Homework 1

Game Graphics
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Goal

- Setting up Android Studio development environment
- Filling in code lines in the vertex shader.
  - Vertex position
  - Vertex normal
  - Texture coordinates
- Filling in code lines in the functions of the scene class in GL program.
- +10 points homework.

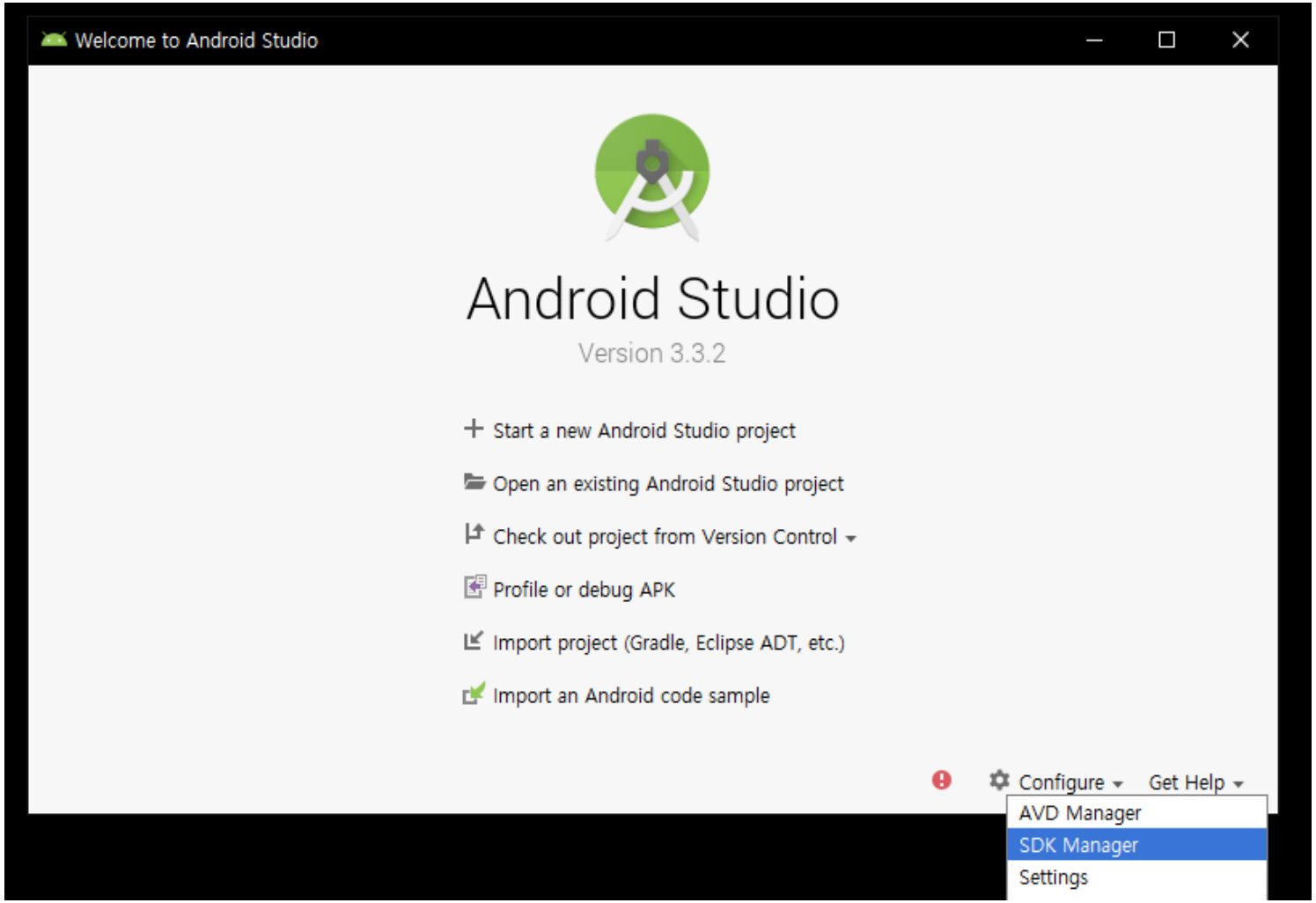
Android Studio

- **Android Studio** is the official integrated development environment (IDE) for the Android platform.

- Android Studio can be downloaded from the official website.

