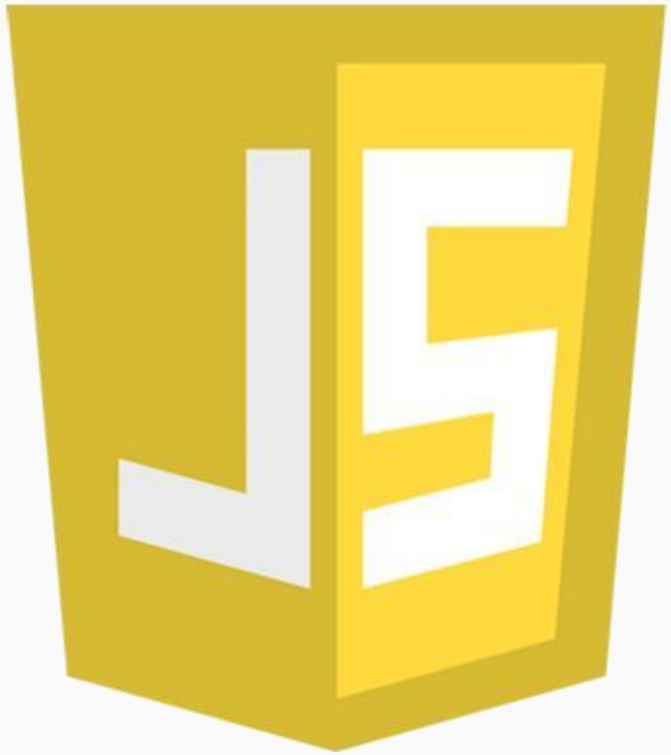


JavaScript

Book we will follow

Online Exercises

Below link provide you online exercises

http://asmarterwaytolearn.com/js/index-of-exercises.html

Installation

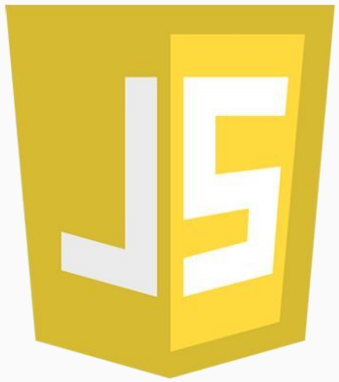
1. To work with JavaScript you don’t need any software
2. You just need to have Browser installed on your machine and you can use any text editor to write code.
3. To manage projects and organize files we use IDE
4. We will use Microsoft’s Visual Studio Code
5. To run JavaScript on server side we will use Node.js

Installation

1. Download and install Visual Studio code
    a. https://code.visualstudio.com

2. Download install Node.js
    a. https://nodejs.org/en/

3. Use default setting while installing both tools



Demo
How to use Visual Studio Code

Initial Code and Setup

1. Open Visual Studio code and create two files
    a. index.html
    b. Index.js

index.html file

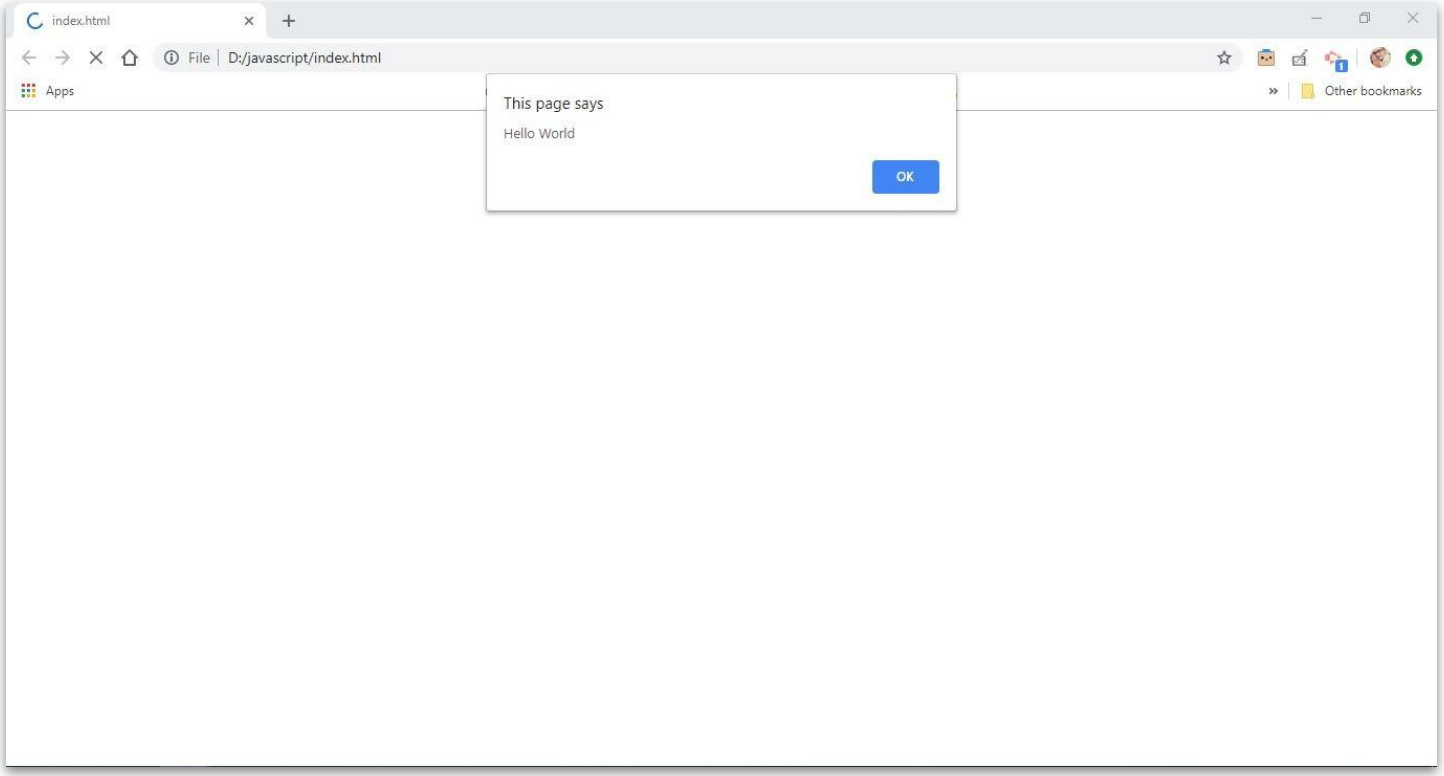
```
<html>
    <head>
        <script src="./index.js"></script>
    </head>
    <body>
        Hello World
    </body>
</html>
```

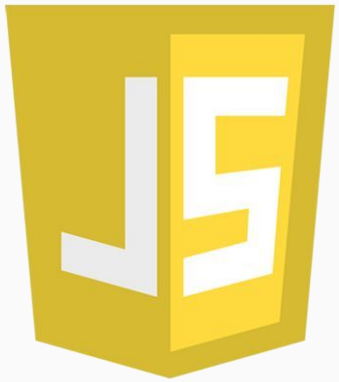
index.js file

```
alert("Hello World");
```

Initial Code and Setup

1. Open file in browser and you will see alert in browser window





Demo
Create First JavaScript Example

Alerts

1. An alert is a box that pops up to give the user a message.
2. Here's code for an alert that displays the message "Thanks for your input!"

```
alert("Hello World");
```

3. alert is a keyword
4. The quoted text "Thanks for your input!" is called a text string or simply a string.

Alerts

1. ‘window.alert’ and ‘alert’ are the same
2. window is object in browser which contains many other objects and properties, and alert is one of them.
3. alert is a function that take any input and display it in popup to user
4. Alerts are not available when you are working with server side JavaScript in Node.js

Console.log

1. console.log is function that write message on console/terminal
2. Objective of console.log is to create logs for debugging
3. Instead of displaying text to user it shows output in browser’s developer tool
4. Also when working with server side javascript, we can use console.log for logging and output will be in terminal

Console.log

```
console.log("Hello World");
console.log(2+8);
```

document.write

1. For testing purpose you can use document.write to display message or text in browser window

```
document.write("Hello Word");   document.write(2+8);
```

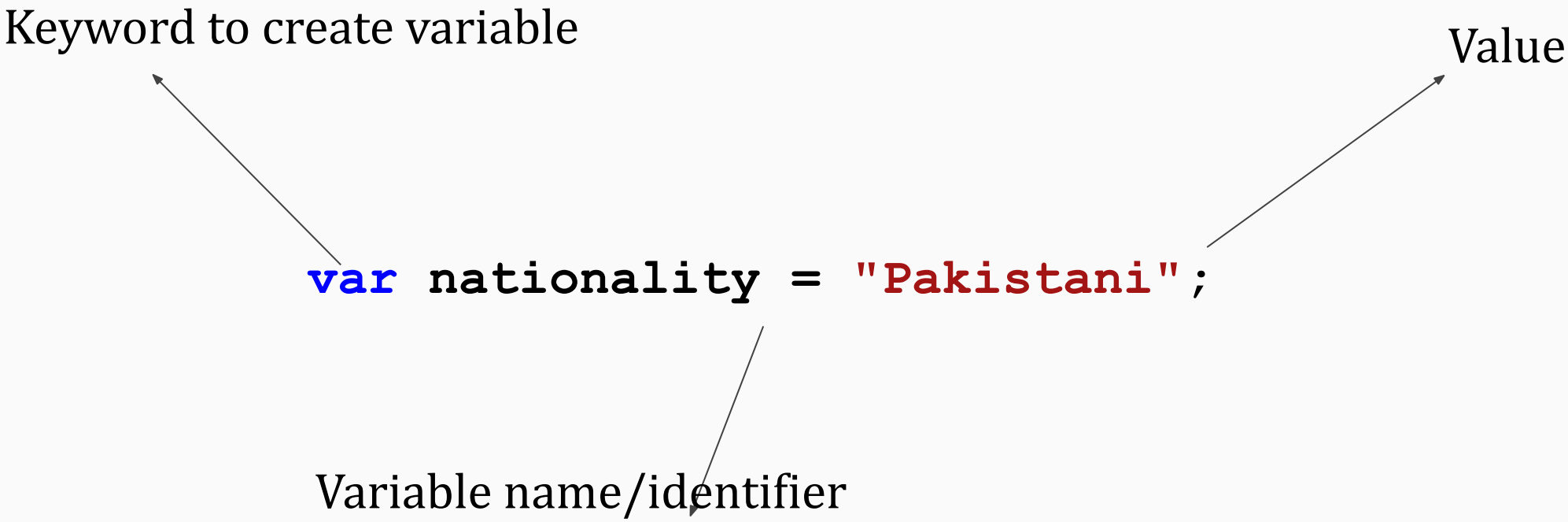
This will be displayed in browser window

Variables

Variables

1. Variables are containers for storing data values.
2. Variables are used to store information to be referenced and manipulated in a computer program
3. Variable is a term that refers to a particular value
4. A variable changes over time or based on user input.
5. A variable is assigned a value in one place and then used repetitively.

