

<image/nation>

Tech Training Series

Exclusive for



HKU  
BUSINESS  
SCHOOL  
港大經管學院

# JavaScript Programming

(2024/2025)

## Introduction Level

*by*

Sunny NG

<image/nation>

To download the slides

[bit.ly/in-download](https://bit.ly/in-download)



# In this workshop (3 hours)

- Web Triangular

- HTML
- CSS
- JavaScript

- Basic Syntax

- HTML
- CSS
- JavaScript

- Browser Dev Tools

- Online Coding Playground

- Modern Code Editors

- What is JSON?

- Processing JSON Data

- Simple JS Data  
Visualization with JSON

# Sunny Ng 吳新陸



Master of Fine Art, CityU (HK)  
Master of Science, HKU  
Bachelor of Science, UH (UK)

- Founder / Master Trainer Image Nation
- Part-time Lecturer HKU, HKUSPACE, City University of Hong Kong
- Developer AI, Web, Mobile, WeChat & IoT
- Content Creator Video producing / Live streaming
- Certified Azure AI Engineer
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- [github.com/ngsanluk](https://github.com/ngsanluk)

# Required Software

Make sure you have the following software installed

1. Google Chrome Browser
2. Visual Studio Code
3. Node js

# Web Development Triangular

- HTML
- CSS
- JavaScript (JS)

A web page is a combination of codes in HTML, CSS & JavaScript files that rendered nicely by a browser

Popular browsers include Google Chrome, Firefox, Safari

# HTML



# HTML

- HyperText Markup Language
- The standard markup language for structuring and delivering web contents
- HTML5 is the latest version
- HTML5 is designed mobile friendly
- File name usually ends with **.html** extension (e.g. index.html)

# Some frequent used HTML tags

## Semantic Tags

Structuring web contents

`<main>`  
`<section>`  
`<article>`  
`<header>`  
`<footer>`  
`<aside>`  
`<nav>`  
`<figure>`

## Other tags

basic formatting function

`<h1>`, `<h2>`, `<h3>`, `<h4>`,  
`<h5>`, `<h6>`  
`<ul>`, `<ol>`, `<li>`  
`<a>`  
`<strong>`, `<b>`, `<em>`, `<i>`  
`<video>`, `<audio>` and  
`<canvas>`  
`<div>`, `<span>`



# HTML5 sample codes

```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="utf-8">
    <title>Demo</title>
  </head>
  <body>
    <nav>Navigation Menu</nav>
    <section>Main content ...</section>
    <aside>side column</aside>
    <footer>footer navigation menu</footer>
  </body>
</html>
```

# CSS



# CSS

- Cascading Style Sheet
- A style sheet language used for styling the presentation of a web document written in a HTML
- The latest version is **CSS3**
- CSS3 offers rich visual effect including animation and transition
- File name usually ends with **.css** extension (e.g. master.css)

# CSS sample codes

```
nav {  
  background: #CCCCCC;  
}
```

Tag selector

```
#main-content {  
  padding: 2em;  
}
```

ID selector. Starts with #

```
.product-photo {  
  width: 100%;  
}
```

Class selector. Starts with .

```
nav ul li a {  
  padding: 1em;  
}
```

Nested selector.

JS



# JavaScript (JS)

- Alongside HTML and CSS, JavaScript is one of the three core technologies of the web content production
- JavaScript handles user interaction and dynamic content loading from server side
- Started as a front-end tool, JavaScript recently is also popular for back-end development ([Node.js](#))
- File name usually ends with **.js** extension (e.g. app.js)

# JavaScript sample codes

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

```
sum(10, 20);  
sum(100, 200);
```

# ECMAScript

- ECMAScript (or ES) is a trademarked scripting-language specification standardized by Ecma International (European Computer Manufacturers Association)
- Browser vendors follow ECMAScript's specification to implement JavaScript features for their browsers
- Current browsers vendor widely support ES5 edition
- Coming version is ES6 (also widely referred as ES2015)
- ES7 is also under early development (also referred as ES2016)

# ECMAScript Editions

Year	Name	Description
1997	ECMAScript 1	First Edition.
1998	ECMAScript 2	Editorial changes only.
1999	ECMAScript 3	Added Regular Expressions. Added try/catch.
	ECMAScript 4	Was never released.
2009	ECMAScript 5	Added "strict mode". Added JSON support.
2011	ECMAScript 5.1	Editorial changes.
2015	ECMAScript 6	Added classes and modules.
2016	ECMAScript 7	Added exponential operator (**). Added Array.prototype.includes.

# ECMAScript browser support

- ECMAScript 3 is fully supported by all browsers
- **ECMAScript 5 is fully supported in all modern browsers**
  - When we say modern browsers, we mean the browsers that offer good support to HTML5, CSS3 and ES5
- ECMAScript 6 (ES6) is partially supported in most modern browsers
- ECMAScript 7 is poorly supported in all browsers



# ES6 is widely used

- Many web developments support ES6 as development language since ES6 solve many major problems of previous version and therefore benefits development process in great deal.
- Coded in ES6 will however be converted to ES5 by development for better compatibility at run time
- The process of converting is known as **transpiling**

# TypeScript (TS)

- TypeScript is a free and open-source programming language developed and maintained by **Microsoft**
- It is a strict **superset** of JavaScript, and adds **optional static typing** and class-based object-oriented programming to the language

```
class Person {  
    private name: string;  
    private age: number;  
    private salary: number;  
  
    constructor(name: string, age: number, salary: number) {  
        this.name = name;  
        this.age = age;  
        this.salary = salary;  
    }  
  
    toString(): string {  
        return `${this.name} (${this.age}) (${this.salary})`;  
    }  
}
```

# Remember we said?

A web page is a combination of coding in **HTML**, **CSS** & **JavaScript** files that rendered nicely by a browser.

