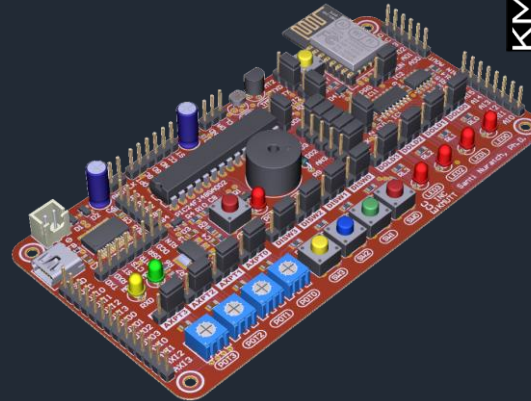
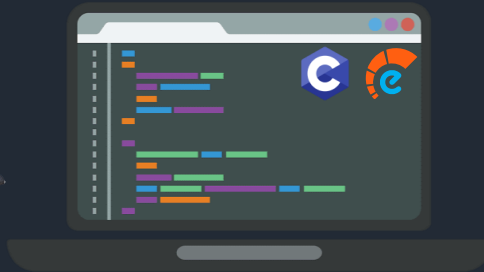
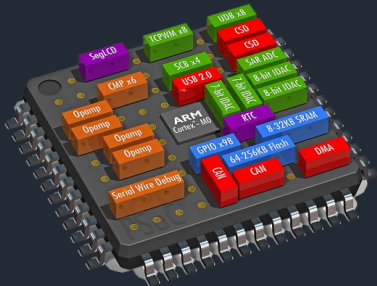


INC281  
2020



Asst.Prof.Dr.Santi Nuratch

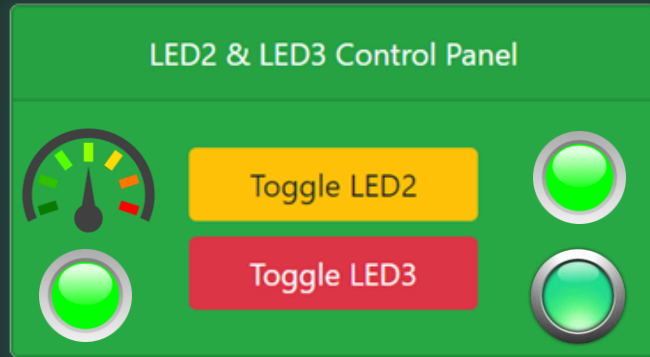
Embedded Computing and Control Lab. @ INC-KMUTT

[santi.inc.kmutt@gmail.com](mailto:santi.inc.kmutt@gmail.com)

Department of Control System and Instrumentation Engineering,  
King Mongkut's University of Technology Thonburi, **KMUTT**

# Develop your own IoT applications

## Web-based Application

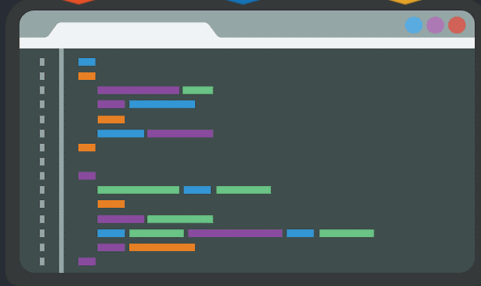
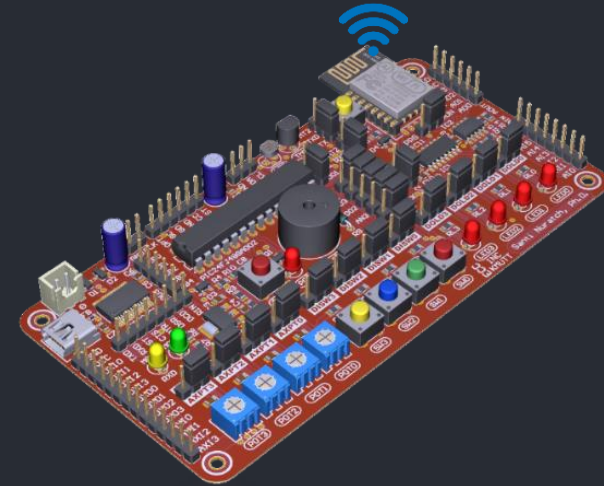


## Internet

HTTP  
WebSockets  
MQTT



## IoT Device



# Develop your own IoT applications

60%



Programming

20%



Documents

20%



Presentation

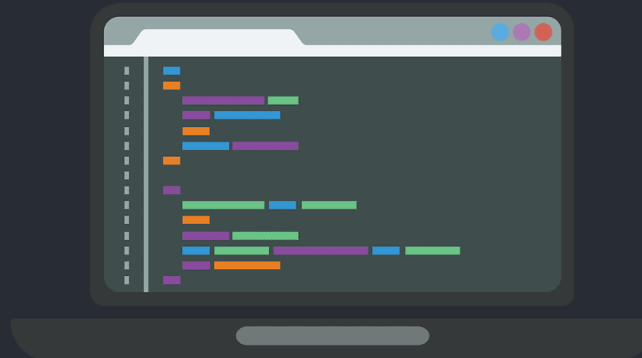
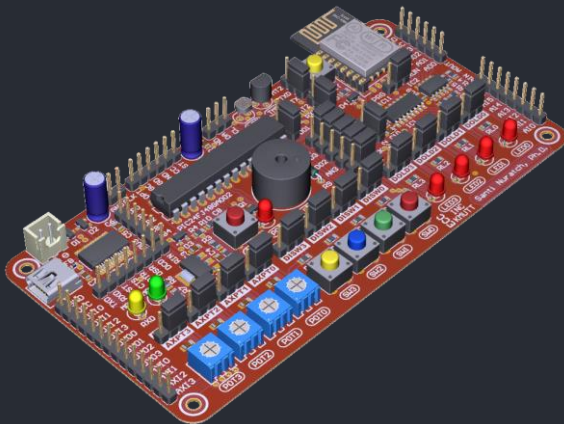
## What is your project?

(Design and submit the 1<sup>st</sup> document next week!)

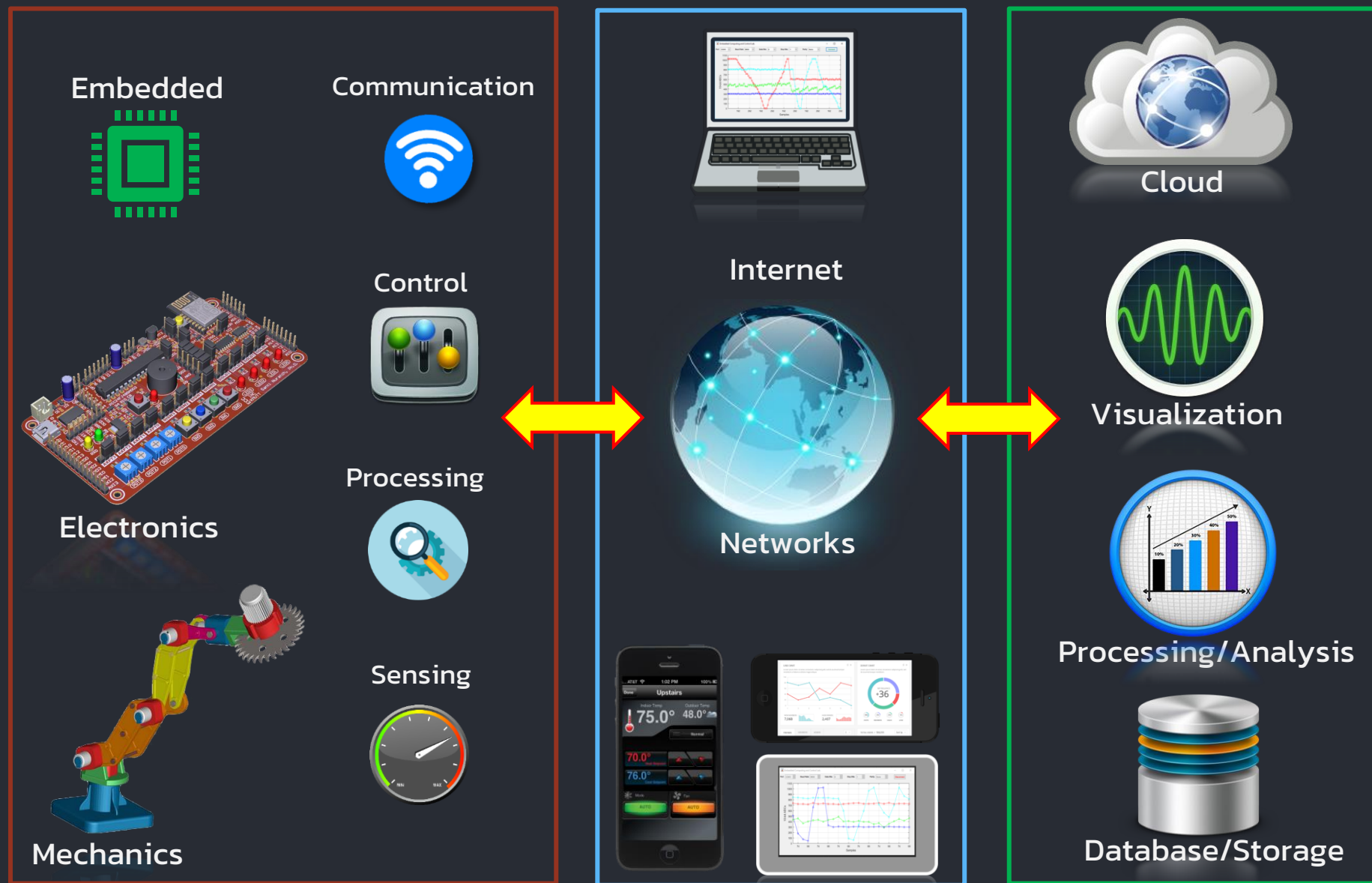
24 March, 2020

20%

1. Hardware: Block diagram, circuit, description (in-depth details)
2. Software: Graphics User Interface, function description (in-depth details)