Variables


Keyword to create variable
Value
var nationality = "Pakistani";
Variable name/identifier

Variables

```
var  nationality = "Pakistani";

var  age = 25;

var  isFeePaid = true;

var  weight = 60.55;
```

Declaration and Initialization

1. You can declare and initialize in single line or you can do that in two line

```
var   age   =   25;   OR
var   age;        --  Declaration

age   = 25;       --  Initialization
```

Only declaration will leave variable *undefined*

Data Types

Data Types

1. Variables contains data
2. Each data has type, that’s why we call it data type
3. Variables can hold numbers like 100 and text values like "John Doe"
4. In programming, text values are called text strings.

Data Types

1. Six types are considered to be primitives.
    a. Number -- integers, floats etc
    b. String -- an array of characters
    c. Boolean -- true or false
    d. Null -- No Value
    e. Undefined -- a declared variable but hasn’t been given a value
    f. Symbol -- a unique value that's not equal to any other value

Data Types

1. Complex Types
    a. Objects
    b. Functions

Function is callable object that executes a block of code, it lies under the object type

Variable for String

1. To store text in variable we use string

```
var name = "Mark";   name = "John";
```

String - Single quotes and double quotes

1. Text strings are always enclosed in quotes
2. You can use single or double quotes

```
var name = "Mark";
var nationality = 'US';
var message = "What is your father's number";
```

Variable for Numbers

1. To store whole numbers or decimal values we use number data type

```
var age = 25;
var weight = 150.5;
var newWeight = weight + 20;  var originalNumber =
   12 + 5;
```

Variable for Boolean

1. To store true/false boolean data type

```
var isFeePaid = true;  var examPassed
= false;
```

Undefined

1. The undefined data type can only have one value-the special value *undefined*
2. If a variable has been declared, but has not been assigned a value, has the value undefined

```
var name;  var age;
```

Undefined

1. You can be empty a variable by setting the value to undefined. The type will also be undefined

```
var name = "Mark";   name = undefined;
```

2. Now this variable contains no value, and it will cause error if we try to apply some operation on it

Null

1. This is another special data type that can have only one value-the null value.
2. A null value means that there is no value.
3. It is not equivalent to an empty string ("") or 0, it is simply nothing

```
var name = null;
var nationality = "Mark";  nationality = null;
```

Difference between null and undefined

1. undefined means a variable has been declared but has not yet been assigned a value.
2. null is an assignment value. It can be assigned to a variable as a representation of no value
3. undefined and null are two distinct types: undefined is a type itself (undefined) while null is an object.
4. Unassigned variables are initialized by JavaScript with a default value of undefined. JavaScript never sets a value to null. That must be done programmatically.

JavaScript Data Types are Dynamic

1. JavaScript has dynamic types. This means that the same variable can be used to hold different data types
2. You can assign any type of value in variable any time and data type of variable will be changed

```
var name = "Mark";   /   It's String
name = 25;    /   Now changed to Number
name = true; /   Now changed to Boolean
```

typeof Operator

1. You can use the JavaScript typeof operator to find the type of a JavaScript variable.
2. The typeof operator returns the type of a variable or an expression

```
typeof "Hello"// Returns "string"  var a = 45;
```

```
typeof   a;                  //  Returns    "number"
typeof   true;               //  Returns    "boolean"
```

Statement and Expression

Statements

1. A computer program is a list of "instructions" to be "executed" by a computer.
2. In a programming language, these programming instructions are called statements.
3. A JavaScript program is a list of programming statements.
4. A statement can set a variable equal to a value.
5. A statement can also be a function call, i.e. document.write().

Statements

1. Statements define what the script will do and how it will be done.
2. Most JavaScript programs contain many JavaScript statements.
3. The statements are executed, one by one, in the same order as they are written.

Statements

1. Each line below is a statement

```
var   a   =   4;                  //   Statement   1

var   b   =   2;                  //   Statement   2

var   c   =   0;                  //   Statement   3

c =   a   +   b;                  //   Statement   4

alert(a);                         //   Statement   4

console.log(c);                   //   Statement   4
```

End of Statement with semicolon ;

1. To end statement add semicolon at the end of each executable statement
2. Semicolons separate JavaScript statements.

```
var a = 4;
```

3. When separated by semicolons, multiple statements on one line are allowed

```
i = 3; j = 5; k = i + j;  alert(i);console.log(k);
```

End of Statement without semicolon ;

1. Typically we end statements with semicolon but JavaScript semicolon is optional, but is highly recommended to end with semicolon
2. The end of a statement is most often marked by pressing enter and starting a new line.

End of Statement without semicolon ;

```
var a = 5   a * 4                    // New line will end statement
alert(a)
console.log(a)
```

```
var a = 5a * 4                       // Error, Will Not work
alert(a)console.log(a)               // Error, Will not work
```

Expressions

1. An expression is a combination of values, variables, function calls and operators, which computes to a value.
2. The computation is called an evaluation.

```
a + b;                                  // expression
4 / 2                                   // expression
    ;

var a = 5;
a * 4;                                  // expression
"John" + " " + "Doe";                   // expression
```

Comments

Comments

1. Comments are for the human, not the machine.
2. They help you and others understand your code when it comes time to revise, they make code more readable.
3. You can also use commenting to comment out portions of your code for testing and debugging.
4. They will prevent execution of code
5. There are two ways mark text as a comment, single line comments and multi-line comments

Single line comments

1. Single line comments start with //.
2. Any text between / and the end of the line will be ignored (will not be executed).

```
// Declare and initialize variable  var a = 6; //This is comment


//This below code will not execute
//var b = 8;
```

Multi-line comments

1. Multi-line comments start with /* and end with */.
2. Any text between /* and */ will be ignored.

```
/*
This code declared and initialize  variable a and show on
screen
*/
var a = 6;  alert(a);
```

Variable Names

Variable Names Legal and Illegal

1. A variable name can't contain any spaces
2. A variable name can contain only letters, numbers, dollar signs, and underscores.
3. The first character must be a letter, or an underscore (_), or a dollar sign ($).
4. Subsequent characters may be letters, digits, underscores, or dollar signs.
5. Numbers are not allowed as the first character of variable.

Variable Names Legal and Illegal

1. Legal names:

```
var  hello =   56;
var  _xyz =   44;
var  $work =   90;
var  user2 =   56;
var  i_info   = 99;
var  my$work   = 77;
```

Variable Names Legal and Illegal

1. Illegal names:

```
var 2user = 12; // Can't start with number  var my user =
23; // Can't contains space  var hello#world = 34;
var my-info = 44;  var my?info = 45;  var my*info = 45;
```

Reserved Keywords

1. Reserved Keywords cannot be used as variable name
2. Here are few reserved keywords

abstract	arguments	await*	boolean
break	byte	case	catch
char	class*	const	continue
debugger	default	delete	do
double	else	enum*	eval
export*	extends*	false	final
finally	float	for	function
goto	if	implements	import*

abstract	arguments	await*	boolean
break	byte	case	catch
char	class*	const	continue
debugger	default	delete	do
double	else	enum*	eval
export*	extends*	false	final
finally	float	for	function
goto	if	implements	import*
in	instanceof	int	interface
let*	long	native	new
null	package	private	protected
public	return	short	static
super*	switch	synchronized	this
throw	throws	transient	true
try	typeof	var	void
volatile	while	with	yield

Case Sensitive

1. Variable names are case sensitive.
2. So **`rose`** and **`Rose`** are two different variables

```
var   rose   =    "Hello";
var   Rose   =    "Hello";
alert(rose);  alert(Rose);
alert(ROSE); // Error
```

Camel Case

1. If there's more than one word in the variable name, then it is recommended to use camel case
2. A camelCase name begins in lower case. If there's more than one word in the name, each subsequent word gets an initial cap, creating a hump.