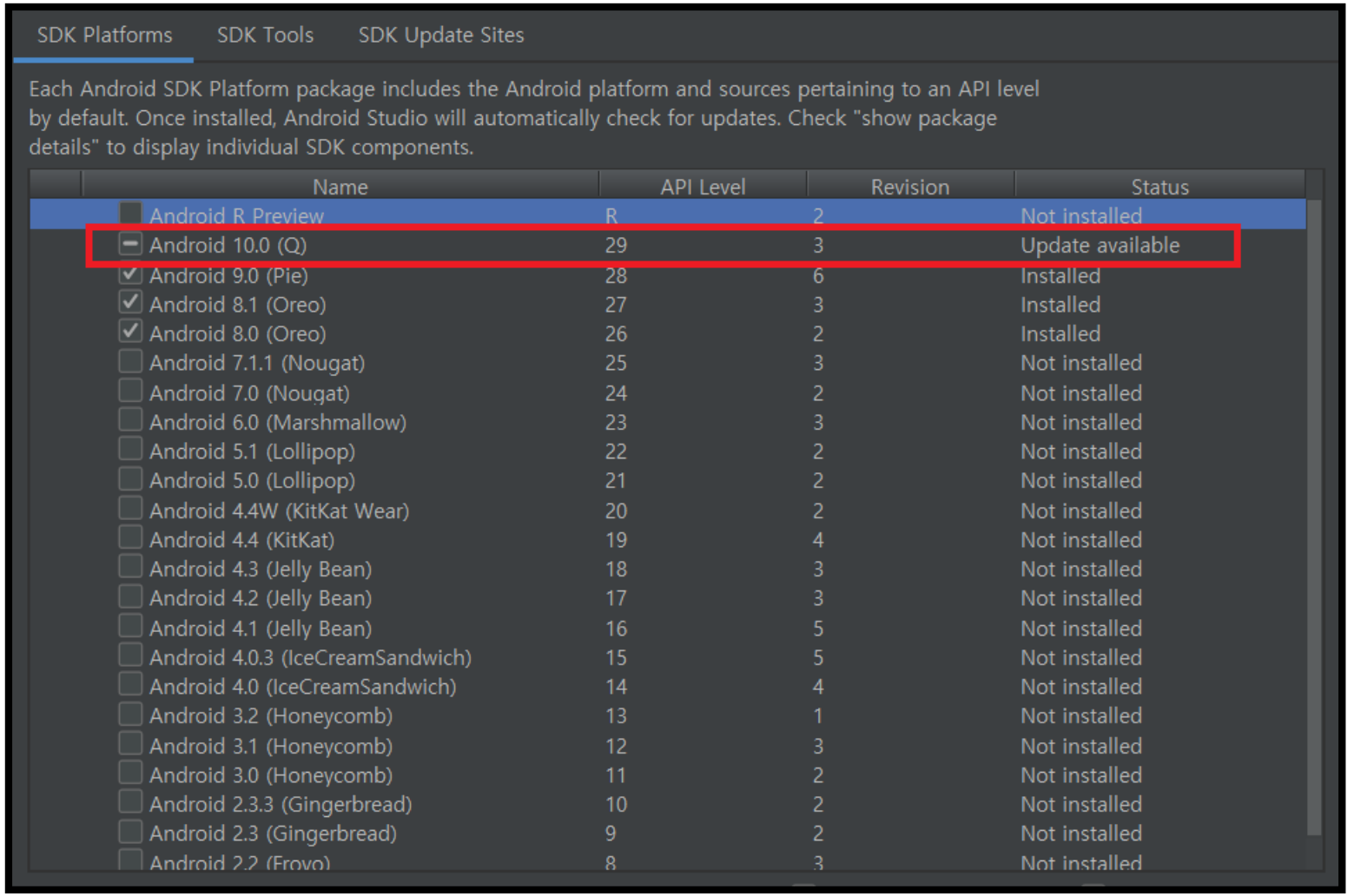
Android SDK

- **Android SDK** can be installed through the SDK Manager in Android Studio.



Android SDK

- The **latest platform** (2020.03.26. Android 10.0 Q) will be installed automatically.

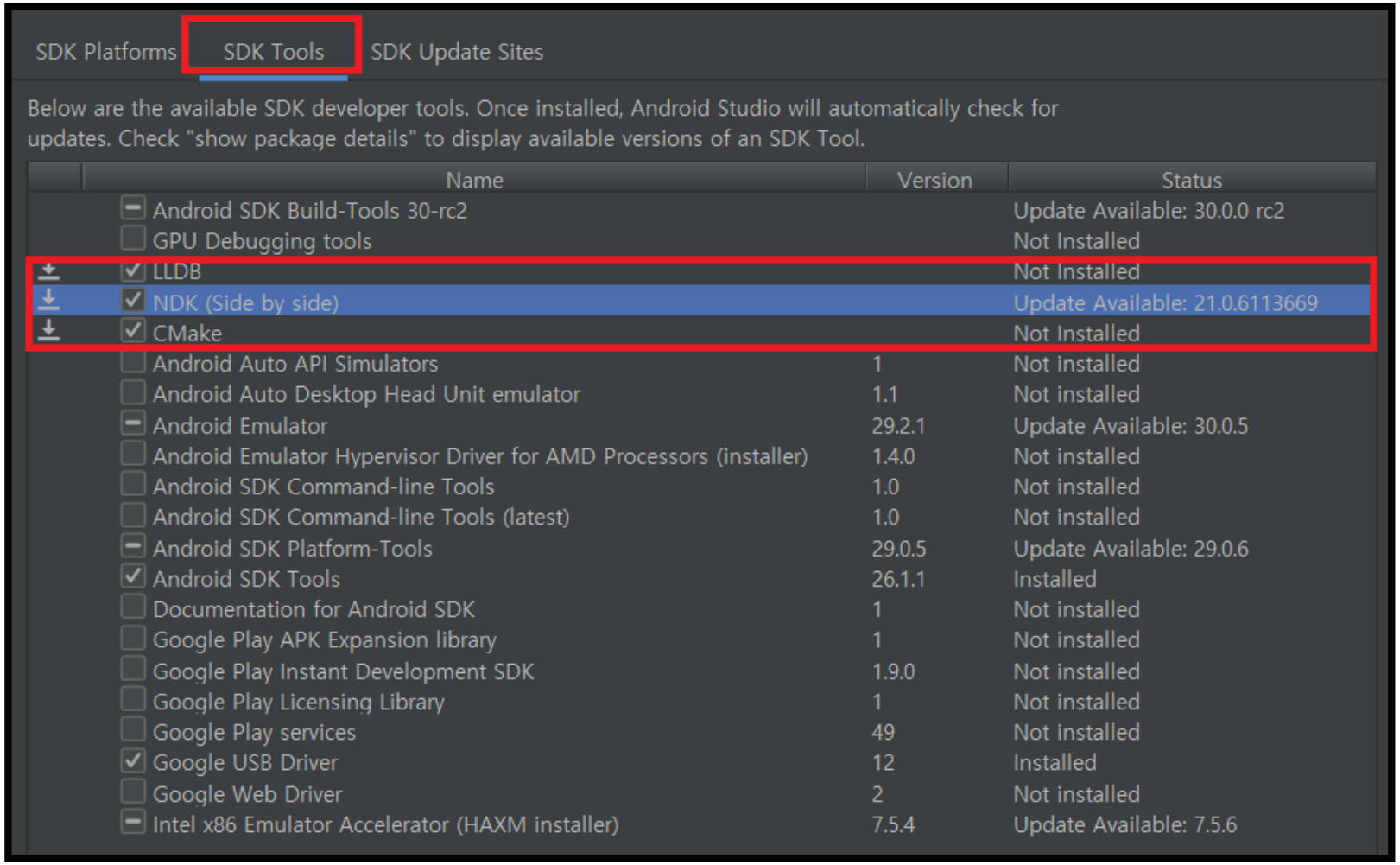


The image and the actual screen can be different.

Android SDK

To use C++ native language on Android, you need to install the following three tools.