# IoT Application Components



## IoT Device

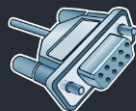


- Electronic Circuits (Sensors/Actuators)
- Microcontroller Circuit & System
- Embedded C Programming

### Embedded Programming

Embedded C

Algorithms



## IoT Application



- Web/GUI Design (HTML, CSS)
- JavaScript Programming (ES6)
- Web-based Control & Data Visualization

### Web (Client/Server) Programming

Web

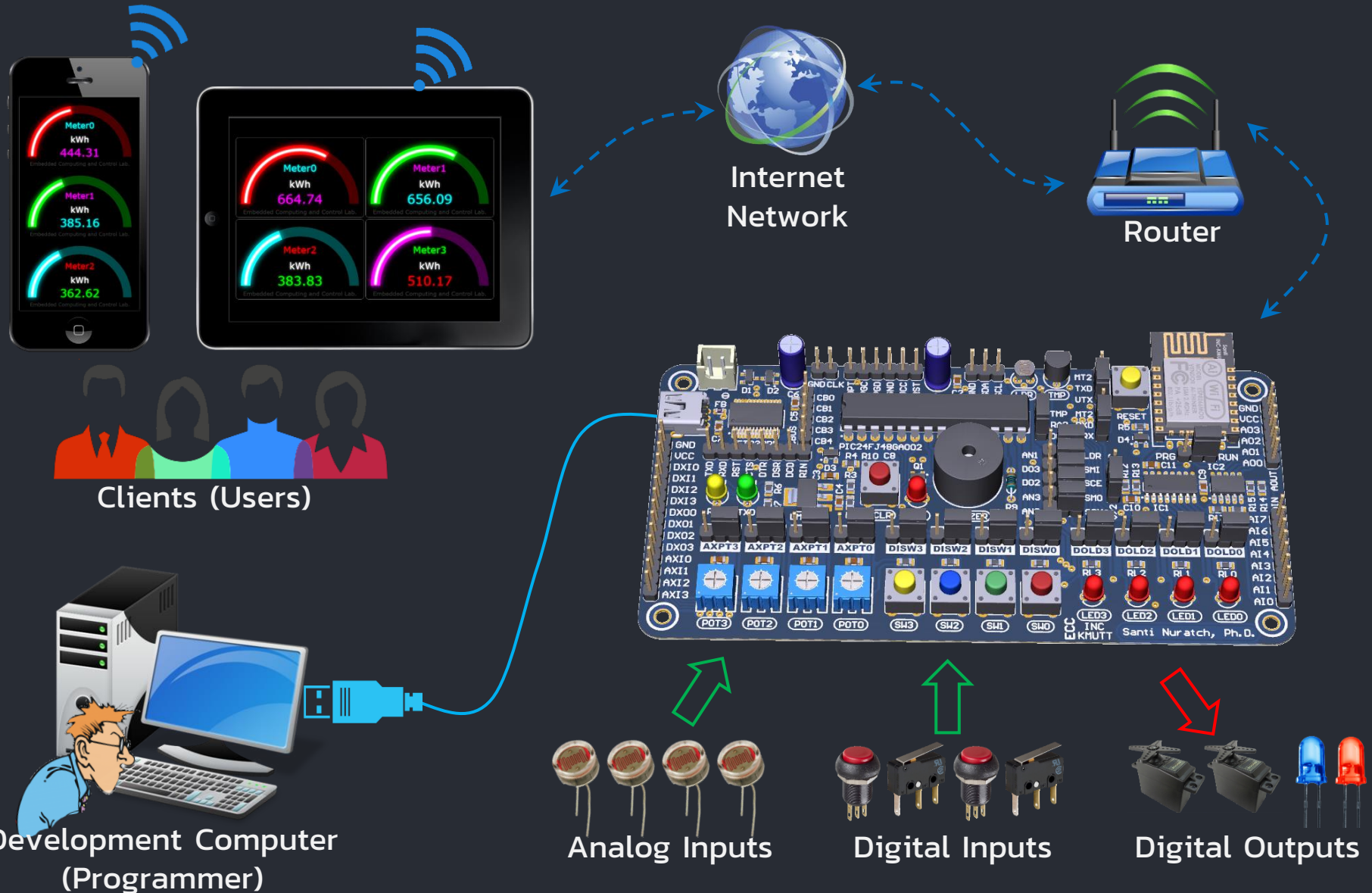
Node.js

MongoDB





# We integrate hardware and Software



# INC281/2 Learning Topics

This is the second section of the INC281. We focus on the basics of Web-based application development, Web-based programming. Three main parts to be studied in this section.

15% 1. **HTML** (Hypertext Markup Language)

15% 2. **CSS** (Cascading Style Sheet)

30% 3. **JavaScript**

60%



Programming

20%



Documents

20%



Presentation

**HTML** is the markup language that we use to structure and give meaning to our web content, for example defining paragraphs, headings, and data tables, or embedding images and videos in the page.

```
<html><head><title>INC281</title></head><body><h1>Welcome to Web Programming</h1></body></html>
```

**CSS** is a language of style rules that we use to apply styling to our HTML content, for example setting background colors and fonts, and laying out our content in multiple columns.

```
body{background-color: red; color: red; font-family: Helvetica; text-align: center; padding: 3px 10px;}
```

**JavaScript** is a scripting language that enables you to create dynamically updating content, control multimedia, animate images, and pretty much everything else.

```
let h1 = document.querySelector("h1"); h1.addEventListener("click", ()=>{h1.textContent="Hello INC281"});
```



# Code Editor and Extension

We use the **VSCode** and **Live Server** to develop our applications. Also, a Web browser, e.g., **Google Chrome** or **Mozilla Firefox**, is required.