Camel Case

```
var userResponse

var userResponseTime
var userResponseTimeLimit  var response
```

This Style of naming a variable is called camel case

Operators

Arithmetic Operators

```
var a = 5;
var b = 3;
var c = a + b;  var d = a - b;  var e = a * b;  var f = a / b;  var g = a % b;  var h = a ** b;
```

```
// Addition, result 8
// Subtraction, result 2
// Multiplication, result 15
// Division, result 1.66
// Modulus, result 2
// Exponentiation, result 125
```

Assignment Operators

1. Assignment operator assign value to variables
2. When you need to apply arithmetic operation and assign value to same variable then you can also use them

```
var   a  =  5;  //  equals    =  is  assignment operator
a =   a  +  2;  //  Assign    7  in  variable a
OR
```

```
var   a  =  5;
a+=2;           //  Assign    7  in  variable    a
```

Assignment Operators

Example	Same as
`a += 5;`	`a = a + 5;`
`a -= 5;`	`a = a - 5;`
`a *= 5;`	`a = a * 5;`
`a /= 5;`	`a = a / 5;`
`a %= 5;`	`a = a % 5;`
`a **= 5;`	`a = a ** 5;`

Eliminating ambiguity -- BODMAS

1. Complex arithmetic expressions can pose a problem when there are multiple operators in single expression

```
var a = 5 + 2 * 3 - 2 / 2; // result 10
```

2. The evaluation of above expression is depends on BODMAS rule
3.

Eliminating ambiguity -- BODMAS

B	Brackets first
O	Orders (i.e. Powers and Square Roots, etc.) Division and
DM	Multiplication (left-to-right) Addition and Subtraction
AS	(left-to-right)

Eliminating ambiguity -- BODMAS

```
var a = 5 + 2 * (3 - 2) / 2; // result 6
```

1. 3 - 2 with brackets will be evaluated first, result 1
2. 2 * result of (3 - 2) so 2 * 1, result 2
3. Result of 2 * (3 -2) divide by 2 so 2 / 2, result 1
4. 5 + result of 2 * (3 - 2) / 2, so 5 + 1, result 6

Eliminating ambiguity -- BODMAS

```
var  a  =  3  +  5  * 2;                              //  result  13

var  b  =  8  /  2  - 1;                              //  result  3

var  c  =  3  %  2  + 4    - 1;                       //  result  4

var  d   =  a  +  5  * c    - b  /  (3  +    b);//  result  32.5
```

Operator Precedence -- Few of them

Precedence	Operator	Associativity
1	`. []`	left-to-right
	`new`	right-to-left
2	`()`	left-to-right
3	`++ --`	not applicable
4	`! ~` – (negation) + (unary plus) `typeof void delete`	right-to-left
5	`* / %`	left-to-right
6	`+ -`	left-to-right
7	`== != === !==`	left-to-right
8	`&&`	left-to-right
9	`||`	left-to-right
10	`?:`	right-to-left
11	`= += -= *= /= %= &= |= ^=`	right-to-left
12	`,`	left-to-right

Increment and Decrement Operator

1. While working on application you will frequently required to increase variable by 1 or decrease variable by 1
2. For this situation you can use increment and decrement operator
3. ++ increment operator
4. -- decrement operator
5. These operators can be used as prefix and postfix

Increment and Decrement Operator

1. We can increase or decrease value using existing addition and subtraction operators

```
var   a  =  12;
a =   a  +  1;          //   13
a =   a  -  1;          //   12
var   b  =  12;
b +=    1;                //  13
b -=    1;                //  13
```

Increment and Decrement Operator

Prefix Increment and Decrement

```
var age =  12;


 ++age;

 alert(age);        //Result    13

 --age;

 alert(age);        //Result    12
```

Increment and Decrement Operator

Postfix Increment and Decrement

```
var age =  12;


 age++;
 alert(age);       //Result   13,  same   as  prefix
 age--;
 alert(age);       //Result   12,  same   as  postfix
```

Increment and Decrement Operator

1. What is the difference between Prefix and Postfix
2. You will NOT find any difference if you will not assign result of prefix and postfix to any other variable
3. Prefix operator first increase/decrease the value in variable and then assign result to other variable
4. Postfix operator first assign the value in other value then increase/decrease value in actual variable

Increment and Decrement Operator

Prefix Increment

```
var age =  12;
var newAge = ++age;


alert(age);                 //Result  13
alert(newAge);              //Result  13
```

Increment and Decrement Operator

Postfix Increment

```
var age =  12;
var newAge = age++;

alert(age);                 //Result 13
alert(newAge);              //Result 12 , see the difference
```

Increment and Decrement Operator

Prefix Decrement

```
var age =  12;
var newAge = --age;


alert(age);                 //Result  11
alert(newAge);              //Result  11
```

Increment and Decrement Operator

Postfix Decrement

```
var age =  12;
var newAge = age--;

alert(age);                 //Result 11
alert(newAge);              //Result 12 , see the difference
```

Increment and Decrement Operator

Example 1

```
var   a  =  4;
var   b  =  2;

var   c  =  a++ - b;     // first value      of a placed     here
which is 4 then increase 1 in a so will become 5

alert(a);                // 5

alert(b);                // 2

alert(c);                // 2
```

Increment and Decrement Operator

Example 2

```
var   a  =  4;
var   b  =  2;

var   c  =  ++a   + b;   // first value      of a increased      so
will become 5 then value of a will be placed here, 5

alert(a);                  //  5

alert(b);                  //  2

alert(c);                  //  7
```

Increment and Decrement Operator

Example 3

```
var  a  =  4;
var  b  =  3;
var  c  =  a++  +  --b  - --a;
alert(a);              //  4
alert(b);              //  2
alert(c);              //  2
```

Increment and Decrement Operator

Example 4

```
var  a  =  4;
var  b  =  3;
var  c  =  ++a  +  b++  - a  +  --b;
alert(a);              //  5
alert(b);              //  3
alert(c);              //  6
```

String Concatenation

Concatenating Text strings

1. The + operator can also be used for concatenating strings
2. E.g:

```
var firstName = "Abraham";  var lastName = "aLincoln";
//concatenate firstName, space character and lastName  var fullName =
firstName + " " + lastName;  alert(fullName);
```

Concatenating strings and numbers

1. Adding two numbers, will return the sum, but adding a number and a string will return a string:

```
var a = "6" + 2;                    // "62"
var b = 3 + "6";                    // "36"
var c = "Hello " + 2;               // "Hello 2"
var d = 2 + "Hello ";               // "2 Hello"
var e = "Hello "+ 3 + 4;  var f =   // "Hello 34"
3 + 4 + "Hello ";  var g = "Hello   // "7Hello"
"+ (3 + 4);                         // "Hello 7"
```

Prompt and Parsing String

prompt or window.prompt()

1. The prompt()/window.prompt() method displays a dialog box that prompts the visitor for input.
2. In a prompt, you can specify a second string. This is the default response that appears in the field when the prompt displays.
3. The prompt() method returns the input value if the user clicks "OK". If the user clicks "cancel" the method returns null.

prompt or window.prompt()

```
var question = "What is your name?";  var defaultAnswer =
"John";
var name = prompt(question, defaultAnswer);
console.log("Name = "+ name);
```

prompt or window.prompt()

1. If you ask for number in prompt and try apply addition operator on it then it will concatenate the value because prompt returns string

```
var question = "What is your age?";
var age = prompt(question);// Assuming input 12  var newAge = age
+ 5; // It will concatenate  console.log("New Age = "+ newAge);
//result 125
```

Convert string to integer

1. Addition operator in string concatenate values, even if value in string is number

```
var   value1   =  "3";
var   value2   =  "5";
var   value3   =  value1+value2;
console.log(value3);// result, 35
```

Convert string to integer

1. prompt function also returns string even if you provide number in input box

```
//Assuming we will provide value 5 in input  var age =
prompt("What is your age");

var num = 4;
var sum = age + num;  console.log(sum); // result, 54
```

Convert string to integer

1. If you are sure that string has number, then you have to convert it into number to perform addition
2. We need to use **parseInt** function for conversion

```
var age = prompt("What is your age");//input 5
var num = 4;
var sum = parseInt(age) + num;
console.log(sum); // result, 9
```

Convert string to integer

1. If value is not number then it will return NaN

```
var   age   =  prompt("What       is   your  age");//input       abc
var   num   =  4;
var   sum   =  parseInt(age)       +   num;
console.log(sum); // result, NaN
```

Convert string to decimal

1. If your string is number with decimal places then you can use parseFloat for conversion

```
var   age   =  prompt("What      is  your   age");//input      5.5
var   num   =  4;
var   sum   =  parseFloat(age)       +  num;
console.log(sum); // result, 9.5
```

Convert string to Number

1. The Number() function converts the object argument to a number that represents the object's value.
2. If the value cannot be converted to a legal number, NaN is returned.

```
var   age   =  prompt("What is your          age");//input 5.5

var   num   =  4;

var   sum   =  age + Number(num);
console.log(sum); // result, 9.5
```

Convert string to Number

1. In case of Number() function you don't have to use separate parseInt or parseFloat function for conversion

```
var a = Number(true);                    //returns 1
var b = Number(false);                   //returns 0
var c = Number("999");                   //returns 999
var d = Number("999 888");               //returns NAN
var e = Number("Hello");                 //returns NAN
```

Comparison Operators

Comparison operators

1. Comparison operators are used in logical statements to determine equality or difference between variables or values. They will result in **true** or **false** only

Operator	Description
==	equal to
===	equal value and equal type
!=	not equal
!==	not equal value or not equal type

Operator	Description
>	greater than
<	less than
>=	greater than and equal to
<=	less than and equal to

Comparison operators

```
var a = 3;
console.log(a      == 6);          //return  false
console.log(a      === 6);         //return  false
console.log(a      != 6);          //return  true
console.log(a      !== 6);         //return  true
console.log(a      > 6);           //return  false
console.log(a      < 6);           //return  true
console.log(a      >= 6);          //return  false
console.log(a      <= 6);          //return  true
```

Comparison operators

1. == and === are used for equality check
2. == does not consider data type of values being compared and
3. == tries to convert one of the value and compare based on that
4. === also check datatype of the values and datatype of value on both side should be same otherwise it will return false

Comparison operators

```
var a = 3;
console.log(a      ==   3);              //return  true

  console.log(a    ==   "3");            //return  true

  console.log(a    ==   6);              //return  false


  console.log(a    ===   3);             //return  true

  console.log(a    ===   "3");           //return  false

  console.log(a    ===   6);             //return  false
```

Comparison operators

1. Be careful JavaScript is dynamic language and many decision taken at start are still causing confusion
2. Comparing different type of values will result in answer which is not easily understandable
3. E.g: When comparing a string with a number, JavaScript will convert the string to a number while doing the comparison. An empty string converts to 0. A non-numeric string converts to NaN which is always false.

