Lab 0

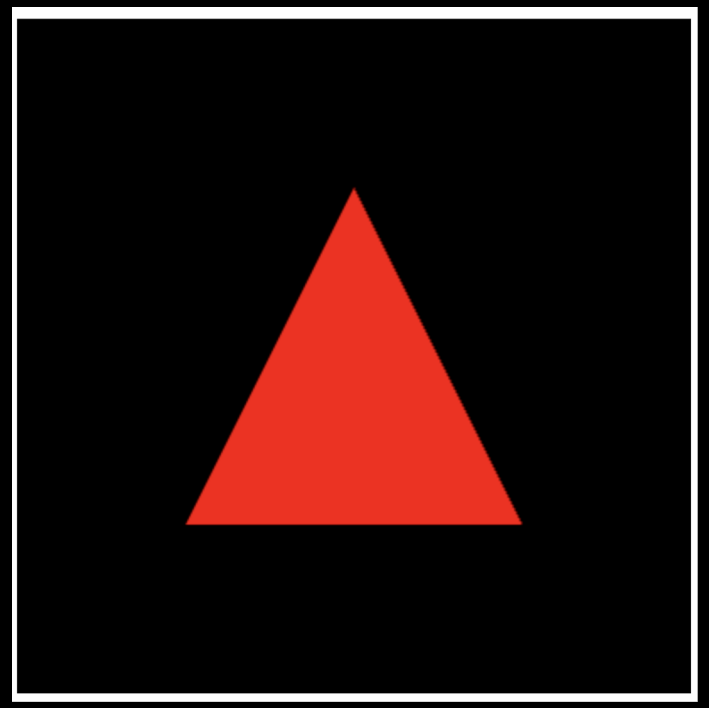
What You will Learn

- Familiar with a simple WebGL program
  - Run a WebGL program
  - Know the basic WebGL programming environment
  - Modify the code by instructions
  - Submit the code