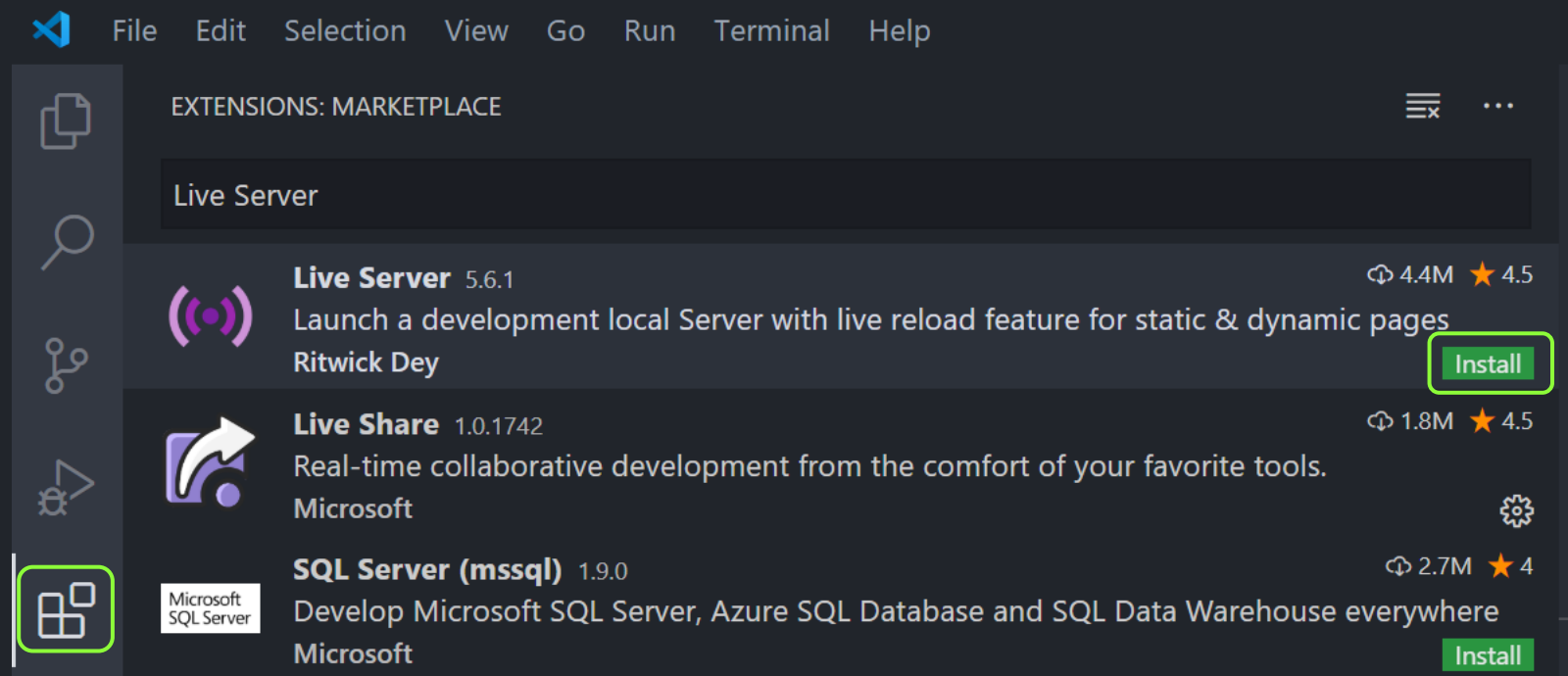
1. Download and install the VSCode



2. Install the Live Server extension

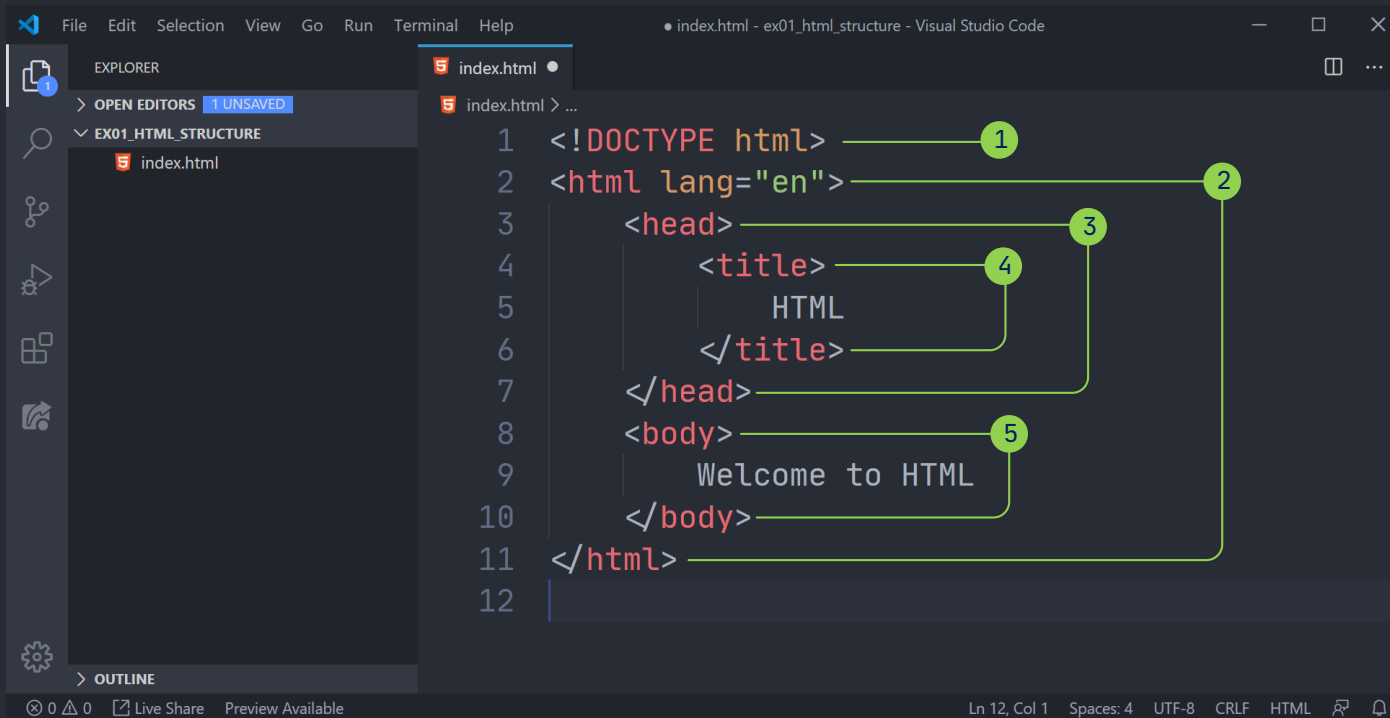


3. Download and install the Google Chrome or Mozilla Firefox



# Create a new Project

- 1) Create a new directory (folder), "ex01\_html\_structure.html"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "index.html" and add the lines of code



The screenshot shows the Visual Studio Code interface with a file named 'index.html' open. The code is as follows:

```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       HTML
6     </title>
7   </head>
8   <body>
9     Welcome to HTML
10  </body>
11 </html>
```

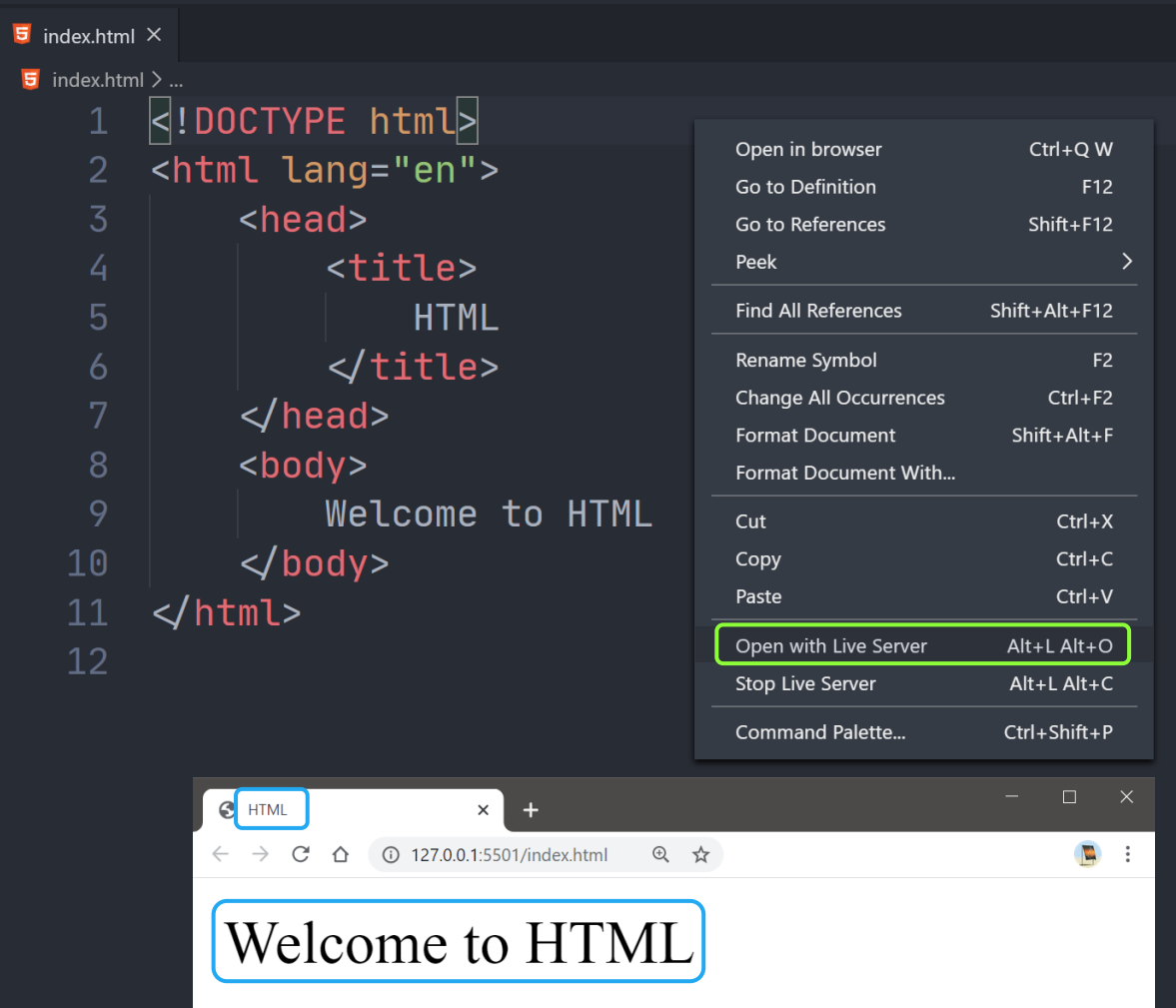
Numbered annotations (1-5) are placed on the code:

- 1: Points to the `<!DOCTYPE html>` declaration.
- 2: Points to the `<html lang="en">` opening tag.
- 3: Points to the `<head>` opening tag.
- 4: Points to the `<title>` opening tag.
- 5: Points to the `<body>` opening tag.