Logical Operators

Short-circuit Logical Operators

1. Logical operators are used to determine the logic between variables or values.
2. Logical operators required boolean operands on both side of operator
3. However, the && and || operators actually return the value of one of the specified operands, so if these operators are used with non-Boolean values, they will return a

   non-Boolean value.

Logical Operators

1. There are three logical operators in JavaScript:
    a. || (OR)
    b. && (AND)
    c. ! (NOT)

&& Logical Operator

1. This logical operator is used with two or more values (operands), and only evaluates to true if all the operands are true. It will return the false value if at least one value is false.

```
alert(    true    &&   true );        //   true
alert(    false    &&   true );       //   false
alert(    true    &&   false );       //   false
alert(    false    &&   false );      //   false
```

&& Logical Operator

```
var a = 60;
var b = a > 50 && a < 70;  alert(b);  //
return true


var c = 80;
var d = c > 50 && c < 70;  alert(d);  //
return false
```

|| Logical Operator

1. The logical operator || (OR) also is used with two or more values, but it evaluates to true if any of the operands (values) are true, so only evaluates to false if both operands are false.

```
alert(    true    ||   true );        //   true
alert(    false    ||   true );       //   true
alert(    true    ||   false );       //   true
alert(    false    ||   false );      //   false
```

|| Logical Operator

```
var a = 60;
var b = a < 50 || a > 70;  alert(b);  //
return false


var c = 80;
var d = c < 50 || c > 70;  alert(d);  //
return true
```

! Logical NOT

1. Using the ! operator in front of a boolean will convert it to opposite value. It means that a true value will return false, and a false will return true. This method is known as negation:

```
alert( !true ); // false  alert( !false ); // true
```

! Logical NOT

```
var   a  =  60;
var   b  =  !(a   <  50);
alert(b);                  //    return    true


var   c  =  80;
var   d  =  !(c   >  50);


alert(d);                  //    return    false
```

! Logical NOT

1. Using the ! operator in front of a other value will convert it to a Boolean and return an opposite value.

```
alert( !1 ); // false  alert( !0); // true
```

2. Here 1 will be converted to boolean first and it will be true and because of ! operator opposite will return
3. Same for 0, it will be converted to false and ! will negate it to true

!! Double NOT

1. Using the ! operator twice in front of a value will convert it to a Boolean and negate it twice, useful when you want to convert value to boolean

```
alert( !!1 ); // true  alert( !!0); // true
```

2. Here 1 will be converted to boolean first and it will be true and because of first ! operator it will convert to false and then because of second ! operator it will be converted to true

Why they are called short-circuit

1. && and || operator stops evaluation of expression once they find desired value
2. && stops evaluation as soon as it finds false and returns false
3. && returns true if all values are true
4. || stops evaluation as soon as it finds true and returns true
5. || returns false if all values are false

Why they are called short-circuit

```
//returns false,        evaluation stops        at  first value
var a = false &&        true && false;

//returns false,        evaluation stops        at  last value
var b = true && true && false;

//returns false, evaluation stops at second value  var c = true
&& false && true;
```

Why they are called short-circuit

```
//returns true, evaluation stops                    at  second value
var d = false || true || false;

//returns true, evaluation stops  var e =    at  first value
true || true || false;

//returns true, evaluation stops                    at  last value
var f = false || false || true
```

Conditions

Conditions

1. Up until now, all the code in our programs has been executed chronologically
2. Very often when you write code, you want to perform different actions for different decisions.
3. You can use conditional statements in your code to do this.

Conditions

1. In JavaScript we have the following conditional statements:
    a. Use ***if*** to specify a block of code to be executed, if a specified condition is true
    b. Use ***else*** to specify a block of code to be executed, if the same condition is false
    c. Use ***else if*** to specify a new condition to test, if the first condition is false
    d. Use ***switch*** to specify many alternative blocks of code to be executed (Discussed later)

Conditions: if

1. The ***if*** statement is the fundamental control statement that allows JavaScript to make decisions and execute statements conditionally.

```
if (condition) {
   // block of code to be executed if the condition is true

   }
```

Conditions: if

```
var age = 12;

if( age > 9 ) {   console.log("Age =
    "+age);
}
```

Conditions: else

1. Use the ***else*** statement to specify a block of code to be executed if the condition is false.

```
if (condition) {
//block of code to be executed if the condition is true
} else {
//block of code to be executed if the condition is false
}
```

Conditions: else

```
var age =  15;


if( age > 18 ) {
    console.log("Qualifies for driving");
} else {
    console.log("Does not qualify for driving");
}
```

Conditions: else if

1. Use the ***else if*** statement to specify a new condition if the first condition is false.

Conditions: else if

```
if (condition1) {
   //block of code to be executed if condition1 is true
} else if (condition2) {
   //block of code to be executed if the condition1 is false  and condition2 is
true

   } else {
   //block of code to be executed if the condition1 is false  and condition2 is
false

   }
```

Conditions: else if

```
var score = 80;  if( score > 80   )
{

   console.log("Grade A");
}  else if( score > 70 ) {
   console.log("Grade B");
}  else if( score > 60 ) {
   console.log("Grade C");

}  else {
console.log("Failed");
}
```

Conditions: nested if

1. ***nested if*** statements means an if statement inside an if statement.

```
if (condition1) {
//Code to be executed if the condition1 is true
if (condition1) {
    //Code to be executed if the condition2 is true
}
}
```

Conditions: nested if

```
var score = 80;  if( score > 80 ) {
    console.log("Grade A");  if( score > 90){
        console.log("Reward $100")
    }
}
```

Set of Conditions

```
var score = 70;
if(score > 80 && score <= 100){
    console.log("Grade A");

}
else if    (score > 70   && score <= 80){
    console.log("Grade B");

}
else if    (score > 60   && score <= 70){
    console.log("Grade C");

}
```

Set of Conditions

```
var input = "M";
if(input == "A" || input == "E" || input == "I"
          || input == "O" || input == "U"){  console.log("It's
   a Vowel");

      }
      else {
         console.log("It's a consonants");
      }
```

Value conversion to boolean

1. In JavaScript value or expression can be converted to boolean
2. If you apply boolean comparison on values then JavaScript convert that value into boolean and make comparison
3. You can use values in if/else conditions and they will result in true or false according to values

Value conversion to boolean

1. Following values will be converted to false
    a. null
    b. NaN
    c. 0 / Zero
    d. “” or ‘’ or `` / Empty String single or double quotes
    e. undefined
2. All else will be converted to true

Value conversion to boolean

1. Following values will be converted to true
    a. {} / Object
    b. “AnyText” / String with any text
    c. 1 / Any number other than zero

Number to Boolean

```
var age = 45;
// 45 will be converted to true, if will be executed  if(age){
    console.log("In If Age = "+age);
}
else{
    console.log("In else Age = "+age);
}
```

null to Boolean

```
var name = null;
//null will be converted to false, else will be executed
if(name){
  console.log("In If name = "+name);
}
else{
  console.log("In else name = "+name);
}
```

String to Boolean

```
var name = "Hello";
//Hello will be converted to true, if will be executed  if(name){
   console.log("In If name = "+name);
}
else{
   console.log("In else name = "+name);
}
```

String to Boolean

```
var name = "";
//it will be converted to false, else will be executed  if(name){
   console.log("In If name = "+name);
}
else{
   console.log("In else name = "+name);
}
```

undefined to Boolean

```
var name;   // Default value is undefined
//it will be converted to false, else will be executed  if(name){
  console.log("In If name = "+name);
}
else{
  console.log("In else name = "+name);
}
```

Value conversion to boolean

1. Value conversion also works with Logical operator && and ||
2. For &&
    a. If all values are converted to true, it will returns last value
    b. If any of the value converted to false it will that value
3. For ||
    a. If all values are converted to false, it will returns last value
    b. If any value converted to true it will return that value

Value conversion to boolean &&

```
var   a1  =  'Cat'    &&  'Dog';          //  t  &&  t    returns  "Dog"
var   a2  =  false    &&  'Cat';          //  f  &&  t    returns  false
var   a3  =  'Cat'    &&  false;          //  t  &&  f    returns  false
var   a4  =  ''       &&  false;          //  f  &&  f    returns  ""
var   a5  =  false    &&  '';             //  f  &&  f    returns  false
var   a6  =  0 && 1;                      //  f  &&  t    returns  0
```

Value conversion to boolean &&

```
var   a7   =  1 && false;                  //  t  &&  f    returns  false
var   a8   =  true && {};                  //  t  &&  t    returns  {}
var   a9   =  false && {};                 //  f  &&  t    returns  false
var   a10   =   'Cat' && (3==4);           //  t  &&  f    returns  false
var   a11   =   'Cat' && 0;                //  t  &&  f    returns  0
var   a12   =   undefined && 'Cat';// f && t returns undefined
```

Value conversion to boolean ||

```
var   a1  =  'Cat'    ||  'Dog';          //  t  ||  t    returns  "Cat"
var   a2  =  false    ||  'Cat';          //  f  ||  t    returns  "Cat"
var   a3  =  'Cat'    ||  false;          //  t  ||  f    returns  "Cat"
var   a4  =  ''       ||  false;          //  f  ||  f    returns  false
var   a5  =  false    ||  '';             //  f  ||  f    returns  ""
var   a6  =  0 || 1;                      //  f  ||  t    returns  1
```

Value conversion to boolean ||

```
var a7  = 1 || false;                  // t || f   returns 1
var a8  = true || {};                  // t || t   returns true
var a9  = false || {};                 // f || t   returns {}
var a10 =      'Cat' || (3 == 4);      // t || f   returns "Cat"
var a11 =      'Cat' || 0;             // t || f   returns "Cat"
var a12 =  undefined || 'Cat';         // f || t   returns "Cat"
```

For Loop

For Loop

1. Looping in programming languages is a feature which facilitates the execution of a set of instructions/functions repeatedly while some condition evaluates to true.
2. The for statement creates a loop that is executed as long as a condition is true.
3. It will only stop when the condition becomes false.

