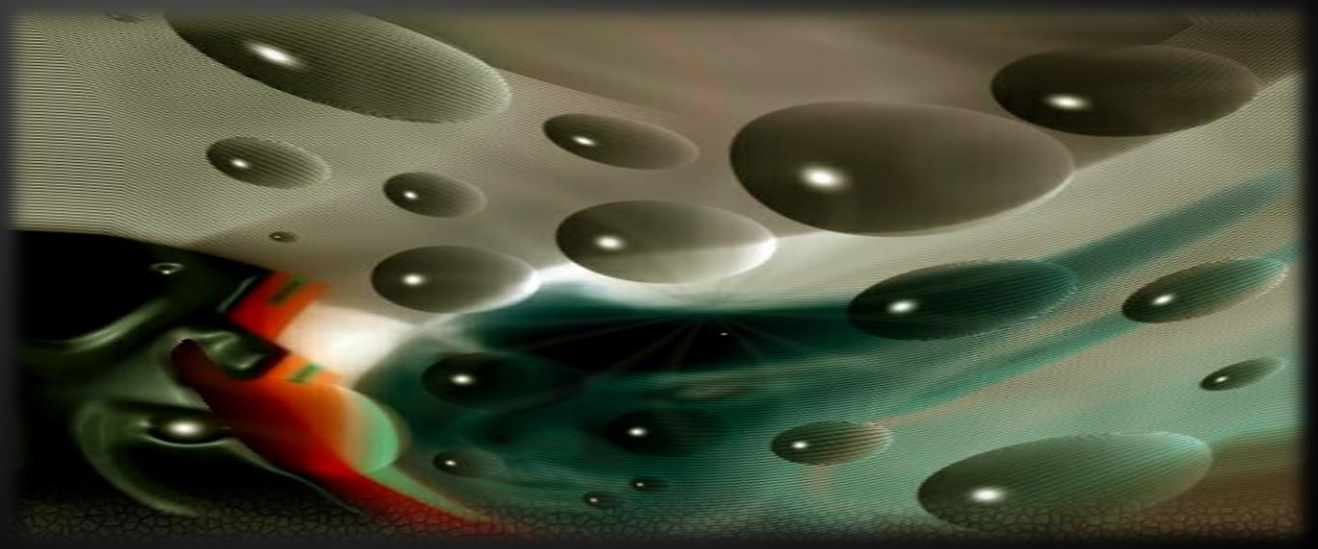
Other Operators



Other Operators

- String concatenation operator + is used to concatenate strings
- If the second operand is not a string, it is converted to string automatically

```
var first = "First";
var second = "Second";
console.log(first + second);
// FirstSecond
var output = "The number is : ";
var number = 5;
console.log(output + number);
// The number is : 5
```

Other Operators (2)

- Member access operator . is used to access object members
- Square brackets [ ] are used with arrays indexers and attributes
- Parentheses ( ) are used to override the default operator precedence

Other Operators (3)

- Conditional operator `? :` has the form

```
b ? x : y
```

(if b is true then the result is x else the result is y)

- The `new` operator is used to create new objects
- The `typeof` operator returns the type of the object
- `this` operator references the current context
  - In JavaScript the value this depends on the current scope

Other Operators – Example

- Using some other operators:

```
var a = 6;
var b = 4;
console.log(a > b ? 'a>b' : 'b>=a'); // a>b

var c = b = 3; // b=3; followed by c=3;
console.log(c); // 3
console.log(a is int); // True
console.log((a+b)/2); // 4
console.log(typeof(int)); // System.Int32
```

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Other Operators

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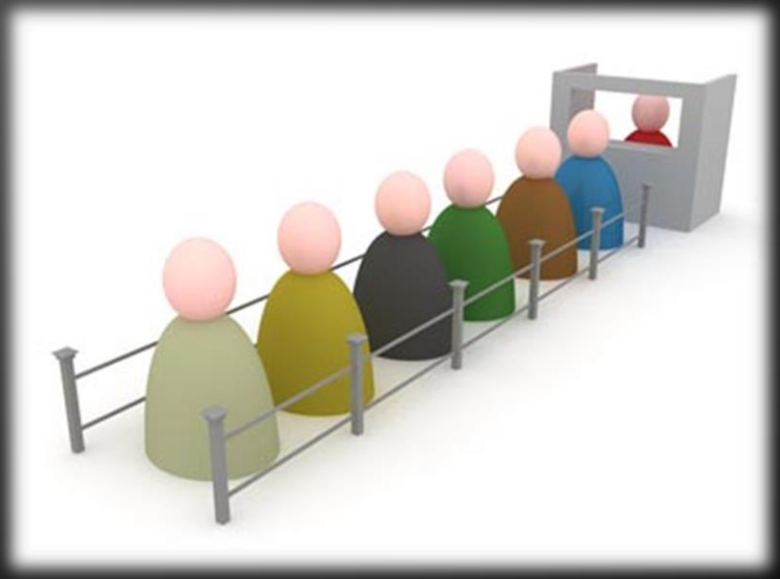
Operators Precedence



Operators Precedence

Precedence	Operators
Highest	`()`
	`++ --` (postfix) `new typeof`
	`++ --` (prefix) `+ -` (unary) `! ~`
	`* / %`
	`+ -`
	`<< >>`
	`< > <= >= is as`
	`== !=`
	`&`
Lower	`^`

Operators Precedence (2)

Precedence	Operators
Higher	|
	&&
	||
	?:
Lowest	= *= /= %= += -= <<= >>= &= ^= |=

- Parenthesis operator always has highest precedence
- Note: prefer using parentheses, even when it seems stupid to do so

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Expressions

Expressions

- Expressions are sequences of operators, literals and variables that are evaluated to some value
- Examples:

```
var r = (150-20) / 2 + 5; // r=70

// Expression for calculation of circle area
var surface = Math.PI * r * r;

// Expression for calculation of circle perimeter
var perimeter = 2 * Math.PI * r;
```

Expressions (2)

- Expressions has:
  - Type (integer, real, boolean, …)
  - Value
- Examples:

Expression of type Number.
Calculated at compile time.

```
var a = 2 + 3; // a = 5
var b = (a+3) * (a-4) + (2*a + 7) / 4;  // b = 12
var greater = (a > b) || ((a == 0) && (b == 0));
```

Expression of type boolean.
Calculated at runtime.

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Expressions

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