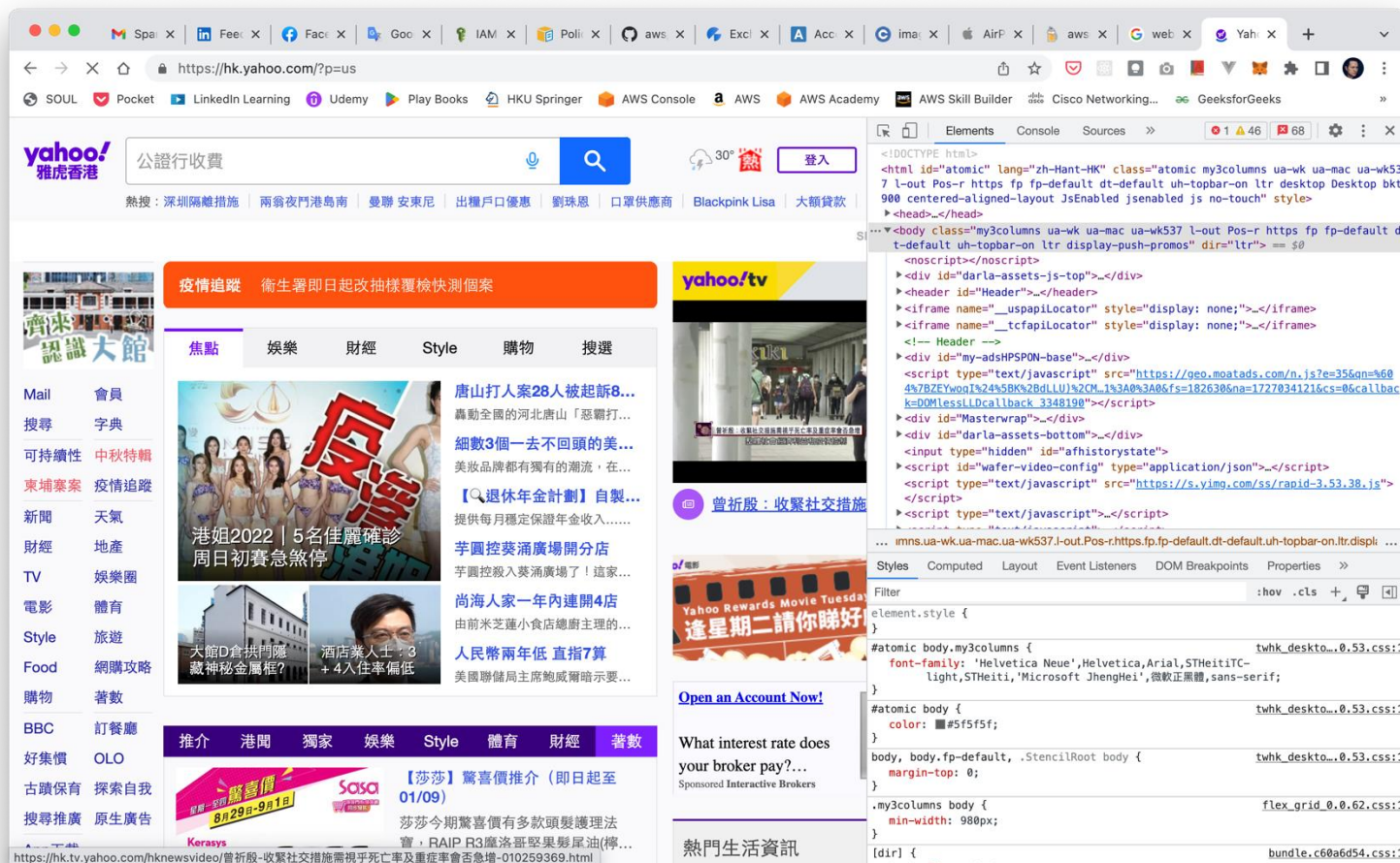
# HTTP Request & Response



Response from server is usually a combination of HTML, CSS, JS and images

Let's do some hacking on  
HTML, CSS & JavaScript  
(Just for fun. Absolutely legal.)

# Open yahoo.com in Google Chrome & Use Dev Tools

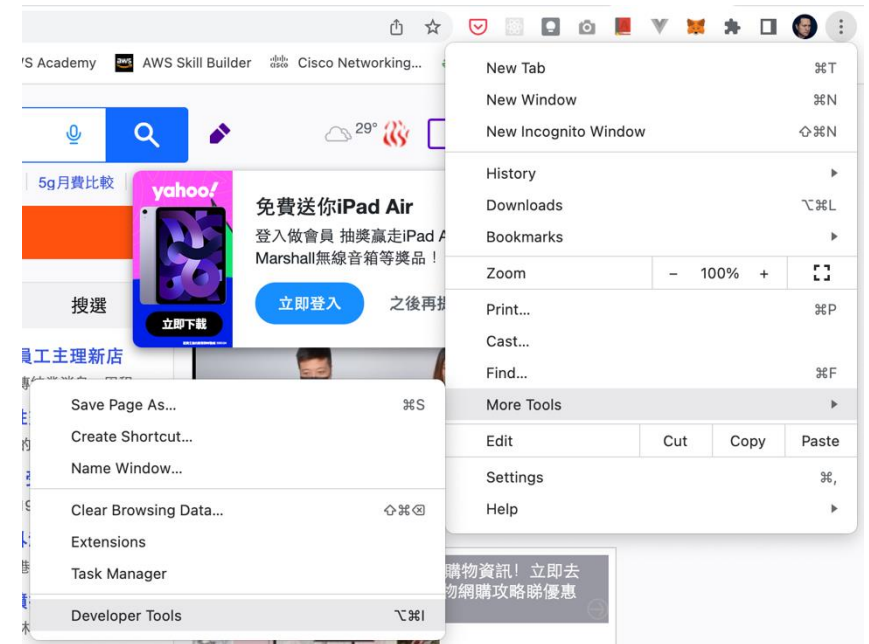


# To Open Chrome Dev Tools

- At Google Chrome menu, go to **View -> Developer -> Developer Tool**

- Or use keyboard shortcut
  - Mac: **CMD + SHIFT + C**
  - Windows: **CTRL + SHIFT + C**

- Or click at the  button, chose **More Tools -> Developer Tools**





Developer Tools - https://www.google.com/search?safe=active&site=&tbm=isch&source=hp&ei=1Di-WJCALcPW8QWWqLPgAQ...