- 1 The `<!DOCTYPE>` type declaration must be the very first thing in your HTML document
- 2 Declares the webpage to be written in **HTML**
- 3 Delimits the webpage's **head**
- 4 Defines the webpage's **title**
- 5 Delimits the webpage **body**

# Check the result on the Web browser

- 1) Save the code (**CRTL+S**)
- 2) Right-Click on the HTML code and choose the "**Open with Live Server**"
- 3) Check the result on the web browser



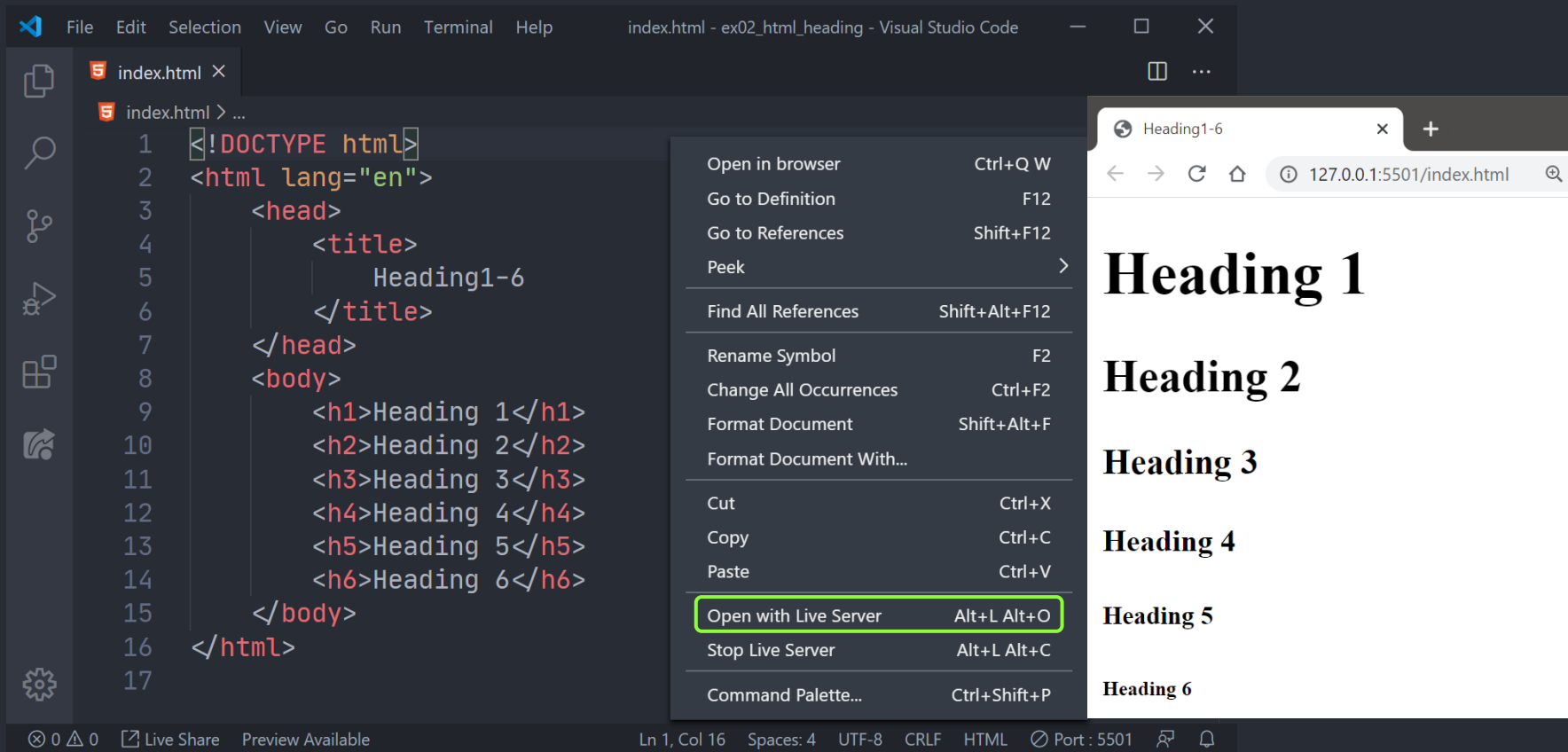
```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       HTML
6     </title>
7   </head>
8   <body>
9     Welcome to HTML
10  </body>
11 </html>
12
```

Open in browser Ctrl+Q W  
Go to Definition F12  
Go to References Shift+F12  
Peek >  
Find All References Shift+Alt+F12  
Rename Symbol F2  
Change All Occurrences Ctrl+F2  
Format Document Shift+Alt+F  
Format Document With...  
Cut Ctrl+X  
Copy Ctrl+C  
Paste Ctrl+V  
**Open with Live Server Alt+L Alt+O**  
Stop Live Server Alt+L Alt+C  
Command Palette... Ctrl+Shift+P

HTML x +  
127.0.0.1:5501/index.html  
Welcome to HTML

# HTML Heading (h1 to h6)

- 1) Create a new directory (folder), "ex02\_html\_heading"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "index.html" and add the lines of code
- 4) Save the file, run the "Live Server" and check the result in the web browser



The screenshot displays the Visual Studio Code editor with a file named `index.html` open. The code is as follows:

```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       Heading1-6
6     </title>
7   </head>
8   <body>
9     <h1>Heading 1</h1>
10    <h2>Heading 2</h2>
11    <h3>Heading 3</h3>
12    <h4>Heading 4</h4>
13    <h5>Heading 5</h5>
14    <h6>Heading 6</h6>
15  </body>
16 </html>
17
```

A context menu is open over the code, with the "Open with Live Server" option highlighted. The menu also includes options like "Open in browser", "Go to Definition", "Go to References", "Find All References", "Rename Symbol", "Change All Occurrences", "Format Document", "Format Document With...", "Cut", "Copy", "Paste", "Stop Live Server", and "Command Palette...".

To the right, a web browser window titled "Heading1-6" shows the rendered HTML. The address bar indicates the local URL `127.0.0.1:5501/index.html`. The browser displays the following content:

# Heading 1

## Heading 2

### Heading 3

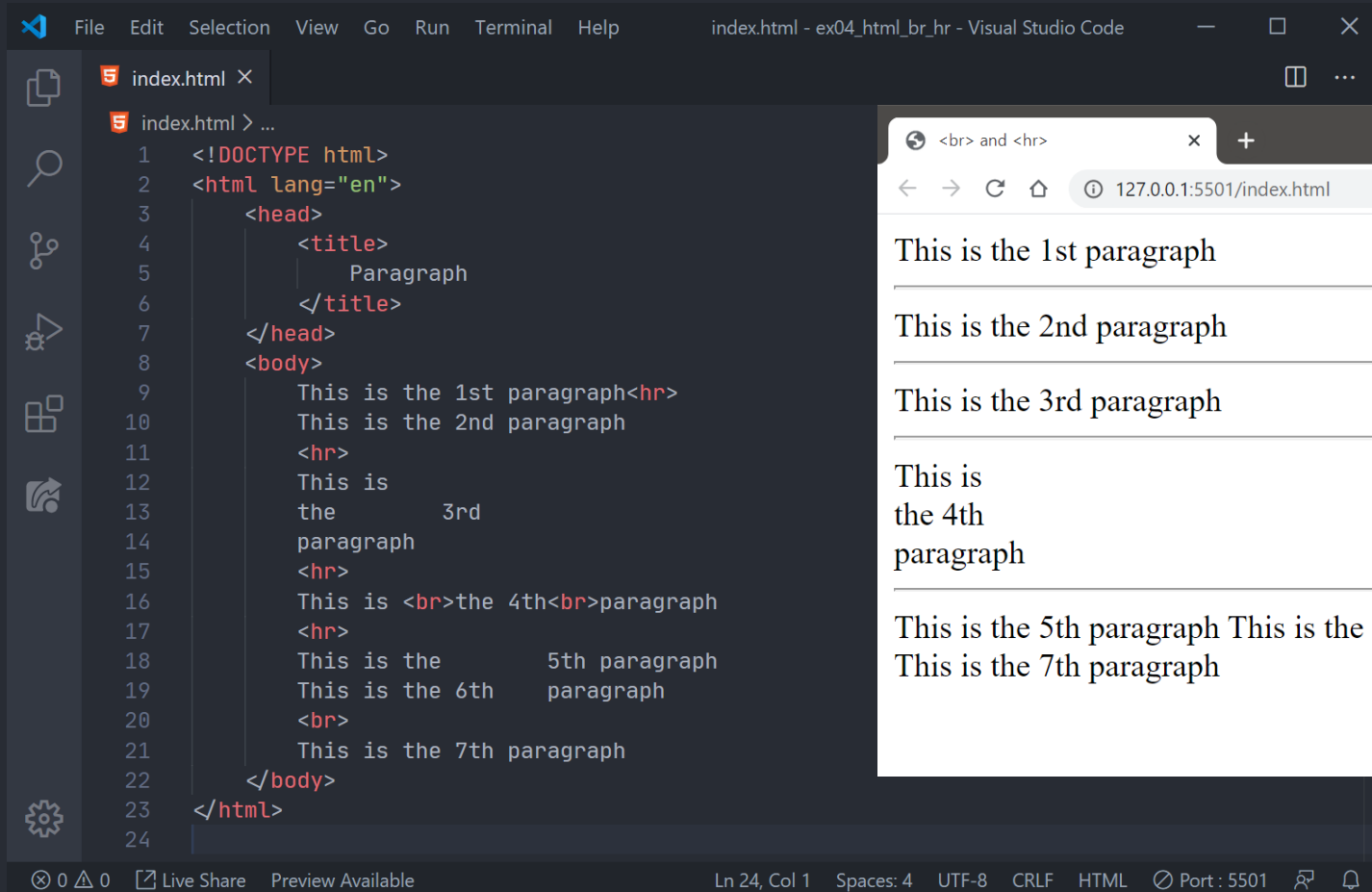
#### Heading 4

##### Heading 5

###### Heading 6

# HTML Line Break and Horizontal Rules

- 1) Create a new directory (folder), "ex04\_html\_br\_hr"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "index.html" and add the lines of code
- 4) Save the file, run the "Live Server" and check the result in the web browser