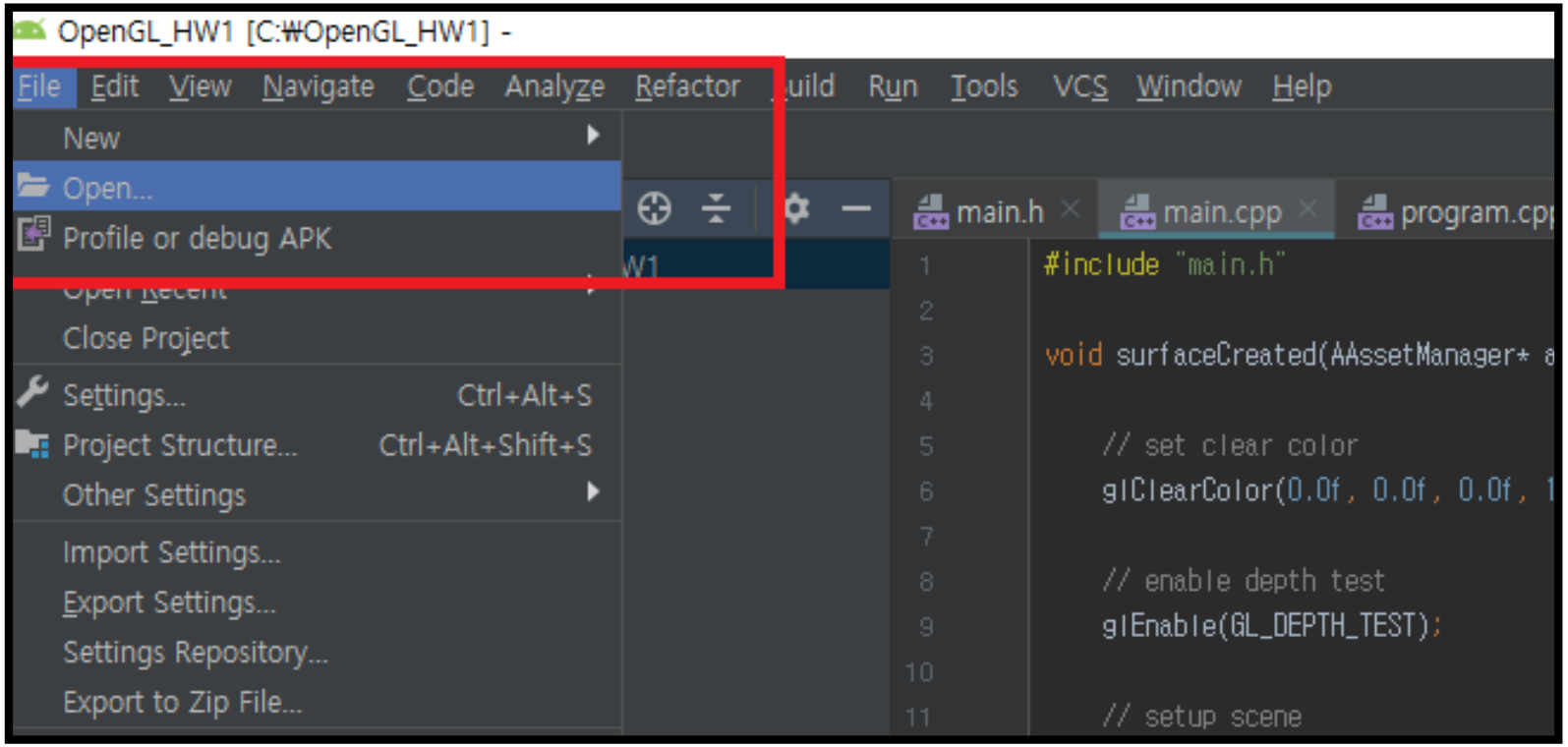
- CMake
- LLDB
- NDK



The image and the actual screen can be different.

Open Project Folder

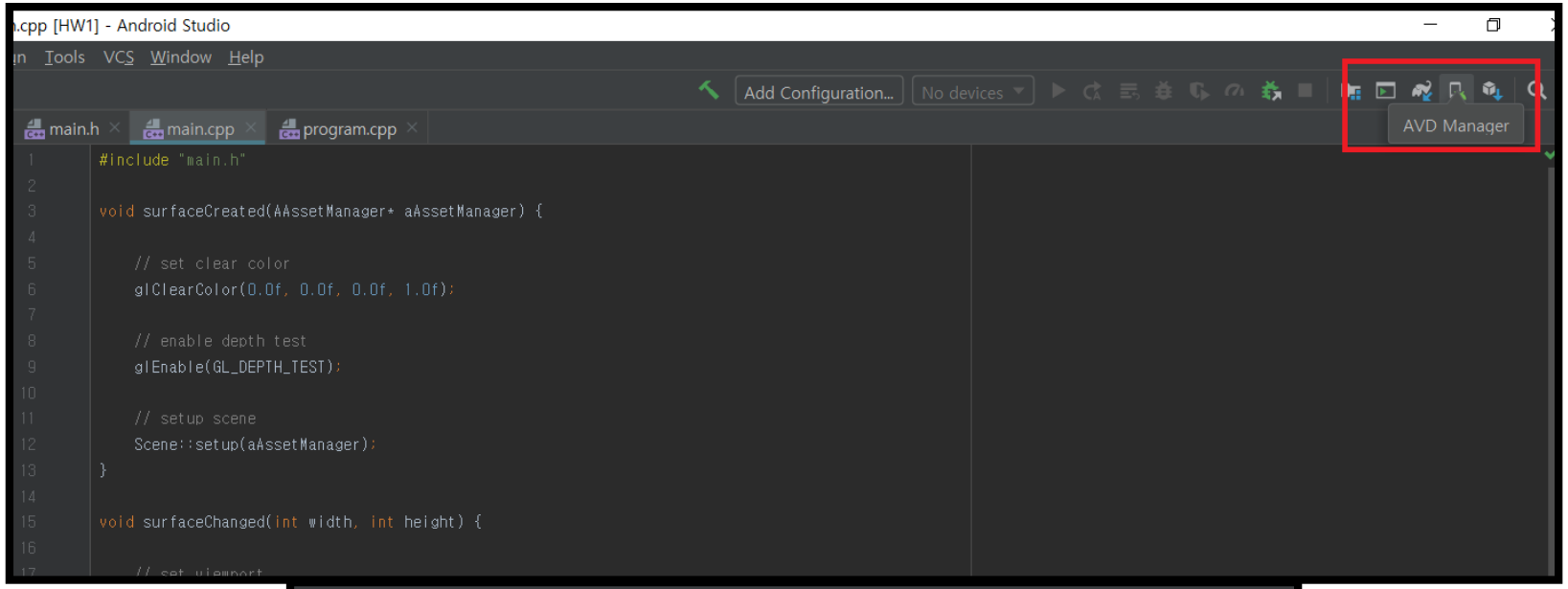
Click the [File] – [Open].