Elements Console Sources Network Timeline Profiles Application Security Audits

<!DOCTYPE html>  
<html itemscope itemtype="http://schema.org/SearchResultsPage" lang="en">  
 <head>...</head>  
 <body class="srp tbo vasq wf-b" marginheight="3" topmargin="3" id="gsr"> == \$0  
 <div data-jiiis="cc" id="doc-info"></div>  
 <div data-jiiis="cc" id="cst">...</div>  
 <noscript><style>.nojsv{visibility:visible}</style></noscript>  
 <script>if(google.j.b)document.body.style.display='none';</script>  
 <textarea name="csi" id="csi" style="display:none"></textarea>  
 <a href="/setprefs?suggon=2&prev=https://www.google.com/search?safe%3Dactive%26...s-  
img..1.4.407.3..35i39k1.wbJJPyiShME&sig=0\_0eqPsuJXpMfptEdHynfqAyuQ2eA%3D" style=  
"left:-1000em;position:absolute">Screen reader users, click here to turn off Google  
Instant.</a>  
 <noscript>...</noscript>  
 <style>...</style>  
 <div class="\_zjd\_GWd" aria-hidden="true">...</div>  
 <script>...</script>  
 <div id="searchform" class="jsrp big">...</div>  
 <div class="sfbqx"></div>  
html body#gsr.srp.tbo.vasq.wf-b

Styles Computed Event Listeners >>  
Filter :hov .cls +  
element.style {  
}  
body { search?safe=act...obile-gws-...:10  
color: #222;  
}  
.g, search?safe=act...obile-gws-...:10  
body, html, input, .std, h1 {  
font-size: small;  
font-family: arial,sans-serif;  
}  
body { search?safe=act...obile-gws-...:10  
background: #fff;  
}  
body { search?safe=act...obile-gws-...:10  
color: #000;

Console

top Preserve log

Mixed Content: The page at 'https://www.google.com/search?safe=active&site=&tbm=isch&source=hp&ei=1Di-W...hME#safe=active&tbm=isch&q=ionic++cordova+app+stack&\*&imgsrc=AEZ7qEZ0-STfLM:' was loaded over HTTPS, but requested an insecure image 'http://ionicframework.com/img/blog/habitrpg-app-preview.png'. This content should also be served over HTTPS.

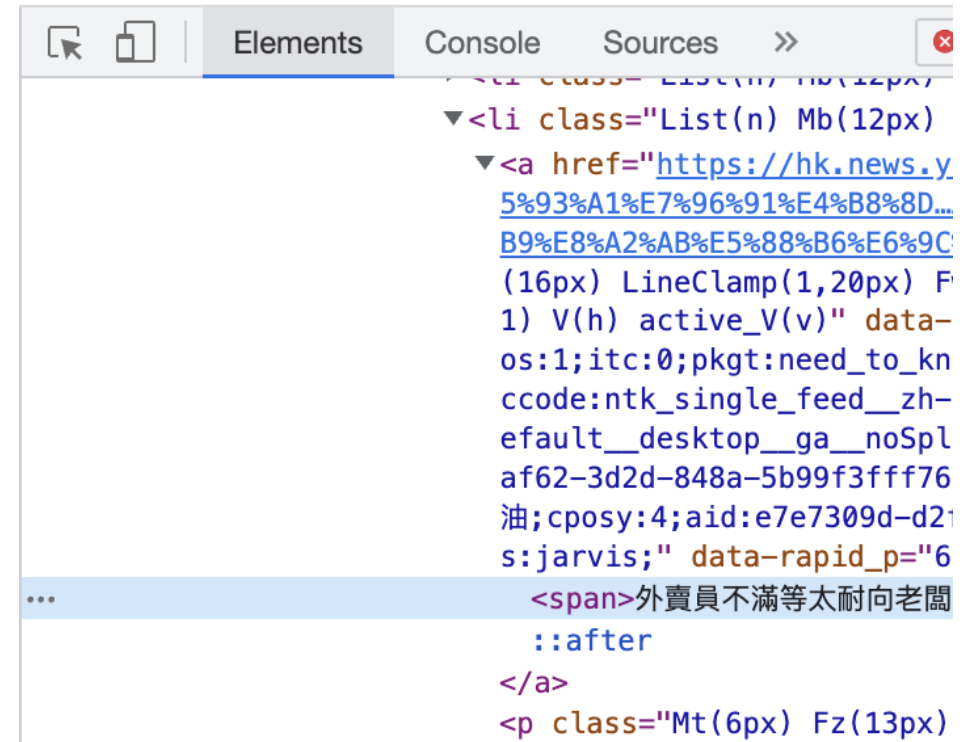
/search?safe=active&site=&tbm=isch&source=hp&ei=1Di-WJCALcPW8QWWqLPgAQ&q=Rw...#safe=active&tbm=isch&q=ionic++cordova+app+stack&\*&imgsrc=AEZ7qEZ0-STfLM::1

Mixed Content: The page at 'https://www.google.com/search?safe=active&site=&tbm=isch&source=hp&ei=1Di-W...hME#safe=active&tbm=isch&q=ionic++cordova+app+stack&\*&imgsrc=AEZ7qEZ0-STfLM:' was loaded over HTTPS, but requested an insecure image 'http://www.angularminds.com/site\_data/images/ionic/ionic-framework-services.png'. This content should also be served over HTTPS.



# Hack #1: Modify HTML contents

- Choose **Elements** tab
- Double-click any DOM object and make some changes
  - DOM: **D**ocument **O**bject **M**odel
- You will see result on the browser