What You Should Do Step by Step

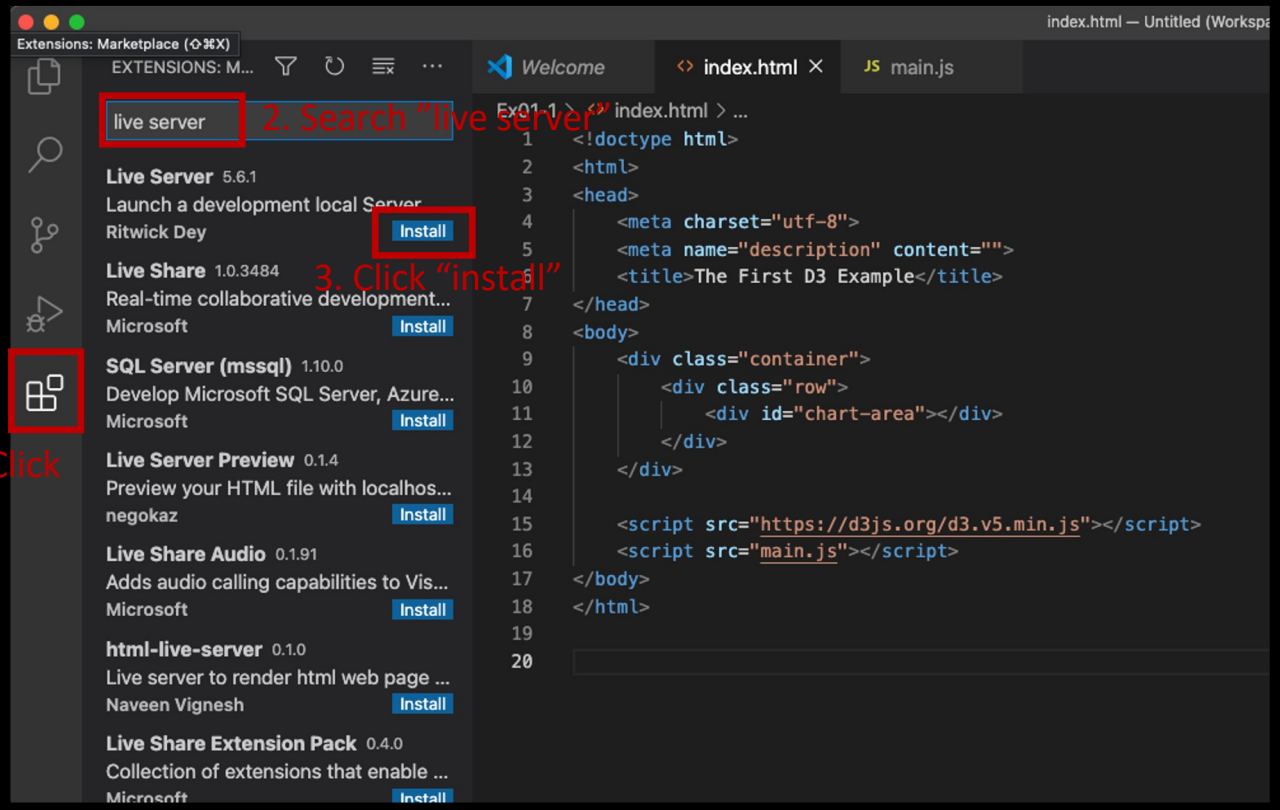
1. Download and Run

- Download the zip file which contains “index.html” and “WebGL.js” from Moodle (unzip the zip file)



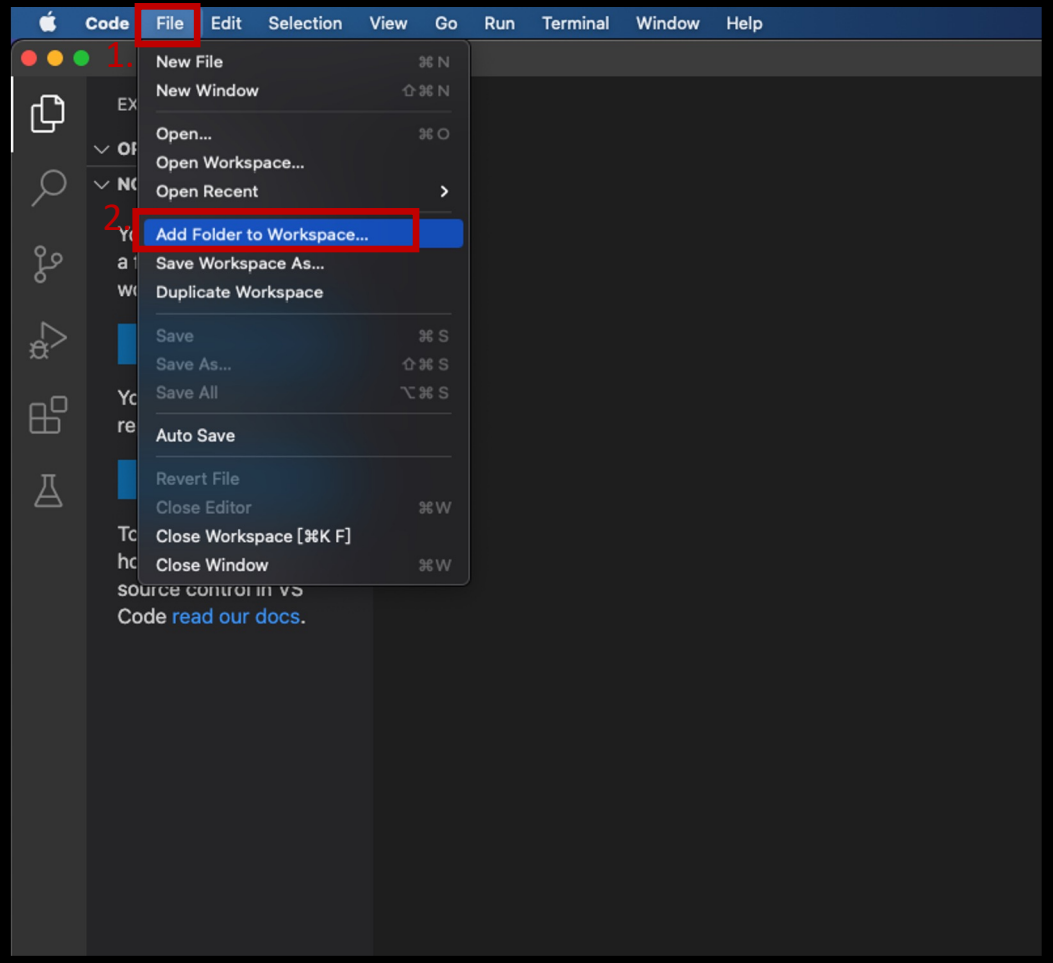
How to Run it?