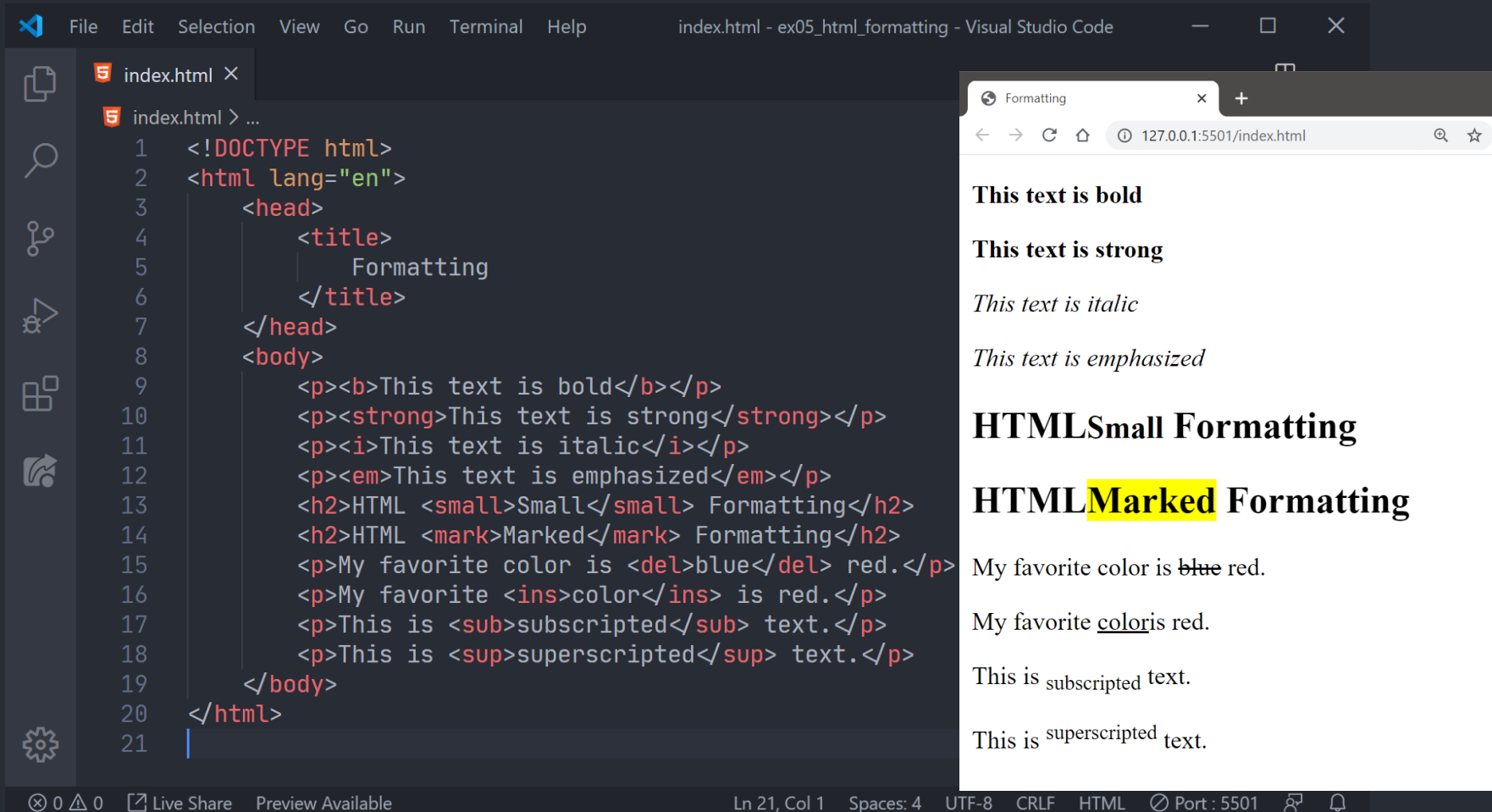


```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       Paragraph
6     </title>
7   </head>
8   <body>
9     This is the 1st paragraph<br>
10    This is the 2nd paragraph
11    <br>
12    This is
13    the      3rd
14    paragraph
15    <br>
16    This is <br>the 4th<br>paragraph
17    <br>
18    This is the      5th paragraph
19    This is the 6th   paragraph
20    <br>
21    This is the 7th paragraph
22  </body>
23 </html>
24
```

The live preview shows the rendered output of the HTML code. It displays seven paragraphs separated by horizontal lines. The first three paragraphs are on separate lines, the fourth is split across two lines, and the fifth and sixth are on the same line, followed by the seventh paragraph on a new line.

# HTML Formatting

- 1) Create a new directory (folder), "ex05\_html\_formatting"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "index.html" and add the lines of code
- 4) Save the file, run the "Live Server" and check the result in the web browser



The image shows a Visual Studio Code editor window with a file named 'index.html' open. The code is as follows:

```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       Formatting
6     </title>
7   </head>
8   <body>
9     <p><b>This text is bold</b></p>
10    <p><strong>This text is strong</strong></p>
11    <p><i>This text is italic</i></p>
12    <p><em>This text is emphasized</em></p>
13    <h2>HTML <small>Small</small> Formatting</h2>
14    <h2>HTML <mark>Marked</mark> Formatting</h2>
15    <p>My favorite color is <del>blue</del> red.</p>
16    <p>My favorite <ins>color</ins> is red.</p>
17    <p>This is <sub>subscripted</sub> text.</p>
18    <p>This is <sup>superscripted</sup> text.</p>
19  </body>
20 </html>
21
```

To the right of the editor is a web browser window showing the rendered HTML. The browser address bar shows '127.0.0.1:5501/index.html'. The rendered content is:

This text is bold

This text is strong

*This text is italic*

*This text is emphasized*

## HTMLSmall Formatting

## HTMLMarked Formatting

My favorite color is ~~blue~~ red.

My favorite color is red.

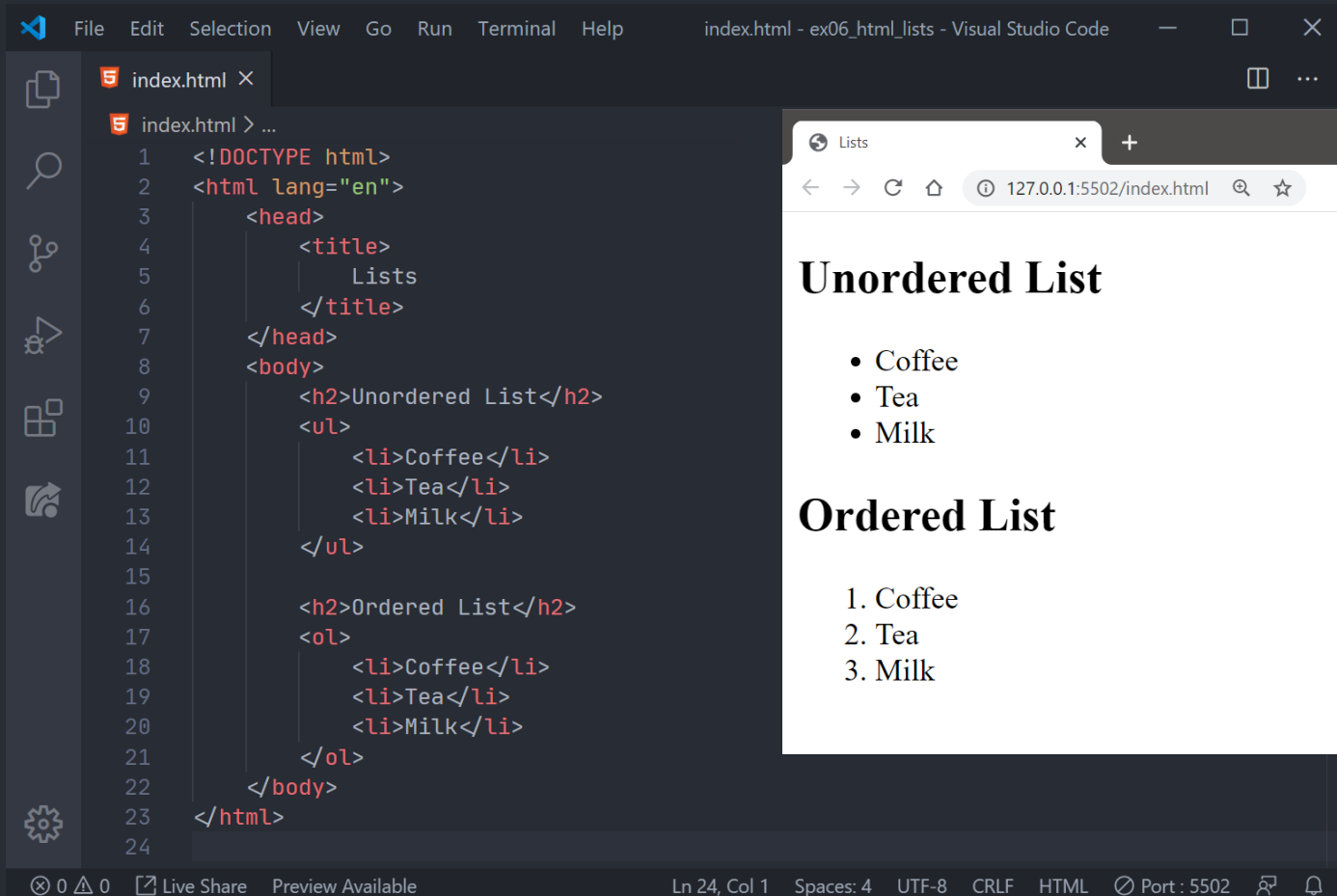
This is subscripted text.