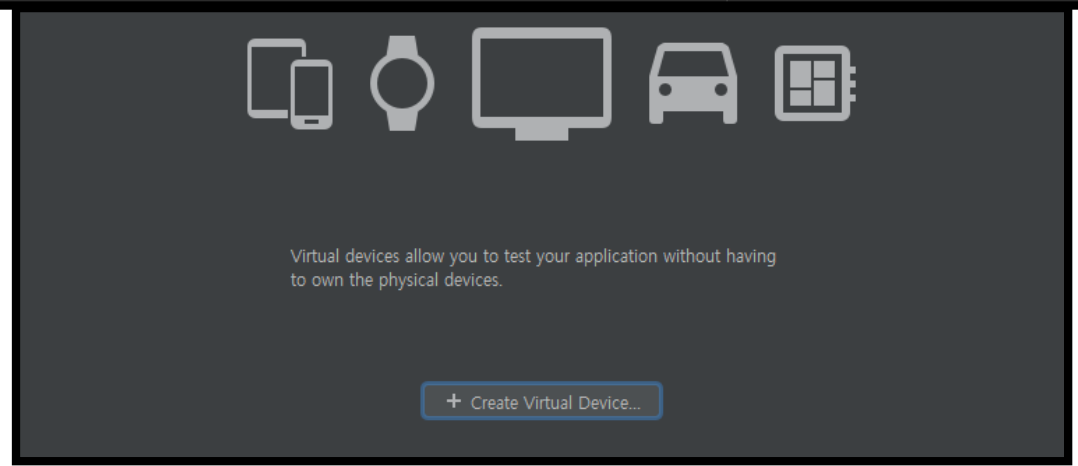


Create Virtual Device

After opening the project, let’s create virtual device.

- Click the AVD Manager and create virtual device.