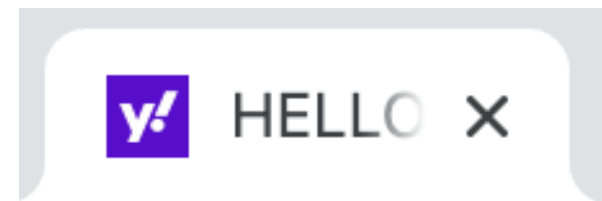
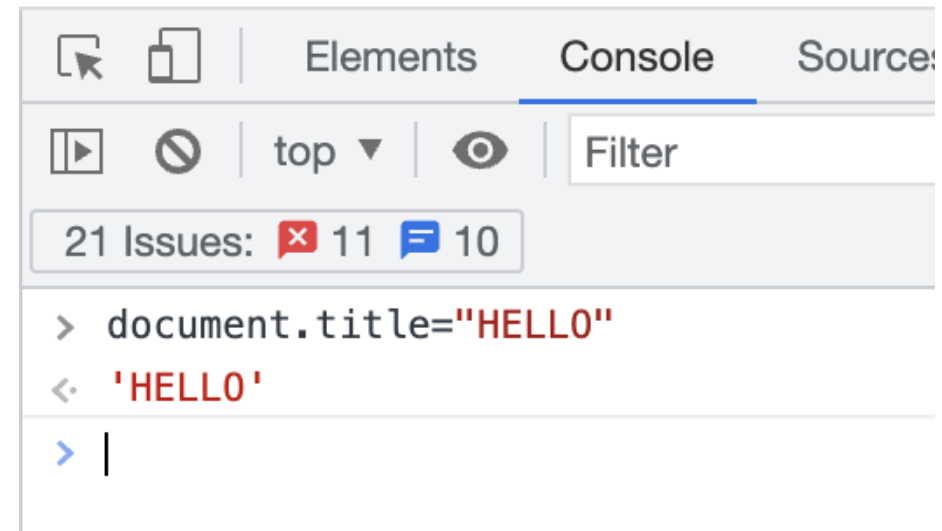
# Hack #2: Modify CSS styles

- Right-click at any **news title** on web page content and choose **Inspect**
- Choose **Styles** tab
- In the **Styles** tab, scroll all the way till you see `color` property
- Change the color to `green`

Styles	Computed	Layout	Event Listeners	DOM Breakpoints
Filter				
#atomic .C\\(\\#324fe1\\) { color: ■ #324fe1; }				
#atomic .Td\\(n\\) { <input checked="" type="checkbox"/> text-decoration: ▶ none; }				
#atomic .Fw\\(700\\) { font-weight: <del>700</del> ; }				
#atomic .Td\\(n\\), #atomic .Td\\(n\\)\\:f:focus { text-decoration: ▶ none; }				

# Hack #3: Code some JavaScript

- Choose **Console** tab
- Type the following statement
  - `document.title="HELLO"`
- You will see the title of the browser tab change to "Hello"



# Online Coding Playground

for HTML / CSS / JavaScript quick testing

# JSFiddle

jsfiddle.net

Let's have  
some fun by  
building a  
mini web  
apps

The screenshot shows the JSFiddle interface with the following code:

```
HTML
1 <div class="wrapper">
2   <div class="box a">A</div>
3   <div class="box b">B</div>
4   <div class="box c">C</div>
5   <div class="box d">D</div>
6   <div class="box e">E</div>
7   <div class="box f">F</div>
8 </div>
```

```
CSS
1 body {
2   padding: 20px;
3   font-family: Helvetica;
4 }
5
6 .wrapper {
7   display: grid;
8   grid-template-columns: repeat(auto-fit, minmax(200px, 1fr));
9   grid-gap: 10px;
10 }
11
12 .box {
13   background-color: #20262e;
14   color: #fff;
15   border-radius: 3px;
16   padding: 20px;
17   font-size: 14px;
18 }
```

```
JavaScript + No-Library (pure JS)
1
```

The preview shows a 2x3 grid of boxes labeled A through F, each with a dark background and white text.

# Lucky Draw Mini Game

HTML ▼

```
1 <h1>Lucky Draw</h1>
2 <hr>
3 <div id="lucky-number">?</div>
4 <hr>
5 <button onclick="play()">PLAY</button>
```

CSS ▼

≡ Tidy

```
1 #lucky-number {
2   font-size: 1200%;
3   color: #CC0000;
4 }
5
6 body {
7   text-align: center;
8 }
```

JavaScript + No-Library (pure JS) ▼

```
1 function play() {
2   luckyNumber = document.getElementById("lucky-number");
3   luckyNumber.innerHTML = Math.floor(Math.random() * 11 + 10);
4
5 }
```

## Lucky Draw

---

?

---

PLAY

# Completed Codes

- <https://jsfiddle.net/sunnyng/trsa271m/25/>

**Lucky Draw**



PLAY

# Other Popular Online Coding Playground



# CodePen

codepen.io

The screenshot displays the CodePen website interface. On the left is a dark sidebar with navigation links: 'YOUR' (Activity, Pins, Dashboard, Profile) and 'EXPLORE' (Pens, Projects, Posts, Collections, Spark, Jobs, Challenges, Blog, Documentation, Support). The main content area has a top navigation bar with 'CODEPEN' and buttons for 'Search' and 'Create'. Below this is a search bar containing 'icon set'. Under the search bar are tabs for 'Pens', 'Projects', 'Posts', and 'Collections'. Further down are filters for 'ORDER RESULTS BY' (set to 'Relevance & Popularity'), 'SEARCH DEPTH' (set to 'Everything'), and 'FORKS' (with an 'Include forks' checkbox). The search results are displayed in a grid of six cards. Each card shows a preview of the icon set, the title, the author's name and profile picture, and engagement metrics (views, comments, and likes). The cards are: 1. 'Pure CSS Iconex Flat Icon Set' by Alireza Attari (16,768 views, 3 comments, 75 likes). 2. 'Zurb Foundicon Cheat Sheet' by tylersnyder (13,397 views, 1 comment, 113 likes). 3. 'CSS3 Monochrome Icon Set Linkable' by Brad Bodine (3,658 views, 0 comments, 34 likes). 4. 'Pure CSS Icon Set' by Alireza Attari (2,612 views, 1 comment, 31 likes). 5. 'App Icon - Setting' by nicolazj (2,093 views, 0 comments, 62 likes). 6. 'free css icon set' by airpwn (1,115 views, 0 comments, 14 likes).