For Loop

```
for (initialization; condition; expression) {
    // code to be executed
}
```

1. Initialization is done (one time) before the execution of the code block.
2. Condition for executing the code block and exit loop
3. Expression is executed (every time) after the code block has been executed.

For Loop

```
for (var i = 0; i < 3; i++){
    console.log(i);
}
```

Output: 0

1

2

For Loop

```
for (var i = 5; i <= 8; i++){
    console.log(i);
}
```

Output:

```
5
6
7
8
```

Infinite Loop

1. All 3 statement in loop are options, in that case it will be infinite loop
2. Also if you do not provide condition in loop it will make loop infinite

```
for ( ; ; ){   console.log("Hello");

}
```

For Loop

1. Printing table of 3 will require hard coded statements

```
console.log("3     x  1  =  3");
console.log("3     x  2  =  6");
console.log("3     x  3  =  9");
console.log("3     x  4  =  12");
console.log("3     x  5  =  15");
```

For Loop

1. With for loop it will be dynamic

```
var num = 3;
for (var i=1; i<=10; i++){  console.log(num+" x "+i+" =
    "+(num*i));
}
```

Output:

3 x 1 = 3

….

3 x 10 = 30

Break

```
for (var i = 0; i < 8; i++){  if(i ==
    4) {
     break;
}
console.log("I = "+i);
}
```

Output: I = 0

I = 1

I = 2

I = 3

Continue

```
for (var i = 0; i < 8; i++){  if(i ==
    4) {
     continue;
}
console.log("I = "+i);
}
```

Output: I = 0

I = 1

I = 2

I = 3

I = 5

I = 6

I = 7

Nested Loops

1. If a loop exists inside the body of another loop, it's called nested loop.

```
for (var i = 0; i < 3; i++){  for(var j = 0; j < 2;
    j++) {
     console.log("I = "+i+" J = "+j);
}
}
```

Output:

I = 0 J = 0
I = 0 J = 1
I = 1 J = 0
I = 1 J = 1
I = 2 J = 0
I = 2 J = 1

Task

1. Find out if number is prime number or not
2. Prime number is divisible only by itself and 1 (e.g. 2, 3, 5, 7, 11).

Task

1. Generate triangle output like below, Hint: nested loop required

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

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

Arrays

Arrays

1. JavaScript arrays are used to store multiple values in a single variable.
2. An array is used to store a collection of data
3. It is an ordered collection which store elements in sequence
4. We can use array to store list of something like:
    a. Students
    b. Cars
    c. Food items

Arrays

1. If you want to store temperature of last 7 days in variable, then you have to create 7 variables

```
var mondayTemprature = 23;  var tuesdayTemprature = 12;  var
    wednesdayTemprature = 35;  var thursdayTemprature = 30;  var
    fridayTemprature = 27;  var saturdayTemprature = 19;  var
    sundayTemprature = 22;
```

Arrays

1. Now what if you want to store temperature of morning and evening for 7 days. That will be 14 variables
2. How about temperature for a year morning and evening that 730
3. It will be very difficult to manage and assign names to these variables

Arrays

1. If you want to find out all days temperature was above 30 then it will be quite difficult
2. If you want to sort temperature in ascending or descending order that will not be possible with separate multiple variables

Arrays

1. With Arrays you can create single variable and hold all temprature in it.
2. With Array you will be able to find and sort temperature easily

```
var temperatures = [34,12,27,65,34,28,  19];
```

Creating an Arrays

1. Creating an Array using array literal

```
var food = ["Pizza",   "Burger",   "Snacks"];
```

2. Creating an Array using ***new*** Keyword

```
var foods = new Array("Pizza", "Burger",   "Snacks");
```

3. Both are same, first one more recommended way to create array

Creating an Arrays

1. Array can be created for all datatypes or you can mix them in single array

```
var   arr1   =  ["Hello", "World",  "Bye"];
var   arr2   =  [29,  38, 16, 22];
var   arr3   =  [true,false,true,false,false];

var   arr4   =  [23.2, 45.8,  98.12];
var   arr5   =  [{name: "John"}, {name: "Jason"}];
var   arr6   =  [74,  "Hello",  true, {name: "John"}];
```

Accessing Array Elements

1. You access an array element by referring to the index number.
2. To access element you provided number in square brackets

```
var foods = ["Pizza", "Burger", "Snacks"];
foods[0];     // Pizza

foods[1];     // Burger

foods[2];     // Snacks
```

Accessing Array Elements

1. Store result in variable or show output directly

```
var foods = ["Pizza", "Burger", "Snacks"];

var a = foods[0];  var
b = foods[1];  var c =
foods[2];  alert(a);
alert(foods[2]);
```

```
// Pizza
// Burger
// Snacks
// Pizza
// Snacks
```

Accessing Array Elements

1. Range of array index is from 0 to Array's length - 1
2. First element is on index 0
3. Second element on index 1
4. Third on index 2
5. Last element will be on array's length -1 e.g
    a. Array has 5 element then last element in on 4th index
    b. Array has 8 element then last element in on 7th index

Accessing full Array

1. The full array can be accessed by referring to the array name

```
var foods = ["Pizza", "Burger", "Snacks"];  console.log(foods);
// Pizza, Burger, Snacks
```

Accessing Index that does not exists

1. If you create array with 3 elements and try to access 4th element, it will return *undefined*
2. There will be no error in accessing index that does not exists

```
var foods = ["Pizza", "Burger", "Snacks"];


console.log(foods[2]);      //  Snacks
console.log(foods[3]);      //  undefined
console.log(foods[8]);      //  undefined
```

Add/Update Element using index

1. You can use array index to add or update elements in array

```
var foods = [];


  foods[0]    =  "Pizza";

  foods[1]    =  "Burger"

  foods[2]    =  "Snacks";
console.log(foods[0]); //Pizza

console.log(foods[2]); //Snacks
```

Add/Update Element using index

```
var foods = ["Pizza", "Burger", "Snacks"];

    console.log(foods[1]);      //  Burger

    foods[1] = "Sandwich";      //  Updating existing       element

    console.log(foods[1]);      //  Sandwich
foods[3] = "French Fries"; // Adding 1 more element

console.log(foods[3]); // French Fries
```

Length property

1. You can find out number of elements in an array by length property

```
var foods = ["Pizza", "Burger", "Snacks"];
console.log(foods.length); // 3

var arr = [];  console.log(arr.length); // 0
```

Push function

1. Push function lets you add element in array without worrying about index
2. You don’t need to remember last index used to add in element, just call push function on array

```
var foods = [];  foods.push("Pizza");  foods.push("Burger");
foods.push("Snacks");
```

Push function

```
var foods = [];
foods.push("Pizza");
foods.push("Burger");
foods.push("Snacks");


 alert(foods[0]);              //  Pizza
 alert(foods[1]);              //  Burger
 alert(foods[2]);              //  Snacks
```

Push function -- Multiple input

```
var foods = [];  foods.push("Pizza");
foods.push("Burger", "Snacks");// Will add in sequence
foods.push("Sandwich");
```

```
alert(foods[0]);              //  Pizza
alert(foods[1]);              //  Burger
alert(foods[2]);              //  Snacks
alert(foods[3]);              //  Sandwich
```

Array Data Structure

1. A data structure is a specialized format for organizing, processing, retrieving and storing data
2. It enables efficient access and modification of data.
3. You can use same array syntax as:
    a. Random Access
    b. Stack (Last in First out)
    c. Queue (First in First out)

Random Access

1. You can access array elements from any index and update them

```
var foods = ["Pizza", "Burger", "Snacks"];


    console.log(foods[1]);      //  Burger
    foods[1] = "Sandwich";      //  Updating existing element
    console.log(foods[1]);      //  Sandwich
```

Stack

Last in First out

(LIFO)

Stack (Last in First out)

1. Stack is a linear data structure represented by a real physical stack or pile where insertion and deletion of items takes place at one end called top of the stack.
2. The basic concept can be illustrated by thinking of your data set as a stack of plates or books where you can only take the top item off the stack in order to remove things from it
3. The basic implementation of a stack is also called a LIFO (Last In First Out)

Stack (Last in First out)

1. To behave as stack you have to use push and pop function on array
2. **Push** function will add element at the **end** in array
3. **Pop** function will remove and return **last** elements from array

Stack (Last in First out)

```
var foods = [];  foods.push("Pizza");  foods.push("Burger");
foods.push("Snacks");
console.log("Length "+foods.length); // Length 3
console.log(foods.pop()); // Remove Snacks from array
console.log(foods.pop()); // Remove Burger from array
console.log("Length "+foods.length); // Length 1
```

Queue

First in First out

(FIFO)

Queue (First in First out)

1. Queue is a linear data structure represented by a real physical queue.
2. You can think of it as a line in a grocery store or banks
3. A queue is open at both its ends.
4. The basic implementation of a stack is also called a FIFO (First-In-First-Out)

Queue (First in First out)

1. To behave as queue you have to use push and shift function on array
2. **Push** function will add element at the **end** in array
3. **Shift** function will remove and return **first** elements from array

Queue (First in First out)

```
var foods = [];  foods.push("Pizza");  foods.push("Burger");
foods.push("Snacks");
console.log("Length "+foods.length); // Length 3
console.log(foods.shift());// Remove Pizza from array
console.log(foods.shift());// Remove Burger from array
console.log("Length "+foods.length); // Length 1
```

Unshift function

1. To add element in array we use push function or index
2. These will add element at end of array
3. If you want to add element at the start of array and move all element one index ahead then we can we use unshift function