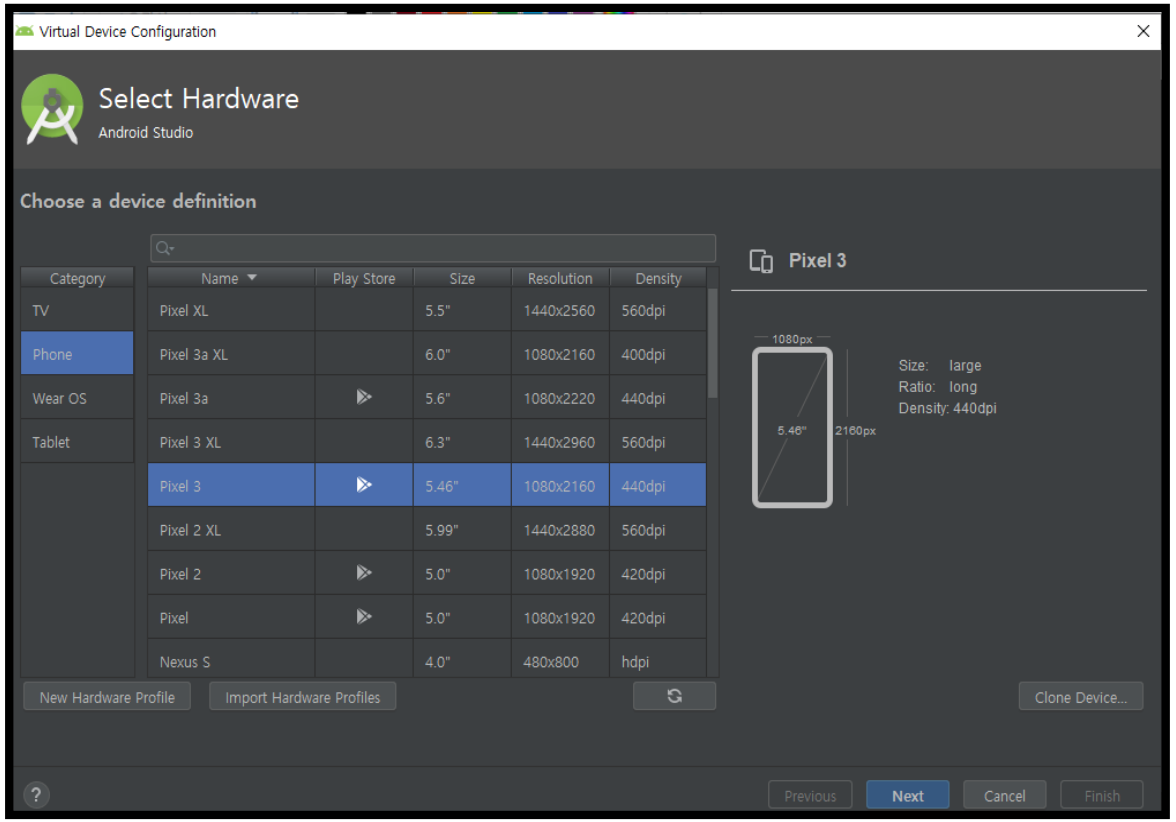


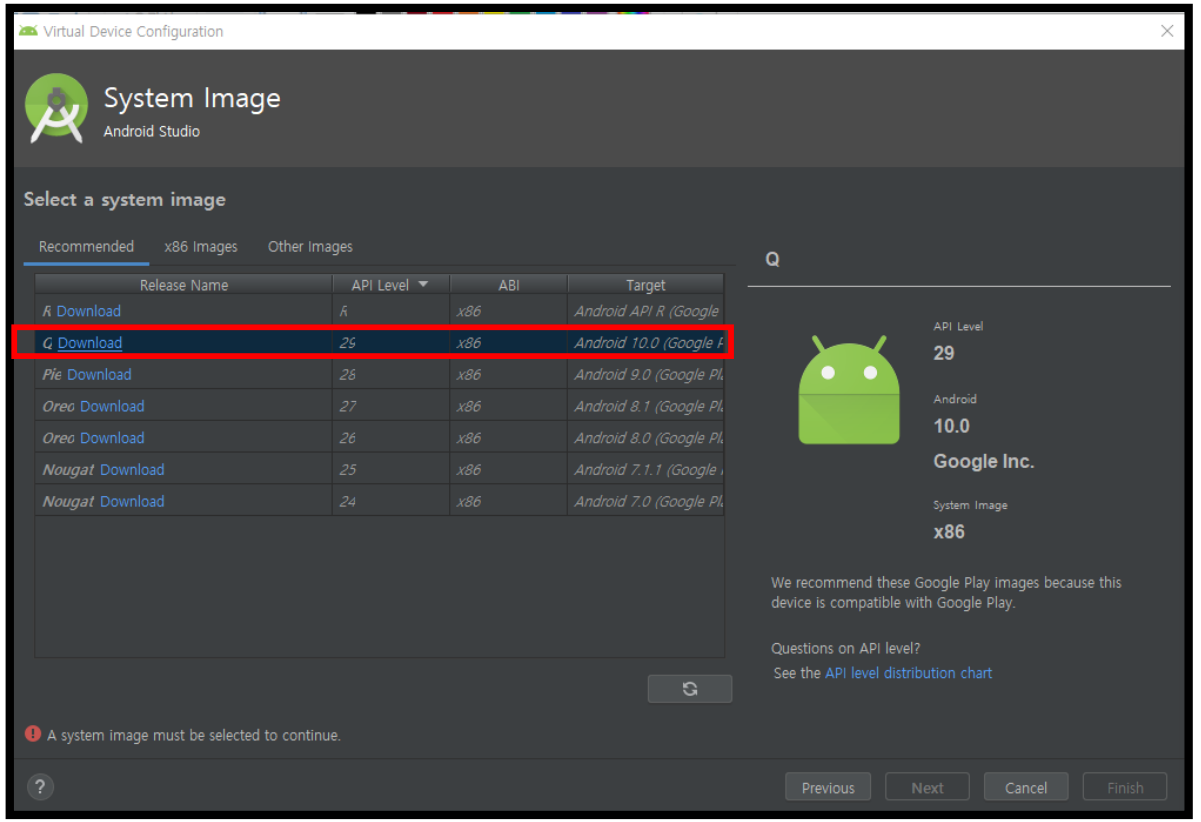


Create Virtual Device

Choose the device you prefer. (In my case, Pixel 3 with system Q.)

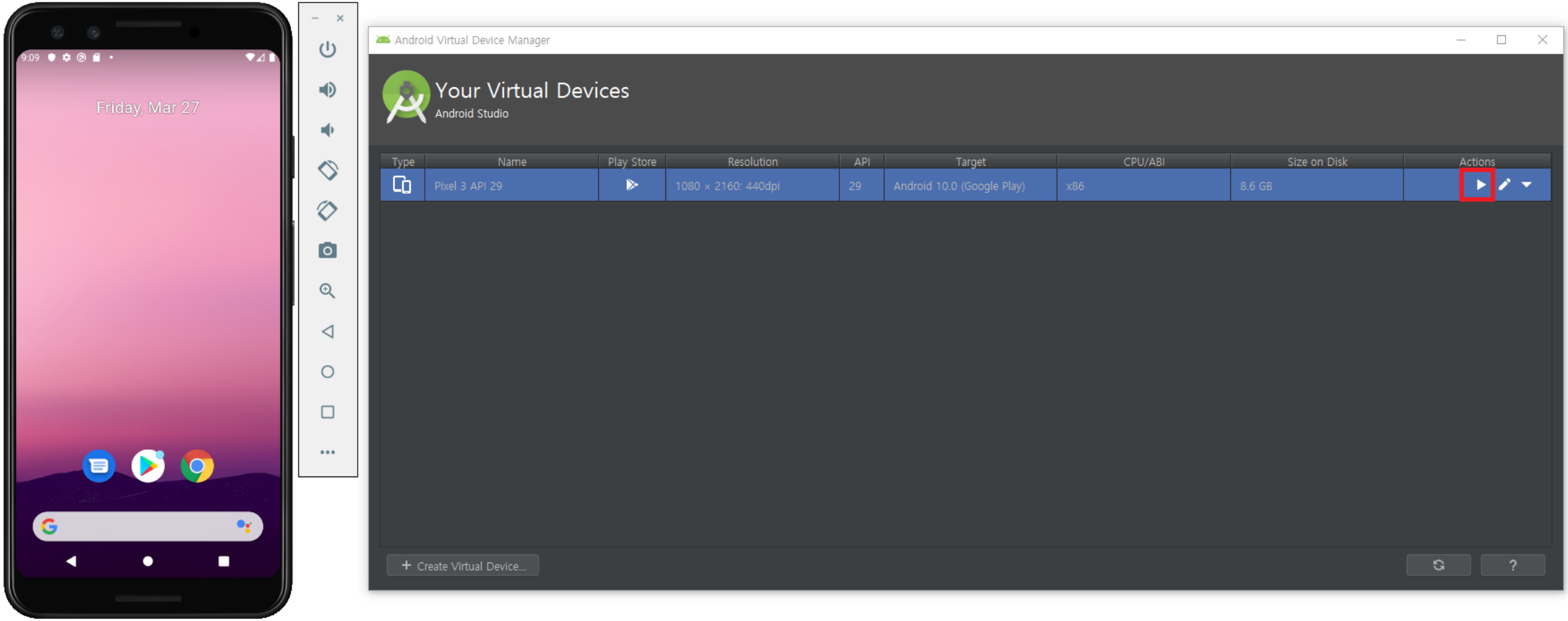
- If required, download the API.