This is superscripted text.

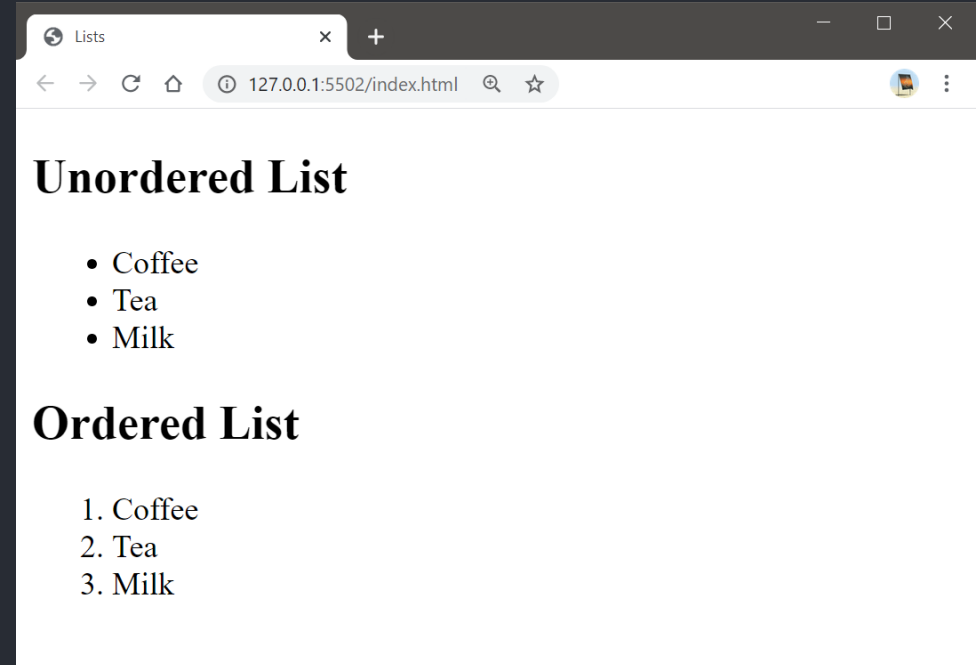


# HTML Lists

- 1) Create a new directory (folder), "ex06\_html\_lists"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "index.html" and add the lines of code
- 4) Save the file, run the "Live Server" and check the result in the web browser

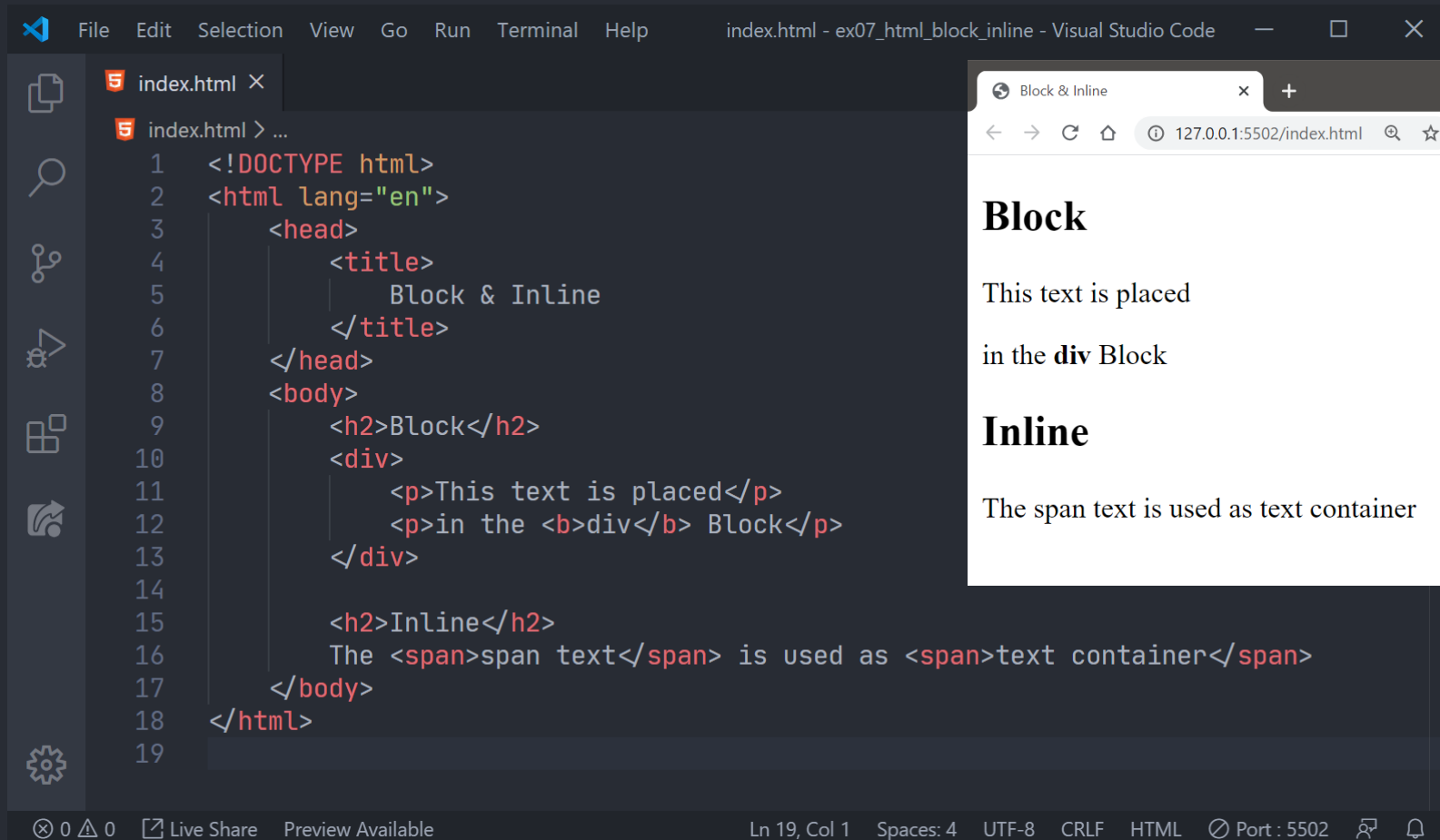


```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       Lists
6     </title>
7   </head>
8   <body>
9     <h2>Unordered List</h2>
10    <ul>
11      <li>Coffee</li>
12      <li>Tea</li>
13      <li>Milk</li>
14    </ul>
15
16    <h2>Ordered List</h2>
17    <ol>
18      <li>Coffee</li>
19      <li>Tea</li>
20      <li>Milk</li>
21    </ol>
22  </body>
23 </html>
24
```



# HTML Block and Inline Elements

- 1) Create a new directory (folder), "**ex07\_html\_block\_inline**"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "**index.html**" and add the lines of code
- 4) Save the file, run the "**Live Server**" and check the result in the web browser



The screenshot shows the Visual Studio Code editor with a file named `index.html` open. The code is as follows:

```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       Block & Inline
6     </title>
7   </head>
8   <body>
9     <h2>Block</h2>
10    <div>
11      <p>This text is placed</p>
12      <p>in the <b>div</b> Block</p>
13    </div>
14
15    <h2>Inline</h2>
16    The <span>span text</span> is used as <span>text container</span>
17  </body>
18 </html>
```

On the right, a web browser window titled "Block & Inline" is shown at the address `127.0.0.1:5502/index.html`. The browser displays the rendered HTML:

**Block**

This text is placed  
in the **div** Block

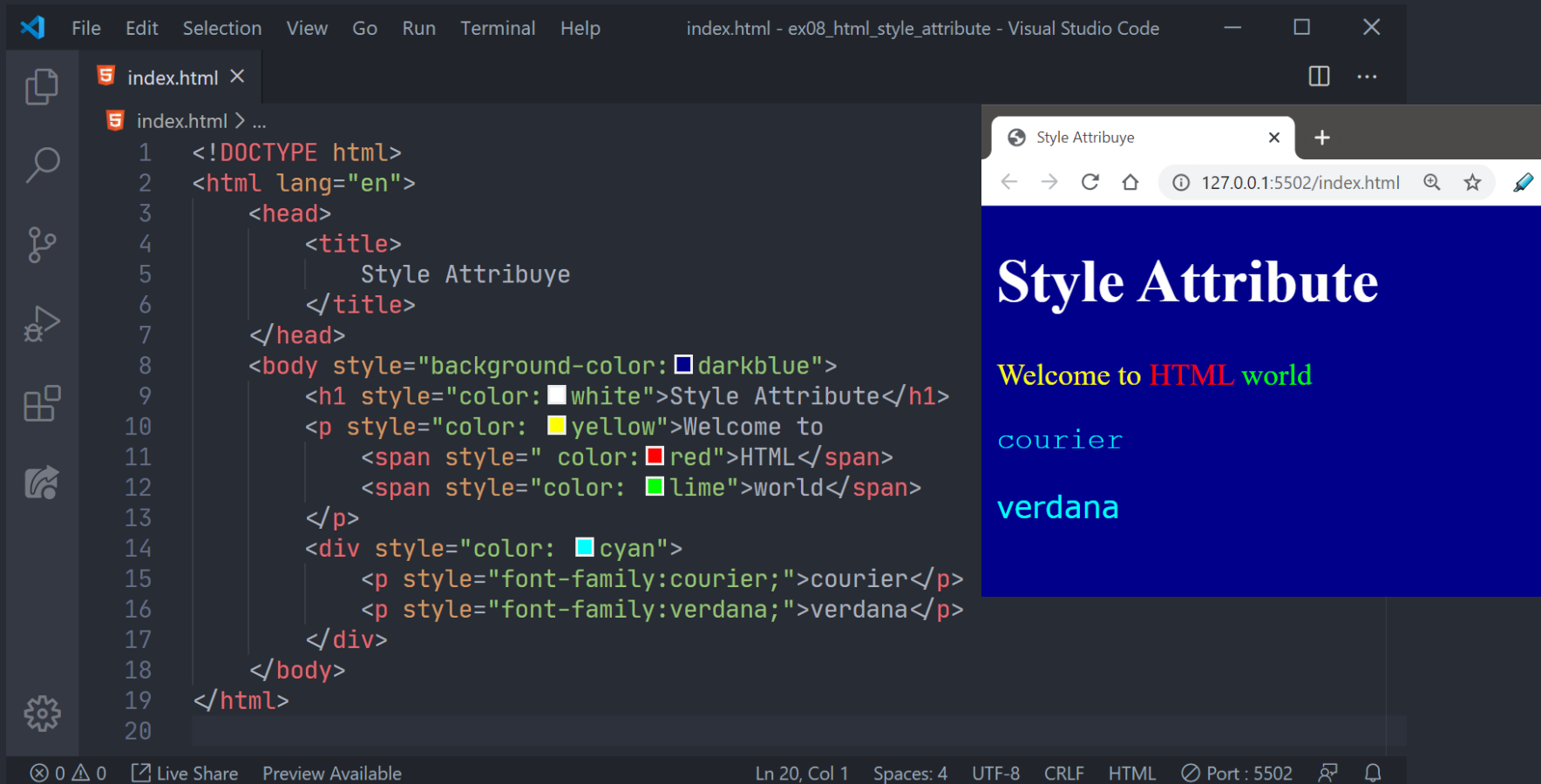
**Inline**

The span text is used as text container

The status bar at the bottom of VS Code indicates "Ln 19, Col 1", "Spaces: 4", "UTF-8", "CRLF", "HTML", and "Port : 5502".

# HTML Style Attribute

- 1) Create a new directory (folder), "ex08\_html\_style\_attribute"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "index.html" and add the lines of code
- 4) Save the file, run the "Live Server" and check the result in the web browser



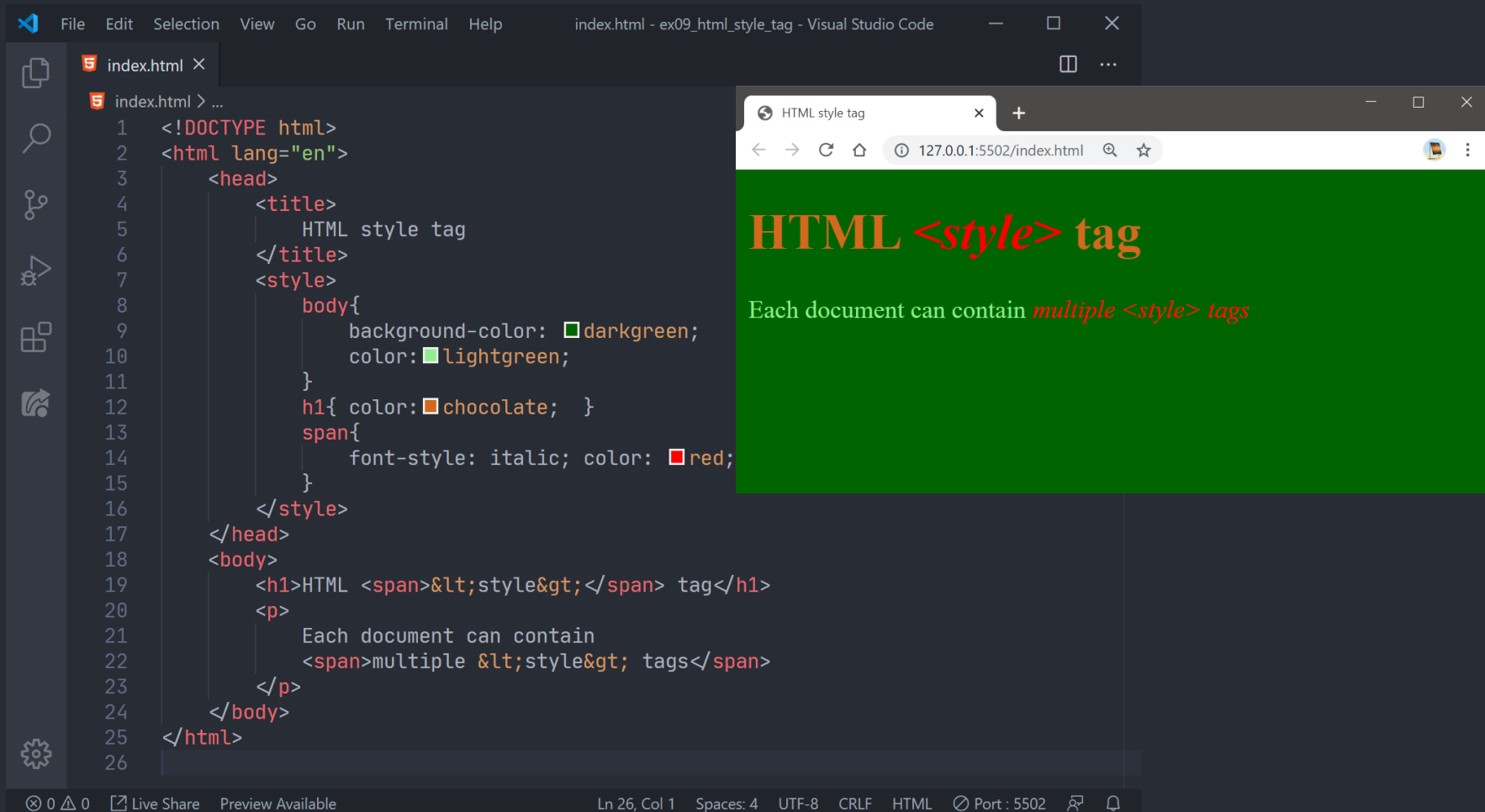
The screenshot shows the Visual Studio Code editor with a file named 'index.html' open. The code is as follows:

```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       Style Attribute
6     </title>
7   </head>
8   <body style="background-color: darkblue">
9     <h1 style="color: white">Style Attribute</h1>
10    <p style="color: yellow">Welcome to
11      <span style="color: red">HTML</span>
12      <span style="color: lime">world</span>
13    </p>
14    <div style="color: cyan">
15      <p style="font-family: courier;">courier</p>
16      <p style="font-family: verdana;">verdana</p>
17    </div>
18  </body>
19 </html>
```

The web browser on the right shows the rendered output. The background is dark blue. The title is 'Style Attribute'. The main heading is 'Style Attribute' in white. The text 'Welcome to' is yellow, 'HTML' is red, and 'world' is lime green. Below this, 'courier' is displayed in cyan with a monospace font, and 'verdana' is displayed in cyan with a serif font.