Unshift function

```
var foods = [];  foods.push("Pizza");  foods.push("Burger");
foods.push("Snacks");
console.log("Length "+foods.length); // Length 3  console.log(foods[0]); //
"Pizza"  foods.unshift("Sandwich");  console.log(foods[0]); // "Sandwich"
console.log(foods[1]); // "Pizza"
```

Iterating array with Loops

1. To access all element in array we can use loops to iterate over each array element

```
var foods = ["Pizza",  "Burger", "Snacks"];  for(var
i=0;i<foods.length;i++){
    alert(foods[i]);
}
```

2. ***i*** will work as index and this code will show alert 3 times each with “Pizza”, “Burger” and “Snacks” respectively

Iterating array with Loops

1. With loops you can utilize arrays in much efficient way.
2. If you want to find element in array, you can use loop to iterate over array in check if particular value exists in array
3. If you want to sort elements in array, you can use loop to iterate over each element and swap elements

Task

1. Create an array and fill it with numbers

2. Ask input from user
3. Find element in array that is provided by user

Splice function

1. Add add element in array we have used
    a. Push function -- add element in last
    b. Unshift function -- add element in start
    c. Index -- add element in last or replace existing element
2. If we want to add element in middle of array or any index other than first/last then we can use splice function

Splice function

1. Splice function can add one or more element on particular index in array
2. Splice function can replace one or more element on particular index in array
3. Splice function returns elements which removed from array, if no element removed then returns empty array

Splice function

```
var foods = ["Pizza", "Burger", "Snacks"];
console.log(foods);// "Pizza","Burger","Snacks"
foods.splice(1,0,"Sandwich");  console.log(foods);

//"Pizza","Sandwich", "Burger","Snacks"
```

This will add 1 element on index 1 and move all elements one index forward

Splice function

```
var foods = ["Pizza", "Burger", "Snacks"];
console.log(foods);// "Pizza","Burger","Snacks"
foods.splice(1,0,"Sandwich", "Fries");  console.log(foods);

//"Pizza","Sandwich","Fries","Burger","Snacks"
```

This will add 2 element on index 1 and 2 and move all elements two index forward

Splice function

```
var foods = ["Pizza", "Burger", "Snacks"];
console.log(foods);// "Pizza","Burger","Snacks"
foods.splice(1,2,"Sandwich");  console.log(foods);

//"Pizza","Sandwich"
```

This will remove 2 element from index 1 and will add 1 element on index 1

Slice function

1. To create array from element of existing array you can use slice function
2. We can create subset of array from existing array
3. Slice takes start and end index of array to create new array
4. Slice Syntax:
    a. slice(index of array, end index)
    b. End index is exclusive, if you say 4 that means 3rd index

Slice function

```
var foods = ["Pizza", "Burger", "Snacks", "Sandwich",  "Fries"];
console.log(foods);//
"Pizza","Burger","Snacks","Sandwich","Fries"
var arr = foods.slice(1,3);
console.log(foods);// output same as above
console.log(arr); //"Burger","Snacks"
```

Slice function

```
var foods = ["Pizza", "Burger", "Snacks", "Sandwich",  "Fries"];
console.log(foods);//
"Pizza","Burger","Snacks","Sandwich","Fries"   var arr =
foods.slice(2); // Just start index   console.log(foods);// output
same as above   console.log(arr); //"Snacks", "Sandwich","Fries"
```

Other Array functions

1. filter()
2. find()
3. indexOf()
4. lastIndexOf()
5. map()
6. reverse()
7. sort()

And others

String

String

1. JavaScript strings are used for storing and manipulating text.
2. String is zero or more characters written inside quotes

```
var a = "Hello World";
```

3. String is zero or more characters written inside quotes

```
var   name1   =   "John";      //   Double   quotes
var   name2   =   'Mark';      //   Single   quotes
```

String Length Property

1. String has built-in length property which return length of character in string

```
var a = "Hello World";
alert(a.length);
                                    // 11
```

Escape Characters

```
var  a  =    "Hello\'World";     //    Single  quote
var  b  =    "Hello\"World";     //    Double  quote
var  c  =    "Hello\\World";     //  Backslash

var  d  =    "Hello\nWorld";     //  New Line

var  e  =    "Hello\tWorld";     //  Horizontal     Tab
```

String functions

String functions

During development you will often require to manipulate string and for that string have many functions to do the job

1. toLowerCase()
2. toUpperCase()
3. slice()
4. indexOf()
5. lastIndexOf()
6. charAt()
7. replace()
8. split()

toLowerCase() function

1. toLowerCase function convert string in lowercase letters
2. It is useful when comparing user input

```
var food = "sANdWiCh";
var updatedFood = food.toLowerCase();


console.log(food);                    // sANDWiCh
console.log(updatedFood);             // sandwich
```

toUpperCase() function

1. toUpperCase function convert string in uppercase letters
2. It is useful when comparing user input

```
var food = "sANdWiCh";
var updatedFood = food.toUpperCase();


console.log(food);                    // sANDWiCh
console.log(updatedFood);             // SANDWICH
```

slice() function

1. slice() extracts a part of a string and returns the extracted part in a new string.
2. The method takes 2 parameters: the start position, and the end position (end not included).
3. String character count starts from 0 same as Arrays
4. First character at zero, second at 1

```
var a = "Hello World";
//H=0,e=1,l=2,l=3,o=4,space=5,W=6...
```

slice() function

1. This example extract portion from 6th index to 8th index

```
var a = "Hello World";
// 6 to (9-1)
var b = a.slice(6,9);
                                    //returns Wor
```

slice() function

1. If we omit second parameter it will return rest of the string

```
var a = "Hello World";
// 6 to end
var b = a.slice(6);
                                    //returns World
```

slice() function

1. If a parameter is negative, the position is counted from the end of the string.

```
var a = "Hello World";
//d=-1,l=-2,r=-3,o=-4,W=-5,space=-6,o=-7...
// -5 to -3
var b = a.slice(-5,-2);  //returns Wor
```

indexOf() function

1. indexOf() returns the index of the first occurrence of a specified text in a string
2. If not found, -1 is returned.

```
var a = "To be or not to be";
var b = a.indexOf("be"); //returns 3
```

indexOf() function

1. Second optional argument in indexOf() specify position to to begin search in string. If not provided its default to 0

```
var a = "To be or not to be";  var b =
a.indexOf("be",  10);
                                        //returns 16
```

lastIndexOf() function

1. lastIndexOf() returns the index of the last occurrence of a specified text in a string.
2. It searches backwards, from the end to the beginning
3. If not found, -1 is returned

```
var a = "To be or not to be";  var b =
a.lastIndexOf("be");
                                        //returns 16
```

lastIndexOf() function

1. Second optional argument in lastIndexOf() specify position to to begin search in string. If not provided its default to last index

```
var a = "To be or not to be";
var b = a.lastIndexOf("be",10);  //returns 3
```

2. It will start looking for text ‘be’ from index 10 to backwards

charAt() function

1. slice() function extract the portion of string provided the starting and ending positions
2. charAt() function takes single index input and return character at that index
3. Returns empty string if index does not exists on negative index provided

```
var a = "To be or not to be";
var b = a.charAt(7);   //returns r
```

replace() function

1. The replace() function replaces a specified value with another value in a string
2. The replace() function does not change the string it is called on. It returns a new string.

```
var str = "To be or not to be";  var b =
str.replace("be","hello");
// result "To hello or not to be"
```

replace() function

1. By default, the replace() function replaces only the first match
2. To replace all matches, use a regular expression with a /g flag (global match) and without quotes

```
var str = "To be or not to be";  var b =
str.replace(/be/g,"hello");
// returns "To hello or not to hello"
```

replace() function

1. To replace case insensitive, use a regular expression with an /i flag (insensitive)

```
var str = "To be or not to be";  var b =
str.replace(/to/i,"hello");
// returns "hello be or not to be"
```

replace() function

1. Combine both g and i flog to replace all matches and case insensitive

```
var str = "To be or not to be";
var b = str.replace(/To/gi,"hello");
// returns "hello be or not hello be"
```

split() function

1. The split() function is used to split a string into an array of substrings, and returns the new array.

```
var str = "To be or not to be";
var b = str.split(" ");// split with space
// returns array: ["To", "be", "or", "not",  "to", "be"]
```

split() function

1. Split can be done with commas, spaces or any character

```
var   str      = "To,be or|not to,be";

var   a =      str.split(",");// Split      on   commas

var   b =      str.split(" ");// Split      on   spaces

var   c =      str.split("|");// Split      on   pipe
```

Other String functions

There are few more string functions you can learn

1. charCodeAt()
2. concat()
3. endsWith()
4. includes()
5. match()
6. repeat()
7. replace()
8. search()
9. startsWith()
10. substr()
11. substring()
12. trim()

Math functions

Math

Math class provides many functions that allows you to perform mathematical tasks on numbers

Math.round() function

1. Math.round(x) returns the value of x rounded to its nearest integer
2. E.g calculating average score will result number with decimal places and you need to round them

```
var average = (15 + 23 + 39) /3 ; // 25.6666  var
roundedAverage = Math.round(average); // 26
console.log(roundedAverage);
```

Math.round() function

```
var  a  =  Math.round(4.7);          //  5
var  b  =  Math.round(4.1);          //  4
var  c  =  Math.round(4.5);          //  5
var  d  =  Math.round(-4.1);         //  -4
var  e  =  Math.round(-4.7);         //  -5
var  f  =  Math.round(-4.5);         //  -4
var  g  =  Math.round(5);            //  5
```

Math.ceil() function

1. Math.ceil(x) returns the value of x rounded **up** to its nearest integer

```
var  a  =  Math.ceil(4.7);          //  5
var  b  =  Math.ceil(4.1);          //  5
var  c  =  Math.ceil(-4.1);         //  -4
var  d  =  Math.ceil(-4.7);         //  -4
```