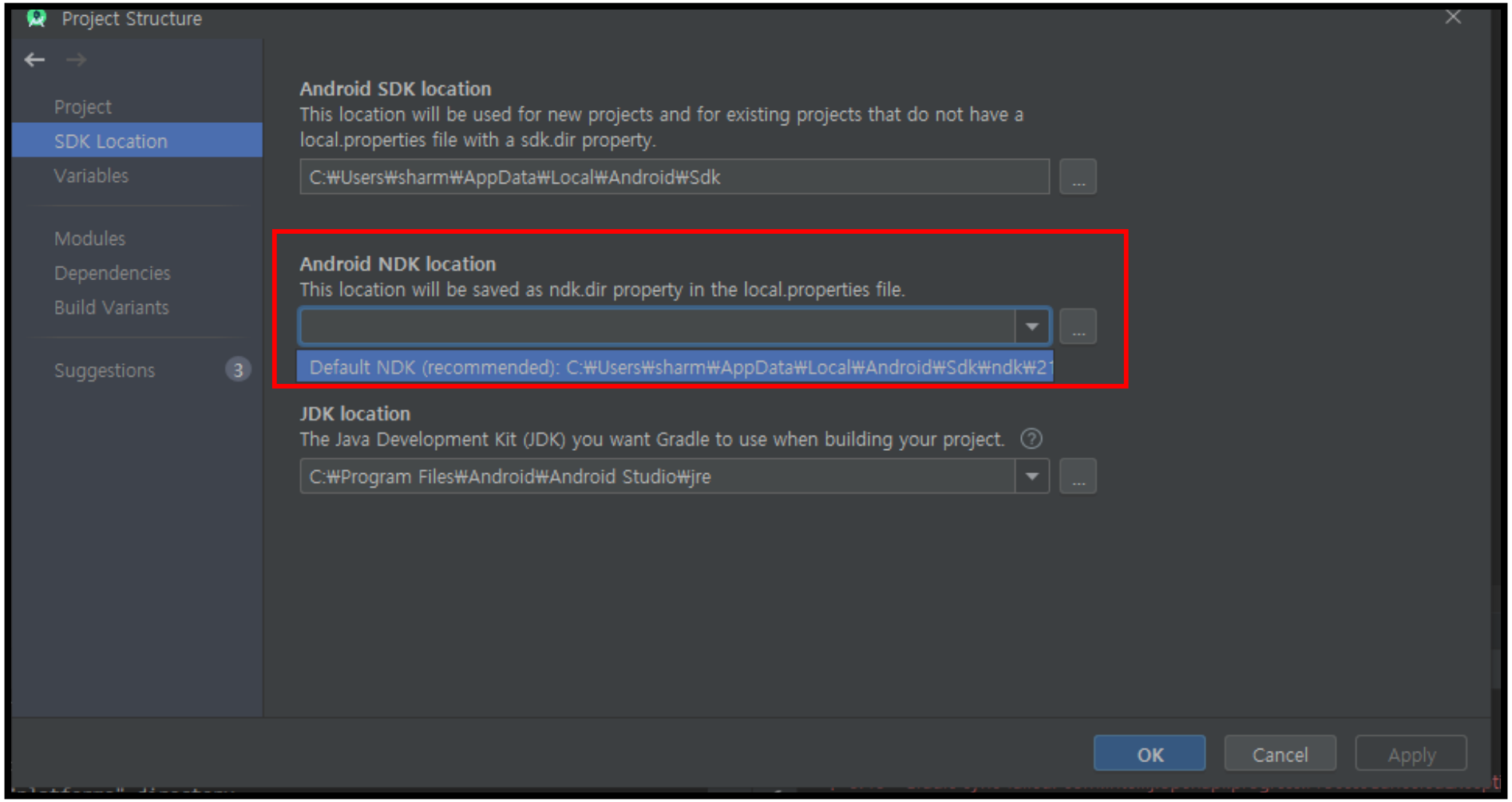
Create Virtual Device

After finishing the creation, click the launch button on the Actions tab.
Then, the virtual device shown on the left will appear.



NDK Location

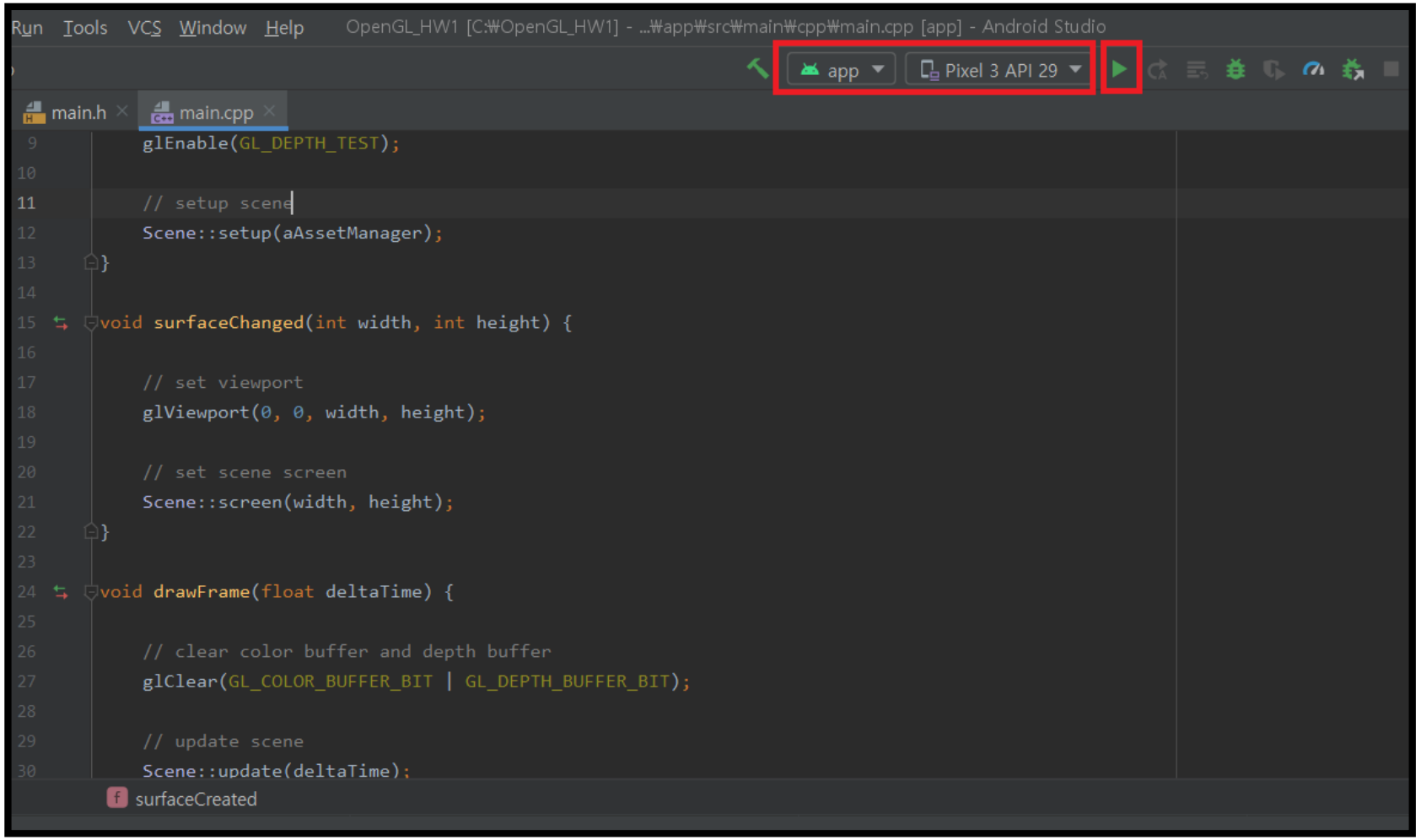
Set a proper Android NDK location. (It varies depending on your computer setting!)