CODEPEN

Search

Create

YOUR

- Activity
- Pins
- Dashboard
- Profile

EXPLORE

- Pens
- Projects
- Posts
- Collections
- Spark
- Jobs
- Challenges
- Blog
- Documentation
- Support

SEARCH

icon set

Pens Projects Posts Collections

ORDER RESULTS BY: Relevance & Popularity

SEARCH DEPTH: Everything

FORKS: ☐ Include forks

Pure CSS Iconex Flat Icon Set

Alireza Attari

16,768 3 75

Zurb Foundicon Cheat Sheet

tylersnyder

13,397 1 113

CSS3 Monochrome Icon Set Linkable

Brad Bodine

3,658 0 34

Pure CSS Icon Set

Alireza Attari

2,612 1 31

App Icon - Setting

nicolazj

2,093 0 62

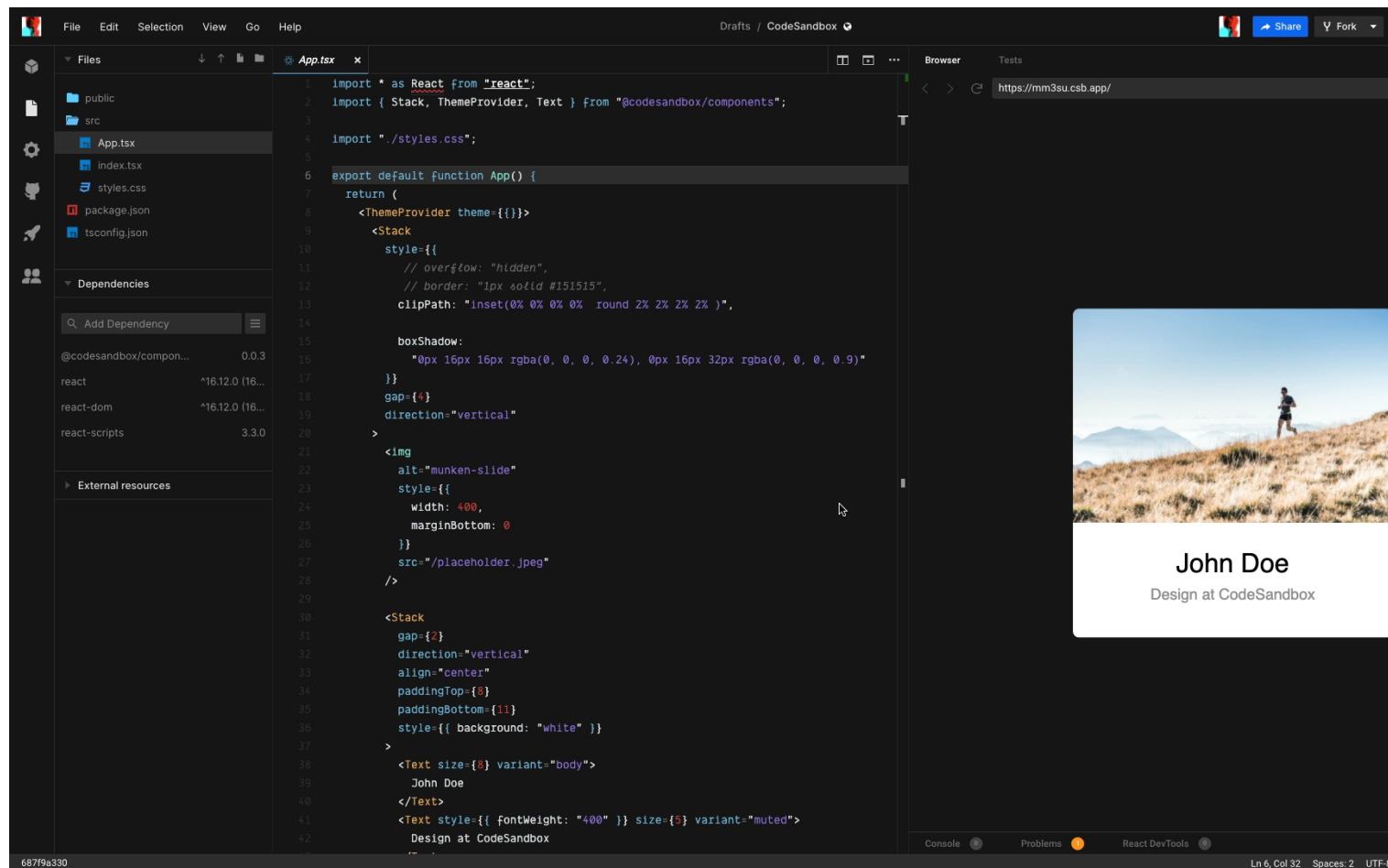
free css icon set

airpwn

1,115 0 14

# CodeSandbox

codesandbox.io



# Web Dev Tools

# Web Dev Tools

## ■ Modern Web Browsers

- Chrome, Firefox, Safari, Edge

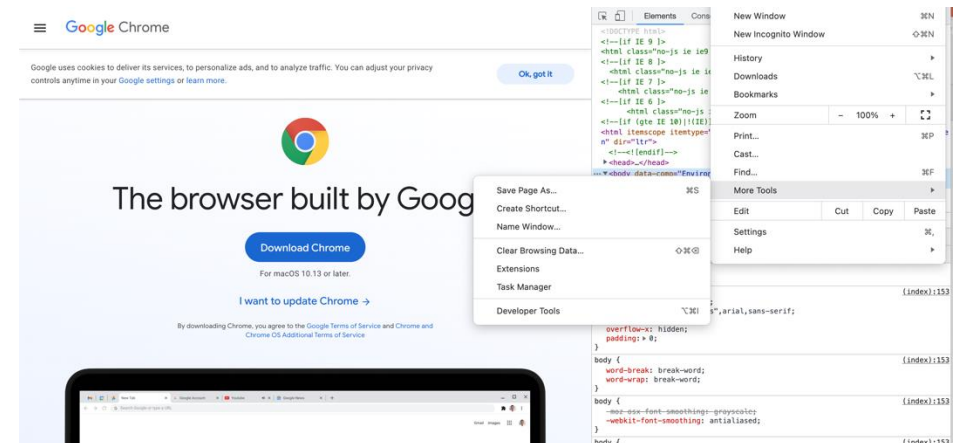
## ■ Modern Code Editors

- VS Code, Atom

## ■ Node.js

# Google Chrome Browser

- Rich Web Development Features
- Download link
  - [https://www.google.com/intl/en\\_hk/chrome/](https://www.google.com/intl/en_hk/chrome/)