Math.floor() function

1. Math.floor(x) returns the value of x rounded **down** to its nearest integer

```
var  a  =  Math.floor(4.7);          //  4
var  b  =  Math.floor(4.1);          //  4
var  c  =  Math.floor(-4.1);         //  -5
var  d  =  Math.floor(-4.7);         //  -5
```

Math.random() function

1. Suppose you want to simulate the throw of a die. In the simulation, you want it to randomly come up 1, 2, 3, 4, 5, or 6
2. If you want build a game that will allow user to guess a number
3. Math.random() returns a random number between 0 (inclusive), and 1 (exclusive)
4. Everytime you execute this function it will return random value

Math.random() function

```
var num = Math.random();
// result will be like 0.5251908043871081
```

If you want to generate random number between some range then you have to add some calculations like:

```
var num = Math.random();  var num2 = (num * 6) + 1;

var dice = Math.floor(num2); // 1 to 6
```

Other Math functions

There are few more string functions you can learn

1. Math.pow()
2. Math.sqrt()
3. Math.abs()
4. Math.sin()
5. Math.cos()
6. Math.min()
7. Math.max()
8. Math.exp()
9. Math.log()

Controlling the length of decimals

1. In arithmetic operation you may face numbers with many decimal place

```
var average = (15 + 23 + 39) /3 ; // 25.666666666
```

2. To limit decimal places to specified number you can call toFixed() function on number and round last digit

```
var avg = average.toFixed(3);// returns 25.667
```

Date Object

Date

1. In JavaScript, you might have to create a website with a calendar, a train schedule, or an interface to set up appointments.
2. These applications need to show relevant times based on the user's current timezone
3. You might need to use JavaScript to generate a report at a certain time every day

Date

1. The Date object is a built-in object in JavaScript that stores the date and time.
2. It provides a number of built-in methods for formatting and managing that data.
3. Date objects are created with new Date().

Date

```
var date = new Date();  console.log(date);
//Thu Nov 07 2019 11:44:50 GMT+0500 (Pakistan  Standard Time)
```

This will be created according to the current computer's system settings.
It will show complete date with current timezone, if you change the timezone of your computer it will show different date

Thu Nov 07 2019 11:44:50 GMT+0500 (Pakistan Standard Time)

Looking at the output, we have a date string containing the following:

Day of the Week	Month	Day	Year	Hour	Minute	Second	Timezone
Thu	Nov	07	2019	11	44	50	GMT+0500

Creating Date Objects

1. There are 4 ways to create a new date object

```
new Date()
new Date(year, month, day, hours, minutes,  seconds,
milliseconds)
new Date(milliseconds)  new Date(date string)
```

Creating Date Objects

```
new  Date()

new  Date(2019,     7,  11,  10,  25,  40,  300);

new  Date(1565501140300);

new  Date("2019/9/8 10:15:15");

new  Date("2019/9/8 10:15:15");

new  Date("January 12 2019 10:15:15");
```

Unix time

1. JavaScript, understands the date based on a timestamp derived from Unix time, which is a value consisting of the number of milliseconds that have passed since midnight on January 1st, 1970. We can get the timestamp with the getTime() method.

```
var date = new Date();  date.getTime(); // 1573110702109
```

Epoch time

1. Epoch time, also referred to as zero time, is represented by the date string 01 January, 1970 00:00:00 Universal Time (UTC), and by the 0 timestamp
2. Epoch time was chosen as a standard for computers to measure time by in earlier days of programming

```
var date = new Date(0);  console.log(date);

//Thu Jan 01 1970 00:00:00 GMT+0000 (UTC)
```

Retrieving the Date Components

1. Once we have a date, we can access all the components of the date with various built-in methods.
2. The methods will return each part of the date relative to the local timezone.
3. Each of these methods starts with get, and will return the relative number.

Date/Time	Method	Range	Example
Year	`getFullYear()`	YYYY	1970
Month	`getMonth()`	0-11	0 = January
Day (of the month)	`getDate()`	1-31	1 = 1st of the month
Day (of the week)	`getDay()`	0-6	0 = Sunday
Hour	`getHours()`	0-23	0 = midnight
Minute	`getMinutes()`	0-59	
Second	`getSeconds()`	0-59	
Millisecond	`getMilliseconds()`	0-999	
Timestamp	`getTime()`	Milliseconds since Epoch time	

Retrieving the Date Components

```
var date = new Date("June 14 2019 10:45:25");
```

```
date.getFullYear();// 2019
date.getMonth();  // 5
date.getDate();   // 14
date.getDay(); // 5
date.getHours();  // 10
```

```
date.getMinutes();          // 45
date.getSeconds();          // 25

date.getMilliseconds();//0
date.getTime();
//1560491125000
```

Modifying the Date

1. For all the **get** methods that we learned, there is a corresponding **set** method.
2. Where **get** is used to retrieve a specific component from a date, **set** is used to modify components of a date

Date/Time	Method	Range	Example
Year	`setFullYear()`	YYYY	1970
Month	`setMonth()`	0-11	0 = January
Day (of the month)	`setDate()`	1-31	1 = 1st of the month
Day (of the week)	`setDay()`	0-6	0 = Sunday
Hour	`setHours()`	0-23	0 = midnight
Minute	`setMinutes()`	0-59	
Second	`setSeconds()`	0-59	
Millisecond	`setMilliseconds()`	0-999	
Timestamp	`setTime()`	Milliseconds since Epoch time	

Modifying the Date

```
var date = new Date("June 14 2019 10:45:25");
console.log(date);
// Fri Jun 14 2019 10:45:25 GMT+0500 (Pakistan  Standard Time)
date.setFullYear(2017);  console.log(date);
// Wed Jun 14 2017 10:45:25 GMT+0500 (Pakistan  Standard Time)
```

Converting Day of Week to Text

1. getDay() function returns day of week, but it will give number representing day from 0 to 6
2. 0 represent Sunday, 1 represent Monday and so on
3. If you want on convert this value into text representation then you have to do it yourself
4. You create array represent day of week in text format and then map value from getDay() function to array

Converting Day of Week to Text

```
var daysList = ["Sun", "Mon", "Tue", "Wed",
"Thu", "Fri", "Sat"];
var date = new Date("June 14 2019 10:45:25");  var day =
date.getDay();   // 5

var nameOfDay = daysList[day]; // Fri
```

Calculate Time difference

1. You can calculate time difference between two days using getTime and calculate difference in days
2. getTime returns time in milliseconds so you can find out time difference in milliseconds by subtracting dates
3. Then need find out of milliseconds in a day
   24 hours * 60 minutes * 60 seconds * 1000 milliseconds
4. And divide time difference in milliseconds with milliseconds of a day

Calculate Time difference

```
var   d1  =  new      Date("June  14   2019   10:45:25");
var   d2  =  new      Date("June  28   2019   10:45:25");
var   timeDiff = d2.getTime()          -  d1.getTime();

var   days = timeDiff / (1000          *  60 * 60 * 24);//        14
```

Functions

Functions

1. A function is a block of JavaScript that does the same thing again and again.
2. A JavaScript function is executed when "something" invokes it (calls it).
3. It saves you repetitive coding and makes your code easier to understand.
4. You can reuse code: Define the code once, and use it many times

Function Declarations

1. A JavaScript function is defined with the function keyword, followed by a name, followed by parentheses ().
2. Function names can contain letters, digits, underscores, and dollar signs (same rules as variables).
3. The parentheses may include parameter names separated by commas: (parameter1, parameter2, ...)
4. The code to be executed, by the function, is placed inside curly brackets: {}

Function Declarations

```
function name(parameter1, parameter2) {
    // code to be executed
}
```

Function Declarations

```
function sum(a, b){  return a + b;

}
```

Declared functions are not executed immediately. They are "saved for later use", and will be executed later, when they are invoked (called upon).

Invoking a Function

1. Functions execute when the function is called.
2. This process is known as invocation.
3. You can invoke a function by referencing the function name, followed by an open and closed parenthesis: ().

Invoking a Function

1. Declarations

```
function showMessage(message){
    console.log(message);
}
```

2. Invoking

```
showMessage("Hello World");
```

Parameters vs. Arguments

1. Parameters:
    a. Function parameters are listed inside the parentheses () in the function definition.
2. Arguments:
    a. Function arguments are the values received by the function when it is invoked.

Parameters vs. Arguments

1. Declarations

```
function showMessage(message){
    console.log(message);
}
```

Parameter

2. Invoking

```
showMessage("Hello World");
```

Argument

Passing Data to Function

1. In order for a function to become a programmable robot rather than a one-job robot, you have to set it up to receive the data you're passing.
2. You can pass any type of data to function depending on requirement

Passing Data to Function

```
function multiply(num1, num2){  var num3
    = num1 * num2;  console.log("Num3
    ",num3);
}

multiply(3,6);  multiply(4,2);
```

Passing Data to Function

```
function showMessage(name){
    console.log("Hello "+name);
}

showMessage("Mike");
showMessage("John");
```

Parameter Rules

1. JavaScript function definitions do not specify data types for parameters.
2. JavaScript functions do not perform type checking on the passed arguments.
3. JavaScript functions do not check the number of arguments received.
4. If a function is called with missing arguments (less than declared), the missing values are set to: ***undefined***

Parameter Rules

```
function showMessage(name){
    console.log("Hello "+name);
}

showMessage("John");                    // Hello John
showMessage(45);                        // Hello 45
showMessage(true);                      // Hello true
showMessage();                          // Hello undefined


showMessage("Mike", 12);// Hello Mike
```

Function Return

1. Function can returns data back to caller
2. After executing logic in function if you want to return result to the caller of function then you use ***return*** keyword
3. When JavaScript reaches a ***return*** statement, the function will stop executing and return value is "returned" back to the "caller"
4. Every function in JavaScript returns ***undefined*** unless otherwise specified