Ready?

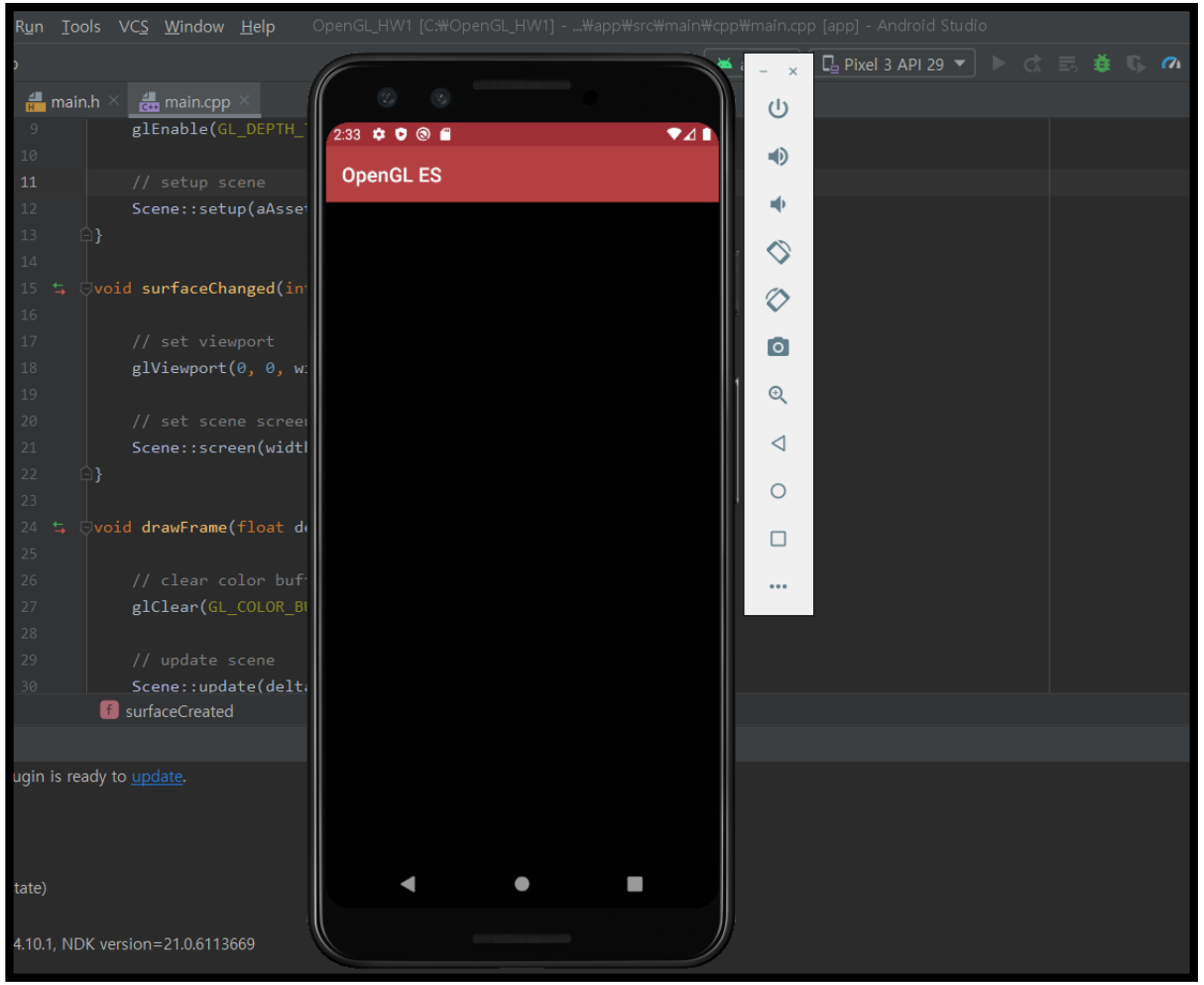
Then click the [Run] – [Run] (or green triangle shown below.)

- If required, several installation process will be performed (It takes several minutes.)



Ready?

The emulator shown bellow will appear. Now, you are ready.



Problem

Fill in lines.

- App/src/main/cpp/scene.cpp (setup and update)
- App/src/main/assets/vertex.glsl (main)

```
    camera->eye = vec3(60.0f, 00.0f, 0.0f);

    // create light
    light = new Light(program);
    light->position = vec3(100.0f, 0.0f, 0.0f);

    // create floral texture
    flower = new Material(program, texFlowerData, texFlowerSize);

    // create teapot object
    teapot = new Object(program, flower, objTeapotVertices, objTeapotIndices,
                        objTeapotVerticesSize, objTeapotIndicesSize);
    //Set world matrix
    //teapot->worldMatrix;
}

void Scene::screen(int width, int height) {

    // set camera aspect ratio
    camera->aspect = (float) width / height;
}
```

```
void Scene::update(float deltaTime) {
    static float angle = 0.0f;

    // use program
    program->use();

    // rotate the camera relative to the object
    // camera->eye = ;

    // setup camera and light
    camera->setup();
    light->setup();

    // draw teapot
    teapot->draw();
}
```

```
uniform vec3 lightPos;

layout(location = 0) in vec3 position;
layout(location = 1) in vec3 normal;
layout(location = 2) in vec2 texCoord;

out vec3 v_normal;
out vec2 v_texCoord;
out vec3 v_lightDir;

void main() {

    // fill in the lines below
    //gl_Position = ;
    //v_normal = ;
    //v_texCoord = ;

    // do not touch below
    vec3 posWS = (worldMat * vec4(position, 1.0)).xyz;
    v_lightDir = normalize(lightPos - posWS);
}
```

Problem

Goal 1 (3points). Write your code at the setup() to transform the teapot as follows:

- Scale the teapot by 1.0, 2.0 and 0.5 along the x, y and z axis respectively.
- Rotate the teapot by 50° around the axis, (1, 1, 0).