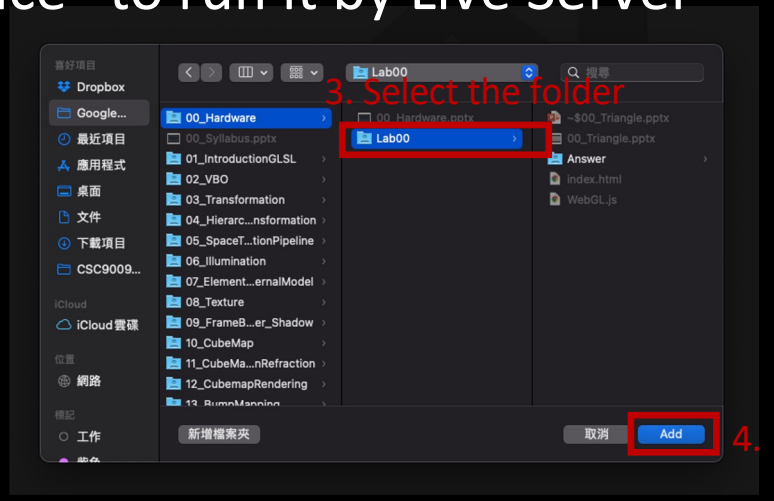
- Open “VSCode”
- Install “Live Server” extension

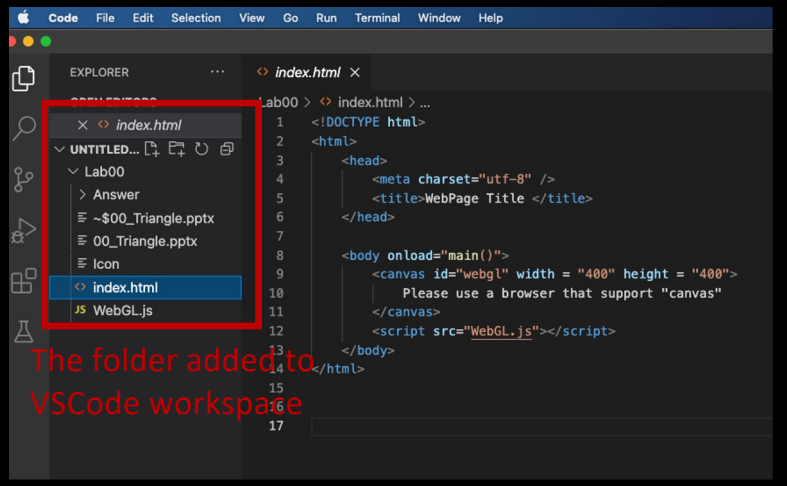


How to Run it?