Function Return

```
function test(){


}

var a = test(); // return undefined
console.log(a); // undefined
```

Function Return

In this example we explicitly tell the function to return 45

```
function test(){
    return 45;
}

var a = test();         //  return 45

console.log(a);         //  45
```

Function Return

```
function multiply(num1,          num2){
    return num1 * num2;
}

var a = multiply(3,6);           //  returns    1
                                                8
var b = multiply(4,2);           //  returns    8

console.log(a);                  //  18

console.log(b);                  //  8
console.log(multiply(2,5)); // 10
```

Function Return

```
function multiply(num1, num2){
    return num2;    // function execution ends here  return num1 *
    num2;


}
var a = multiply(3,6);
                                        // returns 6
console.log(a);
                                        // 6
```

Function in Expressions

1. JavaScript functions can be used in expressions
2. Just like we use variables in calculation we can use function and output function will be included in calculation

```
function multiply(num1, num2){   return num1 * num2;

}
var a = multiply(3,4) + 5
```

Function in Expressions

```
function multiply(num1, num2){  return num1 * num2;

}
function sum(a, b){
// Result of multiply sum with value of b  return
    multiply(a,b) + b;  //16

}
var total = sum(3,4) + 6; // result 22
```

Function in Expressions

```
function multiply(num1, num2){  return num1 * num2;

}
function sum(a, b){  return a + b;

}
// Call multiply first and result passed to sum  var total =
sum(multiply(3,4), 2) + 6; // result 20
```

Local vs Global Variables

1. Variables can have local or global scope
2. A global variable is one that's declared in the main body of your code, not inside a function.
3. A local variable is one that's declared inside a function.
4. A local variable can be either a parameter of the function, which is declared implicitly by being named as a parameter, or a variable declared explicitly in the function with the var keyword.

Local vs Global Variables

5. Global variable is meaningful in every section of your code, whether that code is in the main body or in any of the functions.
6. Local variable is one that's meaningful only within the function that declares it.

Local vs Global Variables

7. there are two differences between global and local variables—where they're declared, and where they're known and can be used.

Global Variables	Local Variables
Declared in the main code	**Declared in a function**
Known everywhere, useable everywhere	**Known only inside the function, usable only inside the function**

Local vs Global Variables

```
var a = 7;  function
sum(){
    var b = 6;
    var c = a + b;

    console.log("C "+c);
}
sum();
console.log("A = "+a);  // 7
```

```
// Global Variable

// Local Variable
// 13, Accessing global
```

Local vs Global Variables

```
var a = 7;  function                                    // Global Variable
sum(){


      var b = 6;                                         //  Local Variable

      a = b + 5;

      console.log("A                  "+a);//  Accessing global          variable
}
sum();
console.log("A = "+a);
                                                        // 11, value of a updated
```

Local vs Global Variables

```
var a = 7;  function sum(){                    // Global Variable
   var b = 6;  a = b + 5;
}
sum();                                         // Local Variable
console.log("B = "+b);



// error, b is not available outside sum function
```

Local vs Global Variables

```
var a = 7;  function                    // Global Variable
sum(){
  var a = 6;  a = 3
  + 2;                  // Local Variable a same name as global
                        // Local a variable will be affected

  console.log("A "+a);//5, access local variable
}
sum();
console.log("A "+a);//7, access global variable
```

Global Variables without var keyword

1. If you create variable without ***var*** keyword it will be global variable not matter where you have created it
2. Variable created without ***var*** inside function it be global variable
3. Variable created without ***var*** in main body/code will be global variable
4. It is recommended to use variable with ***var*** keyword to have defined context

Global Variables without var keyword

```
a = 7;          // Without var still Global Variable

   function  sum(){

      var b  = 6;                 //    Local Variable

      a = b  + 5;

    console.log("A "+a);// Accessing global variable

}
sum();  console.log("A
"+a);
                                  // 11, value of a updated
```

Global Variables without var keyword

```
a = 7;   // Without var still Global Variable  function sum(){
   b = 6;   // Global variable because its without var  a = b + 5;
   console.log("A "+a);// Accessing global variable
}
sum();
console.log("B "+b);//b available outside of function
```

Function Expressions

1. A JavaScript function can also be defined using an expression.
2. A function expression can be stored in a variable

```
var sum = function (a, b){  return
    a + b;
};
var c = sum(4,5);  console.log(c);
```

```
// function as expression
```

Function Expressions

1. After a function expression has been stored in a variable, the variable can be used as a function
2. The function in expression is actually an anonymous function (a function without a name).
3. Functions stored in variables do not need function names. They are always invoked (called) using the variable name.

Function Expressions

```
var square = function(num) { return num * num; };  var b =
square(4); // 16
```

Notice that function above ends with semicolon because it is part of executable statement

Function Hoisting

1. Hoisting is JavaScript's default behavior of moving declarations to the top of the current scope.
2. Hoisting applies to variable declarations and to function declarations.
3. Because of this, JavaScript functions can be called before they are declared

Function Hoisting

```
var total = sum(5,6); //Calling before declaration
console.log("Sum = "+total);

function sum(a, b){  return a + b;
}
```

Arguments Passed by Value

1. Primitive data is passed by value: The function only gets to know the values, not the argument's locations.
2. If a function changes an argument's value, it does not change the parameter's original value.
3. Changes to arguments are not visible (reflected) outside the function.

Arguments Passed by Value

```
var num = 5;
function changeValue(a){
    a = 7;  // change to a will not affect num
}

changeValue(num);
console.log(num);//5, num will be be updated
```

Arguments Passed by Reference

1. In JavaScript, object references are values.
2. Non-primitive value such as Array or a user-defined object are passed by reference
3. If function changes the object's properties, that change is visible outside the function

Arguments Passed by Reference

```
var arr = [4, 6, 7, 9];
function updateArray(val){ // array received in val  val[1] = 57; //
    updating val will also update arr


}
console.log(arr[1]);
                                        // 6 before calling function
updateArray(arr);
console.log(arr[1]);
                                      // 57 after calling function
```

Arguments Passed by Reference

```
var obj = { name: "John", age:56 };
function updateObject(val){ // object received in val  val.age = 40; //
    updating val will also update arr
}


console.log(obj.age);                    // 56 before calling function
updateObject(obj);
console.log(obj.age);
                                         // 40 after calling function
```

Recursive Function

1. A recursive function is a function that calls itself.
2. Recursion is a technique for iterating over an operation by having a function call itself repeatedly until it arrives at a result.
3. In some ways, recursion is analogous to a loop. Both execute the same code multiple times, and both require a condition (to avoid an infinite loop, or rather, infinite recursion in this case)

Recursive Function

1. The classic example of a function where recursion can be applied is the factorial.
2. Factorial of a number n can be defined as product of all positive numbers less than or equal to n.
3. It is the multiplying sequence of numbers in a descending order till 1. It is defined by the symbol of exclamation (!).
4. E.g factorial of 6 is
    a. $6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

Recursive Function

```
function factorial(n) {  if (n <= 1) {
   // Recursion will stop when this condition match  return 1;
} else {
   return n * factorial(n - 1); // calling itself
}
}
```

Switch Statement

1. The switch statement executes a block of code depending on different cases.
2. The switch statement is a part of JavaScript's "Conditional" Statements, which are used to perform different actions based on different conditions.
3. Switch statement works for equality checks only, you can not apply range, greater than or less then checks

Switch Statement

4. This is how it works:
    a. The switch statement evaluates an expression.
    b. The value of the expression is then compared with the values of each case in the structure.
    c. If there is a match, the associated block of code is executed.
5. The switch has one or more case blocks and an optional default.

Switch Syntax

```
switch(expression) {
    case 'value1':   // same as if (expression === 'value1')
        // code block  break;

    case 'value2':
        // code block  break;

    default:
        // code block
}
```

Switch Statement

```
var day = 3;  switch (day) {

    case 6:
       console.log("Today is Saturday");  break;

    case 0:
       console.log("Today is Sunday");  break;

    default:

        console.log("Looking forward to the Weekend");
}
```

Switch - Grouping of case

1. Sometimes you will want different cases to use the same code, or fall-through to a common default.
2. If you skip the break and expression match to the case where there is no break then it will also fall-through the next case

Switch - Grouping of case

```
var day = 3;  switch (day) {
    case 6: // No break  console.log("Today is Saturday");
    case 0: // No break in last case, both will execute
       console.log("Today is Sunday");
       break;  default:
           console.log("Looking forward to the Weekend");
   }
```

Switch - Grouping of case

```
var day = 3;  switch (day) {

    case 6:

    case 0:
       console.log("Yaaaa! It's Weekend");  break;

    default:

        console.log("Looking forward to the Weekend");
}
```

Switch - Strict Comparison

1. Switch cases use strict comparison (===).
2. The values must be of the same type to match.
3. A strict comparison can only be true if the operands are of the same type.

Switch - Strict Comparison

```
var x = "0";  switch (x) {
    case 0:
        console.log("Off");  break;
    case 1:
        console.log("On");  break;
    default:   // this will execute as value did not match  console.log("No
        value found");
}
```

While loop

1. The while loop loops through a block of code as long as a specified condition is true.

Syntax:

```
while (condition) {
  // code block to be executed
}
```

While loop

1. In this example, the code in the loop will run, over and over again, as long as a variable (i) is less than 10:

```
while (i < 10) {  console.log("I " + i);  i++;
}
```

2. You will use while loop when execution is dependent on user input

Do/While loop

1. The do/while loop is a variant of the while loop. This loop will execute the code block once, before checking if the condition is true, then it will repeat the loop as long as the condition is true.
2. You will use do/while loop when execution is dependent on user input but it needs to run code block at least once

Do/While loop

Syntax:

```
do {
     // code block to be executed
}
while (condition);
```

Do/While loop

```
do {
    console.log("I " + i);  i++;

}
while (i < 10);
```