# HTML <style> tag

- 1) Create a new directory (folder), "ex09\_html\_style\_tag"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "index.html" and add the lines of code
- 4) Save the file, run the "Live Server" and check the result in the web browser



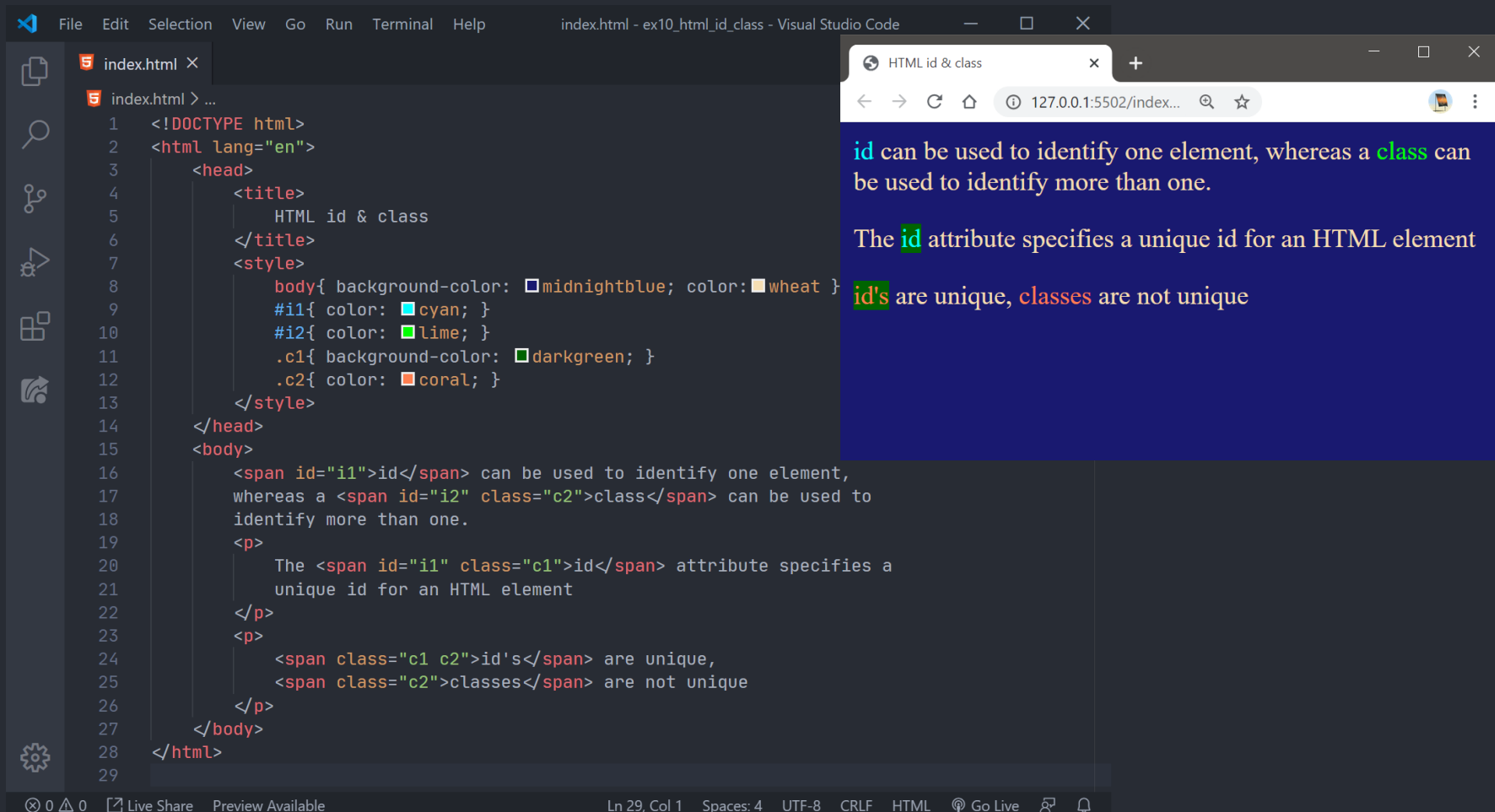
The screenshot shows the Visual Studio Code editor with a file named 'index.html' open. The code is as follows:

```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       HTML style tag
6     </title>
7     <style>
8       body{
9         background-color: darkgreen;
10        color: lightgreen;
11      }
12      h1{ color: chocolate; }
13      span{
14        font-style: italic; color: red;
15      }
16    </style>
17  </head>
18  <body>
19    <h1>HTML <span>&lt;style&gt;</span> tag</h1>
20    <p>
21      Each document can contain
22      <span>multiple &lt;style&gt; tags</span>
23    </p>
24  </body>
25 </html>
```

The web browser (Chrome) displays the rendered page. The background is dark green, and the text is light green. The title is 'HTML style tag'. The main heading is 'HTML <span>&lt;style&gt;</span> tag' in chocolate color. The paragraph text is 'Each document can contain <span>multiple &lt;style&gt; tags</span>' in red, italicized font.

# HTML id and class

- 1) Create a new directory (folder), "**ex10\_html\_id\_class**"
- 2) Run the VSCode and open the created directory
- 3) Create a webpage file, "**index.html**" and add the lines of code
- 4) Save the file, run the "**Live Server**" and check the result in the web browser



The screenshot shows the Visual Studio Code editor with a file named `index.html` open. The code defines an HTML document with a title "HTML id & class" and a style block. The style block includes a body background color of midnightblue, and specific colors for elements with IDs #i1 (cyan) and #i2 (lime), and classes .c1 (darkgreen) and .c2 (coral). The body contains two paragraphs explaining the difference between id and class attributes. A web browser window is open to the right, displaying the rendered page. The browser shows the title and the two paragraphs, with the text color being wheat and the background being midnightblue. The first paragraph uses the #i1 ID and the .c1 class, and the second paragraph uses the #i2 ID and the .c2 class.

```
1 <!DOCTYPE html>
2 <html lang="en">
3   <head>
4     <title>
5       HTML id & class
6     </title>
7     <style>
8       body{ background-color: midnightblue; color: wheat; }
9       #i1{ color: cyan; }
10      #i2{ color: lime; }
11      .c1{ background-color: darkgreen; }
12      .c2{ color: coral; }
13    </style>
14  </head>
15  <body>
16    <span id="i1">id</span> can be used to identify one element,
17    whereas a <span id="i2" class="c2">class</span> can be used to
18    identify more than one.
19    <p>
20      The <span id="i1" class="c1">id</span> attribute specifies a
21      unique id for an HTML element
22    </p>
23    <p>
24      <span class="c1 c2">id's</span> are unique,
25      <span class="c2">classes</span> are not unique
26    </p>
27  </body>
28 </html>
```

HTML id & class

id can be used to identify one element, whereas a class can be used to identify more than one.

The id attribute specifies a unique id for an HTML element

id's are unique, classes are not unique

### HTML and CSS

Learn HTML  
Learn CSS  
Learn Bootstrap  
Learn W3.CSS  
Learn Colors  
Learn Icons  
Learn Graphics  
Learn How To  
Learn Sass

### JavaScript

Learn JavaScript  
Learn jQuery  
Learn React  
Learn AngularJS  
Learn JSON  
Learn AJAX  
Learn W3.JS

### Server Side

Learn SQL  
Learn PHP  
Learn ASP  
Learn Node.js  
Learn Raspberry Pi

### Programming

Learn Python  
Learn Java  
Learn C++

# HTML

The language for building web pages

LEARN HTML

HTML REFERENCE

### HTML Example:

```
<!DOCTYPE html>
<html>
<title>HTML Tutorial</title>
<body>

<h1>This is a heading</h1>
<p>This is a paragraph.</p>

</body>
</html>
```

Try it Yourself »

### CSS Example:

```
body {
  background-color: lightblue;
}

h1 {
  color: white;
  text-align: center;
}
```

# CSS

The language for styling web pages

LEARN CSS

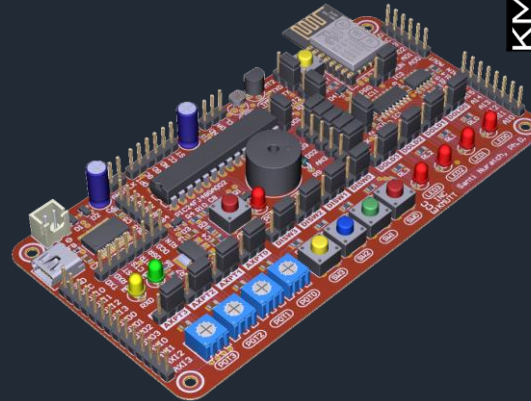
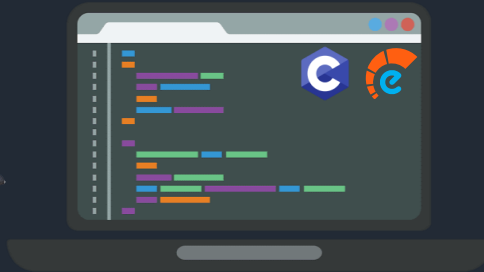
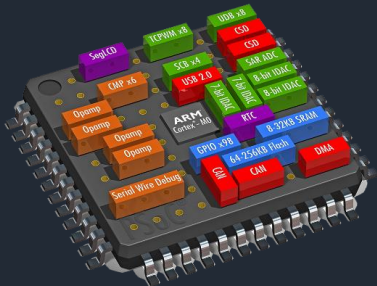
CSS REFERENCE



# THANK YOU!



We Make Computers do More



Asst.Prof.Dr.Santi Nuratch

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[santi.inc.kmutt@gmail.com](mailto:santi.inc.kmutt@gmail.com)

Department of Control System and Instrumentation Engineering,  
King Mongkut's University of Technology Thonburi, **KMUTT**