- You have to add the folder into “workspace” to run it by Live Server

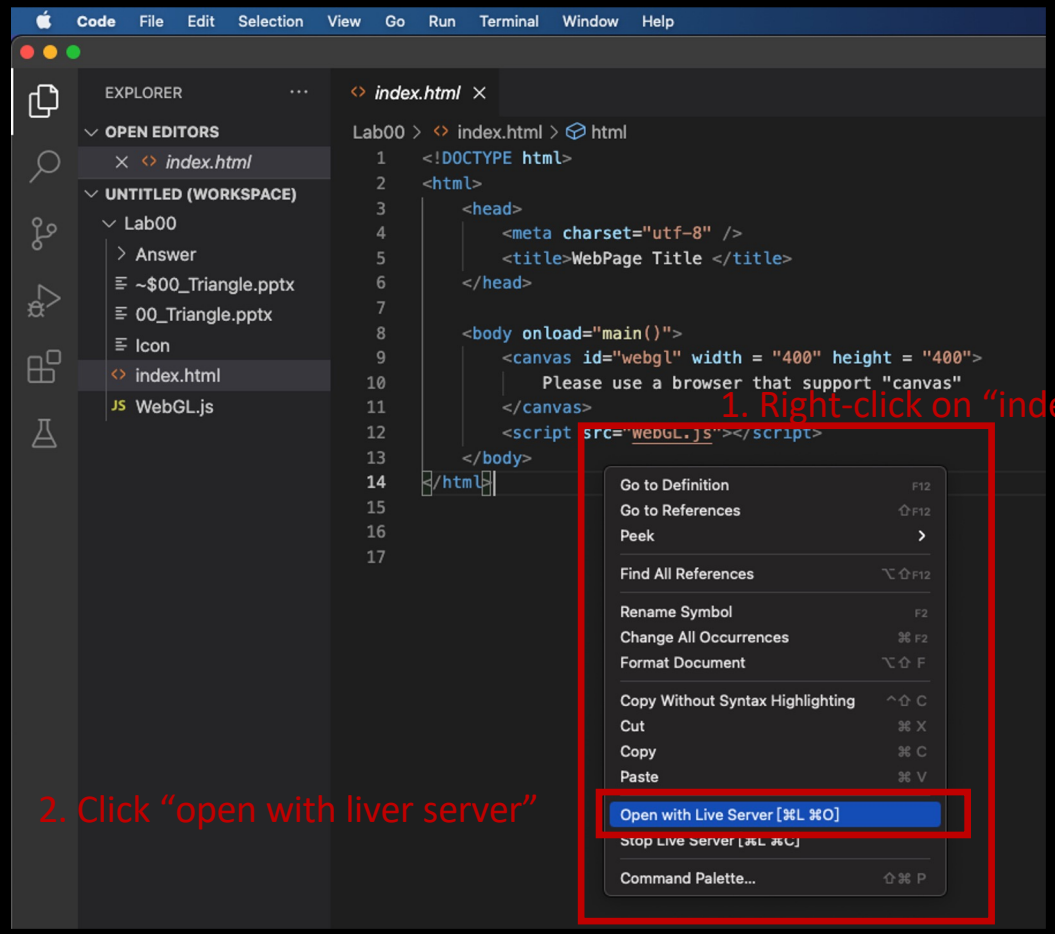






How to Run it?

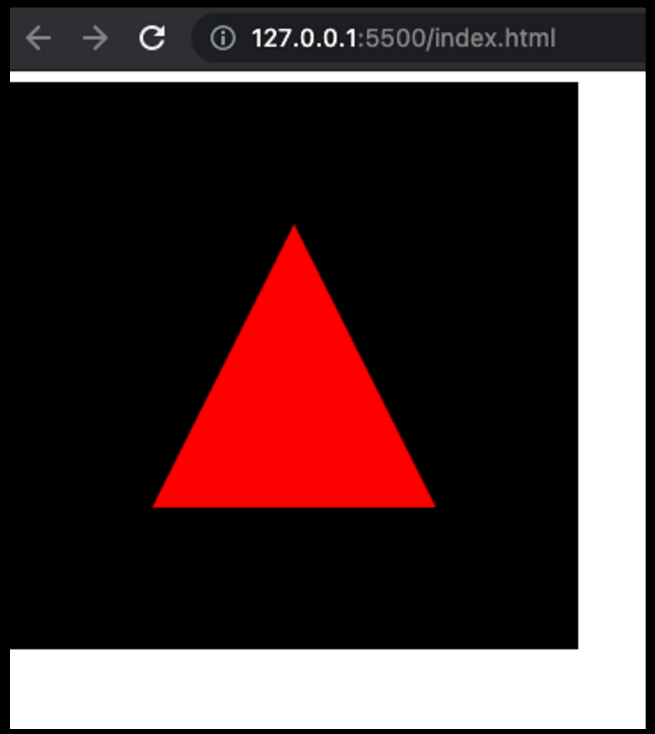
- Run it by right-clicking on “index.html”