# Modern code editors

A modern code editor should provide the following features

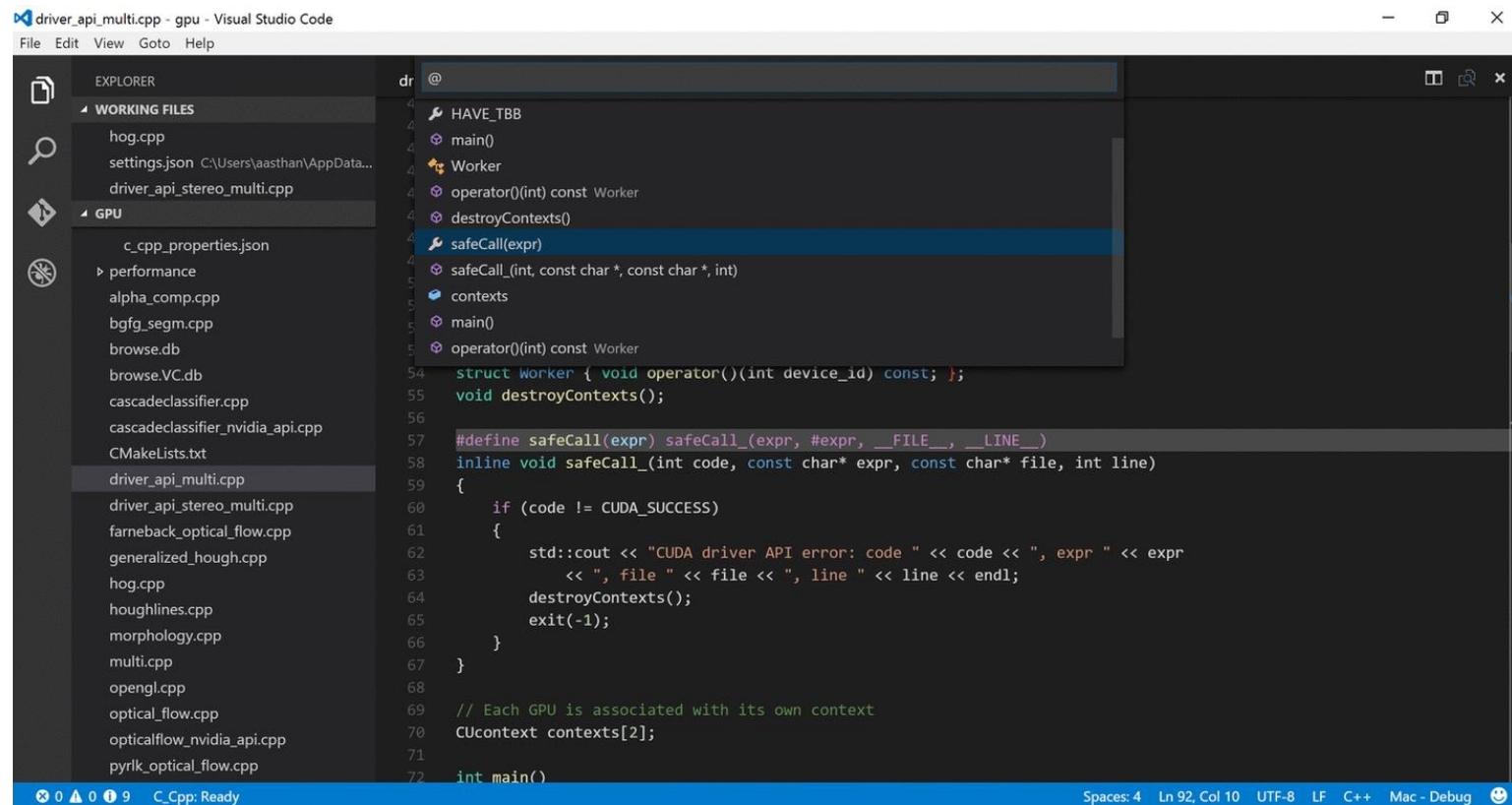
- Opens **project folder** instead of individual file
- Supports many programming languages
- Provides codes completion
- Code colored / highlighted
  - for better readability and more visible errors prompts
- Rich keyboard shortcuts to speed up coding in great deal
- Multiple lines editing
- Rich extension / add-ons / packages to extend code editor's capability

# Popular code editors

- **Visual Studio Code** (a free code editor from Microsoft)
- **Atom** (a free code editor from Github)
- **Sublime** (commercial)
- **WebStorm** (commercial)

# Visual Studio Code

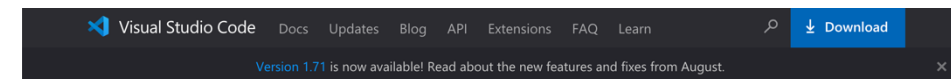
<https://code.visualstudio.com/>





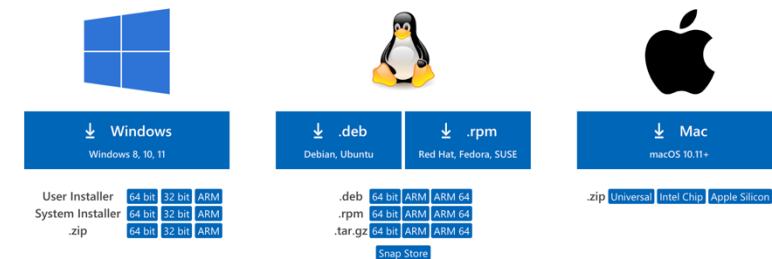
# Visual Studio Code Download

- Visual Studio Code is one of the most popular modern code editor
- We will use VS Code for HTML, CSS and JS coding
- Download link
  - <https://code.visualstudio.com/download>



## Download Visual Studio Code

Free and built on open source. Integrated Git, debugging and extensions.