1. Right-click on “index.html”

2. Click “open with liver server”

3. “live server” can create a http server and run “index.html” on your browser



2. Index.html

- In “index.html”, we have a canvas (for WebGL to draw and set its size (Line 9)

```
1   <!DOCTYPE html>
2   <html>
3       <head>
4           <meta charset="utf-8" />
5           <title>WebPage Title </title>
6       </head>
7
8       <body onload="main()">
9           <canvas id="webgl" width = "400" height = "400">
10              Please use a browser that support "canvas"
11          </canvas>
12          <script src="WebGL.js"></script>
13      </body>
14  </html>
```

3. WebGL.js (Shaders)

- Open the files (index.html and WebGL.js) to edit
  - You should choose an editor you prefer (e.g. Visual Studio Code, Subline Text…)
- "Read and understand" the code, and map this code to the rendering pipeline we just learned
  - Line1 ~ Line7 is the Vertex processing in the pipeline **(Vertex shader)**
  - Line9 ~ Line14 is the pixel processing in the pipeline **(Fragment shader)**
  - **They are so-called GLSL (C-like language)**
  - **The main code segment to render images (run in graphics card to speed up the rendering)**

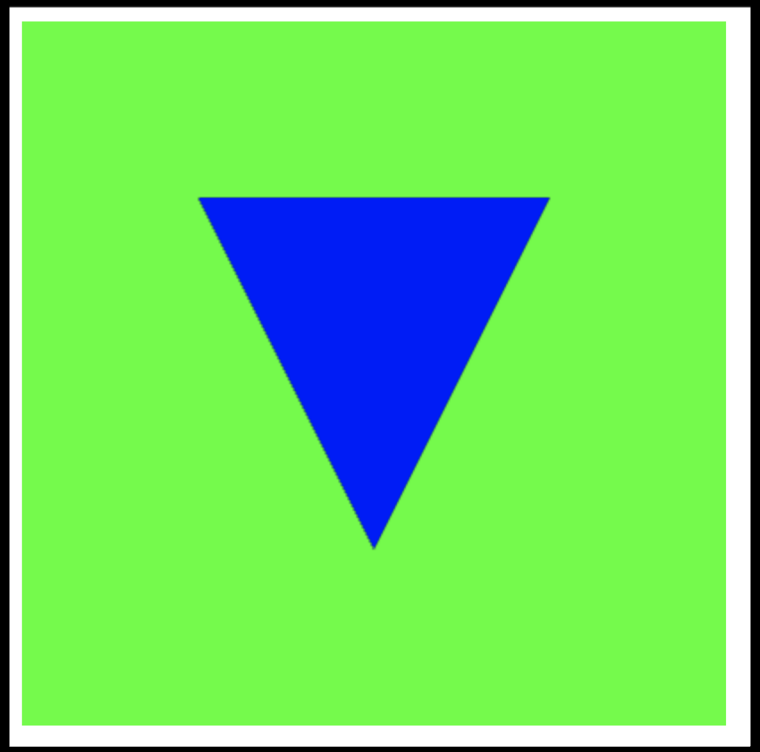

```
1   var VSHADER_SOURCE = `
2           attribute vec4 a_Position;
3           void main(){
4               //gl_Position is key variable in GLSL (pass vertex location to fragment shader)
5               gl_Position = a_Position;
6           }
7       `;
8
9   var FSHADER_SOURCE = `
10          void main(){
11              //gl_FragColor is key variable in GLSL (assign color of a pixel)
12              gl_FragColor = vec4(1.0, 0.0, 0.0, 1.0);
13          }
14      `;
15
```