# Atom ATOM

- Download at
  - <http://www.atom.io/>
- Download the right version for your operation system
- Follow the installer suggested setting and complete the installation


# Node.js

- <https://nodejs.org/>
- Node.js is an open-source, cross-platform **JavaScript runtime environment** for developing a diverse variety of server tools and applications
- A lot time, Node.js is running **behind the scene** when working on web development



# Node.js Download

- Download link
- <https://nodejs.org/en/download/>






The screenshot shows the Node.js website's download section. At the top is a dark navigation bar with the Node.js logo and links for HOME, ABOUT, DOWNLOADS, DOCS, GET INVOLVED, SECURITY, CERTIFICATION, and NEWS. Below this, the 'Downloads' section is highlighted. It states the latest current version is 18.8.0 (including npm 8.18.0) and encourages downloading the source code or a pre-built installer. Two main tabs are visible: 'LTS' (Recommended For Most Users) and 'Current' (Latest Features). Under the 'LTS' tab, there are links for 'Windows Installer' (node-v18.8.0-x86.msi), 'macOS Installer' (node-v18.8.0.pkg), and 'Source Code' (node-v18.8.0.tar.gz). Under the 'Current' tab, there are links for 'Windows Installer (.msi)', 'Windows Binary (.zip)', 'macOS Installer (.pkg)', 'macOS Binary (.tar.gz)', 'Linux Binaries (x64)', 'Linux Binaries (ARM)', and 'Source Code'. A table below these links lists various architectures: 32-bit, 64-bit, 64-bit / ARM64, ARMv7, and ARMv8, with a link to node-v18.8.0.tar.gz for the ARMv8 architecture.

**Downloads**

Latest Current Version: 18.8.0 (includes npm 8.18.0)

Download the Node.js source code or a pre-built installer for your platform, and start developing today.

LTS Recommended For Most Users	Current Latest Features	
 Windows Installer node-v18.8.0-x86.msi	 macOS Installer node-v18.8.0.pkg	 Source Code node-v18.8.0.tar.gz

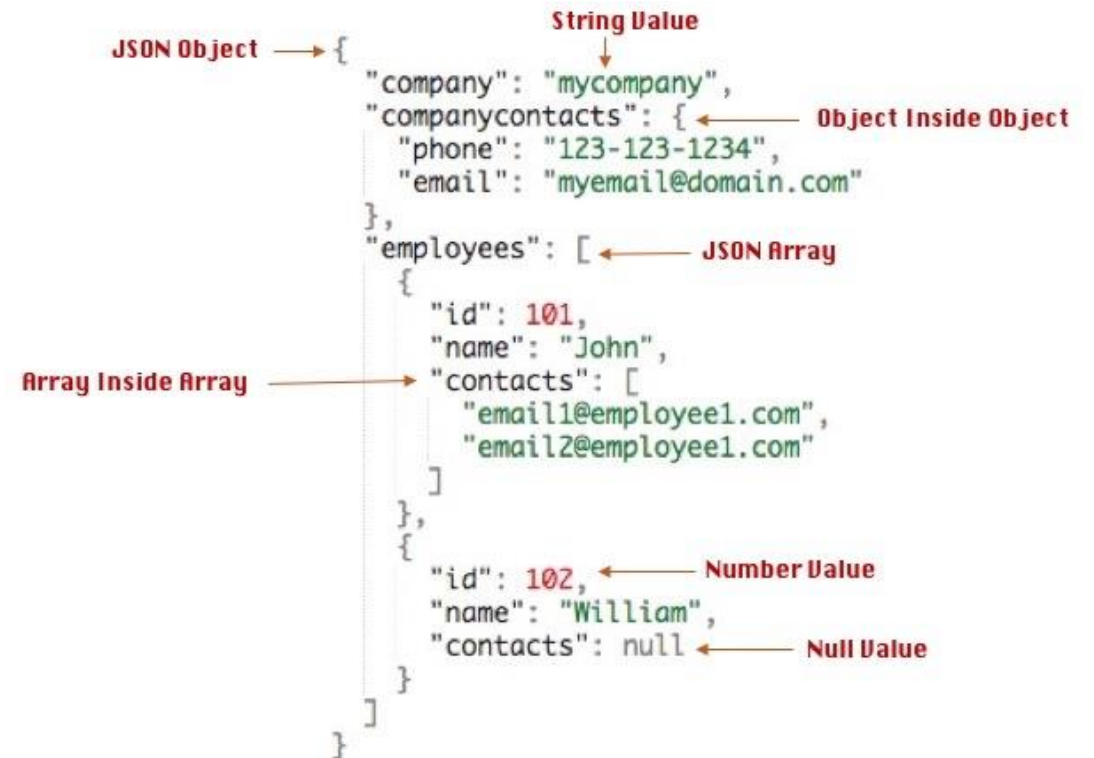
Windows Installer (.msi)	32-bit	64-bit
Windows Binary (.zip)	32-bit	64-bit
macOS Installer (.pkg)	64-bit / ARM64	
macOS Binary (.tar.gz)	64-bit	ARM64
Linux Binaries (x64)	64-bit	
Linux Binaries (ARM)	ARMv7	ARMv8
Source Code	node-v18.8.0.tar.gz	

# JSON

JavaScript Object Notation

# JSON

- JSON (JavaScript Object Notation) is an open standard file format and **data interchange format** that are user friendly
- JSON is just some plain text that follow certain format
- Programming language-independent
- It was derived from JavaScript, but many modern programming languages include code to generate and parse JSON-format data.
- JSON filenames use the extension **.json**

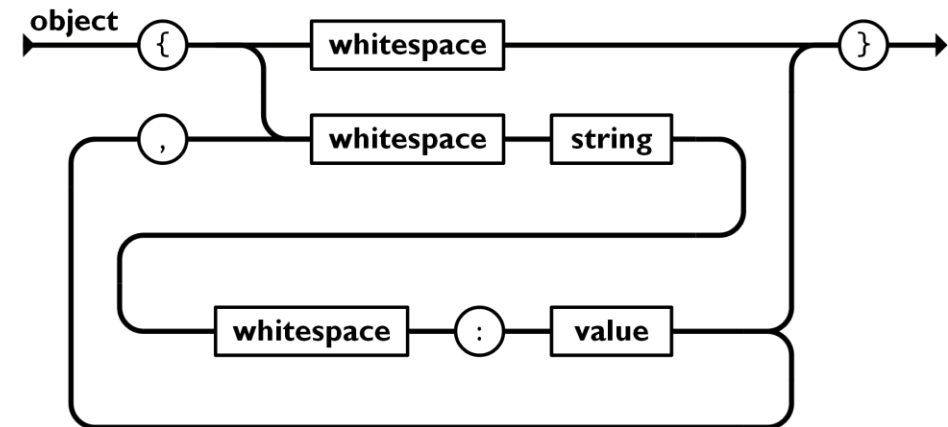


```
{
  "company": "mycompany",
  "companycontacts": {
    "phone": "123-123-1234",
    "email": "myemail@domain.com"
  },
  "employees": [
    {
      "id": 101,
      "name": "John",
      "contacts": [
        "email1@employee1.com",
        "email2@employee1.com"
      ]
    },
    {
      "id": 102,
      "name": "William",
      "contacts": null
    }
  ]
}
```