4. WebGL.js

- Trace the main function in WebGL.js and read the comments in code
  - Step 1 and 2: get the canvas for WebGL to draw later
  - Step 3: “Compile” the shader programs (vertex and fragment shaders)
    - You do not have to understand the details of the two functions, “createProgram” and “compileShader”, so far.
  - Step 4: tell WebGL which shader program you want to use (you may have multiple shader programs later)
  - Step 5: array of triangle vertices and number of vertices
    - Line93~Line107: pass the triangle vertices to shader programs
      - You do not need to know the details so far
  - Step 6: assign the background color and clear screen by the color
  - Step7: “draw” the triangle

What You Should Do for “Submission”

- Modify the code to draw
  - an “up-side down” “blue” triangle
  - on a “green” background

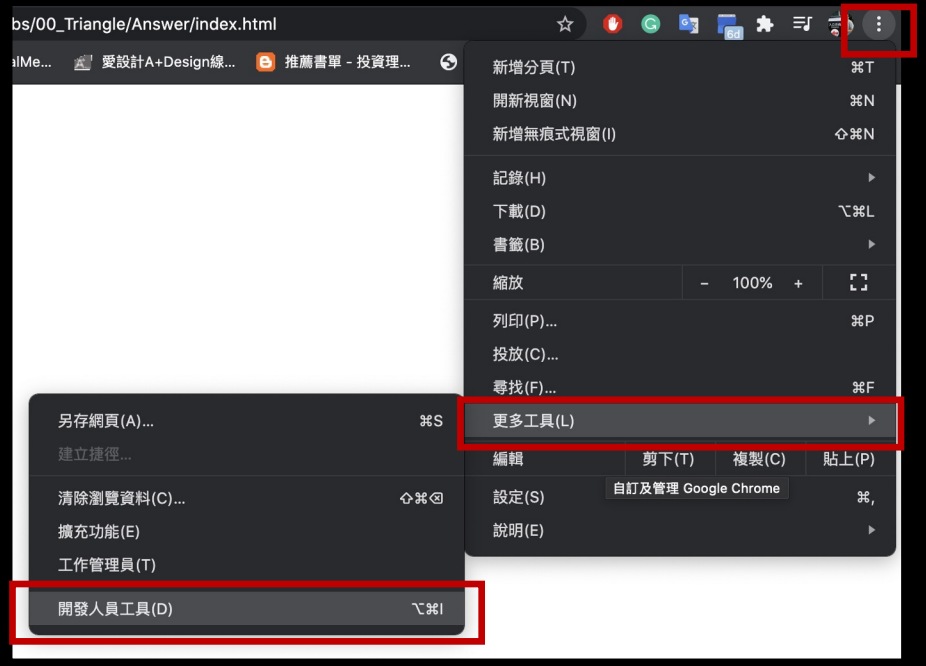


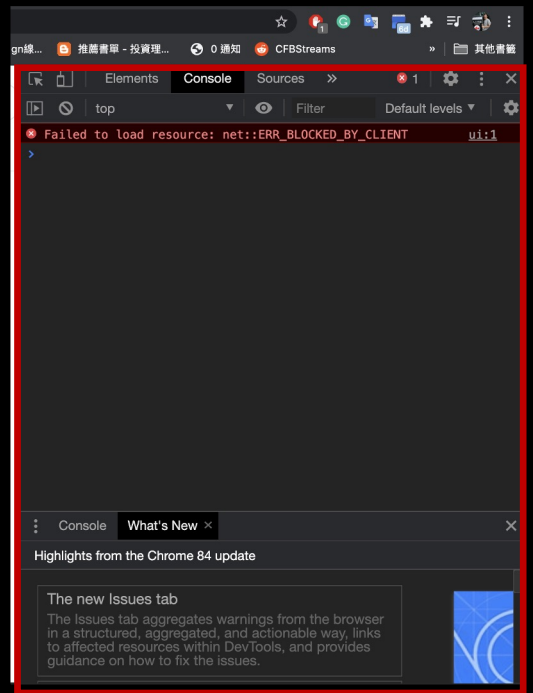
Where to modify

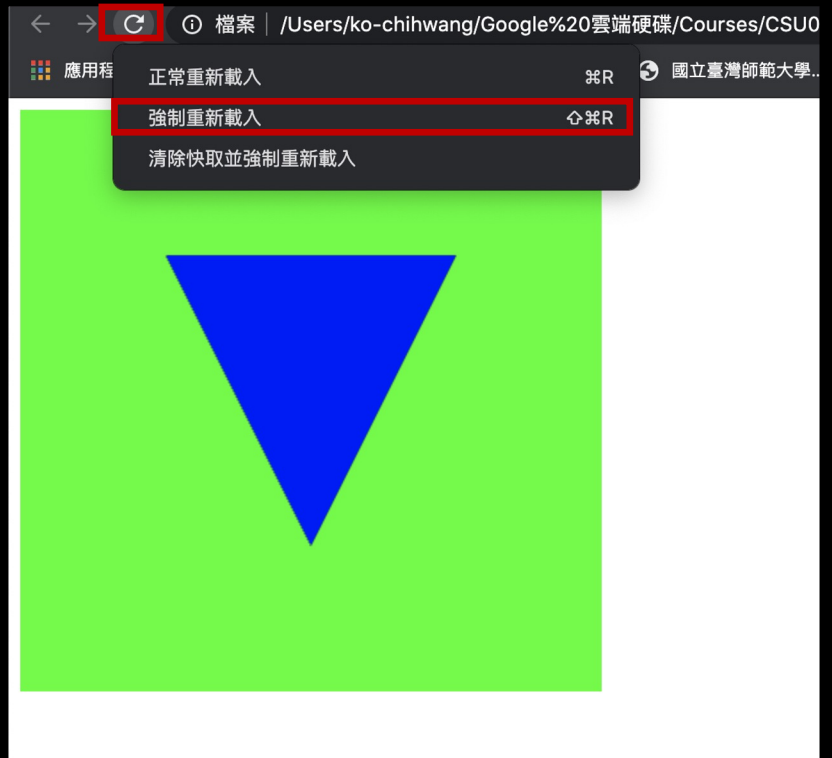
- WebGL.js

```
// var n = initVertexBuffers(gl, renderProgram);
///// 5. prepare the vertices for draw (we just draw 2D object here)
/////    These are vertices of a triangle in 2D
var vertices = new Float32Array(
    [0.0, 0.5, -0.5, -0.5, 0.5, -0.5]
);

var n = 3; /// number of vertices

var vertexBuffer = gl.createBuffer(); ///// create a vertex buffer to store the triangle vertic
if(!vertexBuffer) {
    console.log('Failed to create the buffer object');
}

///// bind buffer and pass the vertices data
gl.bindBuffer(gl.ARRAY_BUFFER, vertexBuffer);
gl.bufferData(gl.ARRAY_BUFFER, vertices, gl.STATIC_DRAW);

///// get the reference of the variable in the shader program
renderProgram.a_Position = gl.getAttribLocation(renderProgram, 'a_Position');
if( renderProgram.a_Position < 0 )console.log("renderProgram.a_Position < 0"); //check you get

gl.vertexAttribPointer(renderProgram.a_Position, 2, gl.FLOAT, false, 0, 0); //setting of the ve
gl.enableVertexAttribArray(renderProgram.a_Position); //enable the vetex buffer

///// 6. clear the screen by designated background color
gl.clearColor(0.0, 0.0, 0.0, 1.0); //background color
gl.clear(gl.COLOR_BUFFER_BIT); // clear

///// 7. draw the shape
gl.drawArrays(gl.TRIANGLES, 0, n);
```

- What if the browser does not load you new code
  - You can force the browser to refresh its cache
  - Here is an example for Chrome
    - Open the developer tool
    - Long press on the refresh button, then select “hard reload”







Submission Instruction

- Create a folder
  - Put the html and js files in the folder
  - Zip the folder
  - Rename the zip file to your student ID
    - For example, if your student ID is “40312345s”, rename the zip file to “40312345s.zip”
  - Submit the renamed zip file to Moodle

- Make sure
  - you put all files in the folder to zip
  - You submit the zip file with correct name
- You won’t get any point if
  - the submitted file does not follow the naming rule,
  - TA cannot run your code,
  - or cannot unzip your zip file.