# JSON Syntax

<https://www.json.org/json-en.html>

- { }
  - Object
- [ ]
  - Array of objects
- JSON is nested, one can have
  - An object that contains array
  - An array that contains objects



# JavaScript Object $\neq$ JSON

## JavaScript object

```
{firstname : "Sam",  
  lastname : "Fernandes"}
```

↑  
Key

↑  
Value

(Need not be enclosed  
within double quotes)

## JSON object

```
{"firstname" : "Sam",  
  "lastname" : "Fernandes"}
```

↑  
Key

↑  
Value

(Must be enclosed  
within double quotes)



<https://jsonlint.com/>  
a good place to practicing JSON

# A place to practice JSON

<https://jsonlint.com/>

```
1 {  
2   "id": 1001,  
3   "name": "Jack"  
4 }
```

Validate JSON

Clear

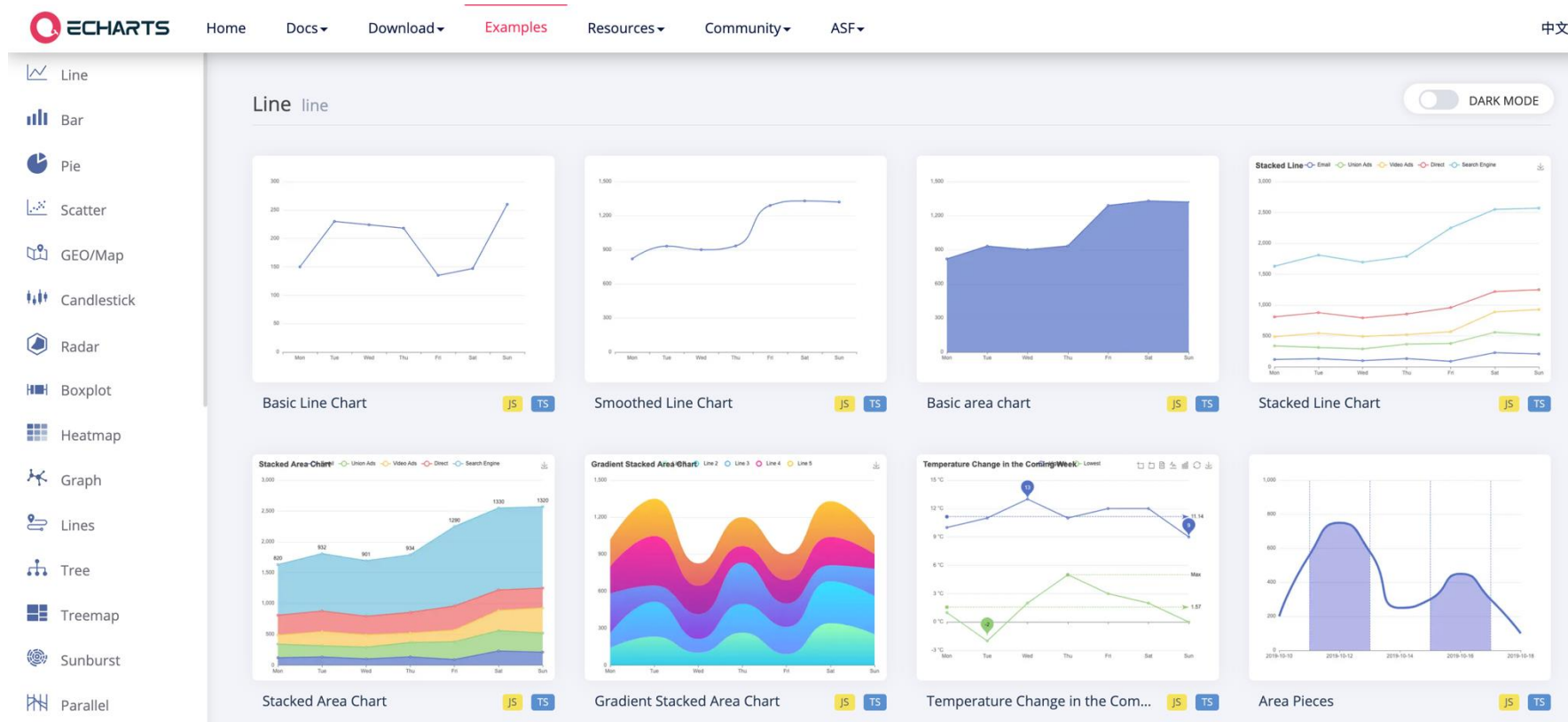
Support JSONLint for \$2/Month

# APACHE ECHARTS

Experience JS Data Visualization with JSON

# ECHARTS Examples

<https://echarts.apache.org/examples/en/>



# ECHARTS Getting Started

<https://echarts.apache.org/handbook/en/get-started/>

## Including ECharts

---

Create a new `index.html` file in the directory where you just saved `echarts.js`, with the following content:

```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="utf-8" />
    <!-- Include the ECharts file you just downloaded -->
    <script src="echarts.js"></script>
  </head>
</html>
```



# Build an ECHARTS from Scratch

**Follow the instructions on the page below**

<https://echarts.apache.org/handbook/en/get-started/>

# Source Codes Download

`bit.ly/in-js-intro`

# What's Next?

## JS Intermediate Level

Coming Soon ...



# JS Intermediate Level (3 hours)

## ■ JavaScript Syntax

- Variables
- Operators
- Arithmetic
- Data Types
- Functions
- Objects
- Array

## ■ Fetch API

## ■ JSON Processing

## ■ JS Data Visualization

- Apache eCharts
- Google Charts
- D3.js
- Observable HQ

Thank You!