Goal 2 (3points). Write your code at the update() to rotate the camera around the y-axis

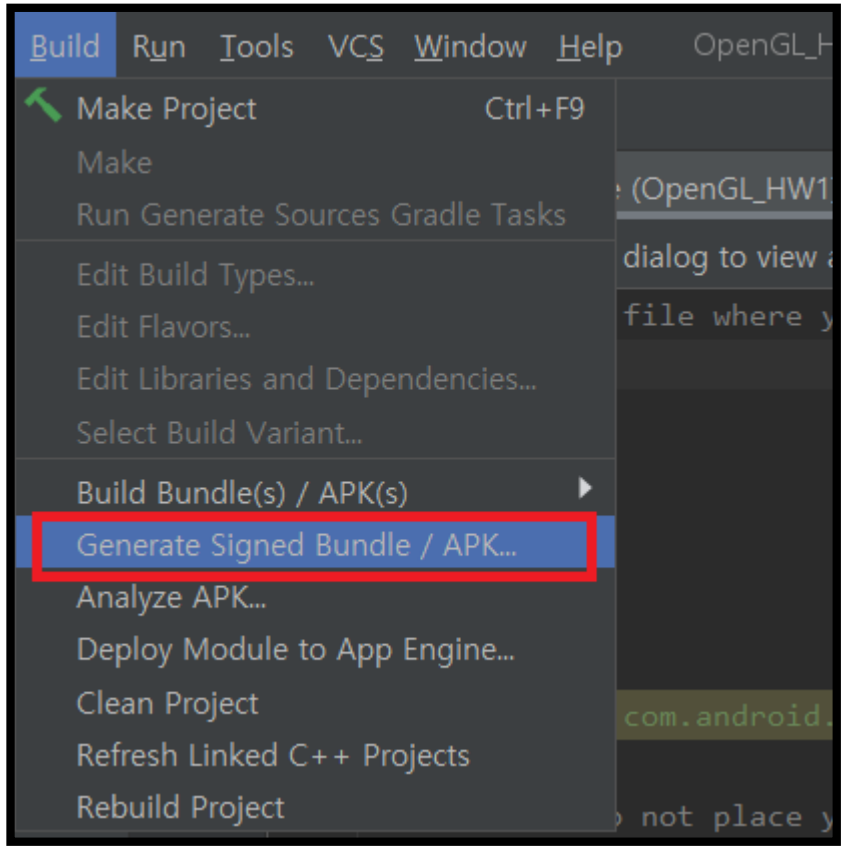
- Rotate the teapot by 2° for every update.

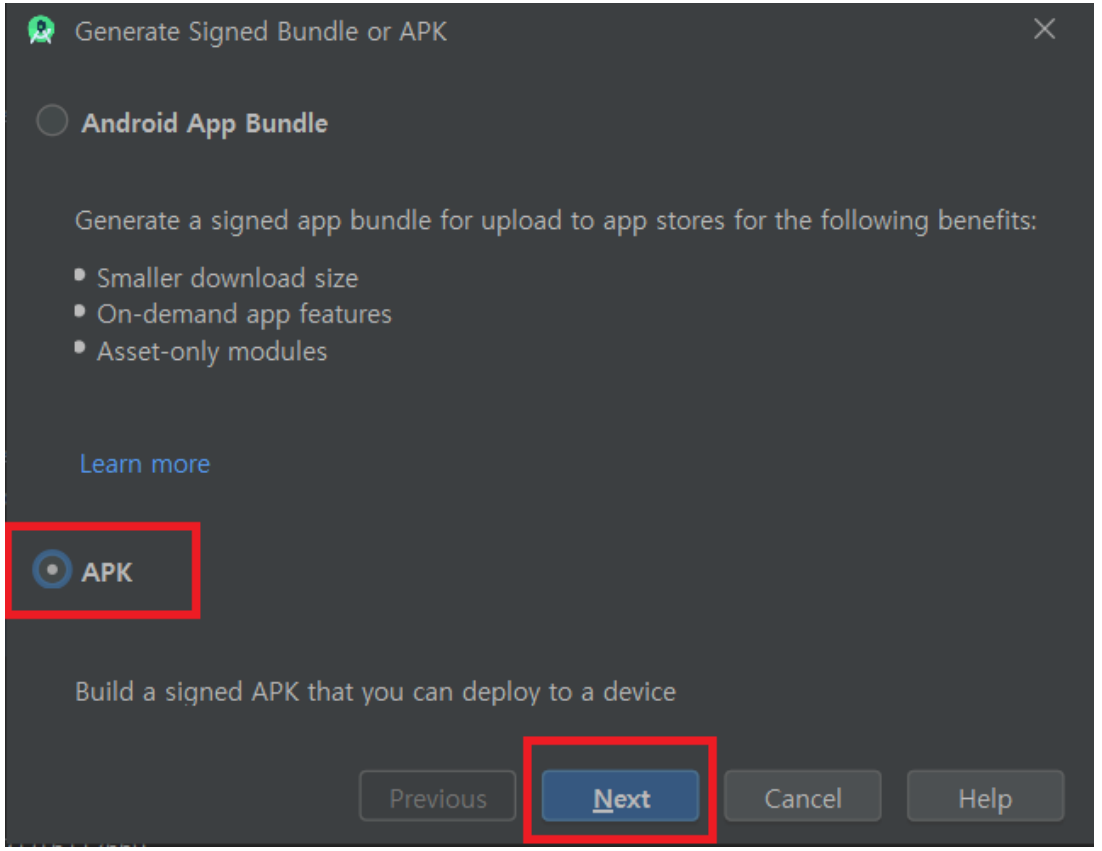
Goal 3 (4points). Write your code at the .glsl main().

- The clip-space vertex position must be calculated.
- The world-space vertex normal must be calculated accurately considering a non-uniform scaling (note that the lighting will look weird if vertex normals are incorrect.)
- The texture coordinates will be sent to the rasterizer stage with no change.

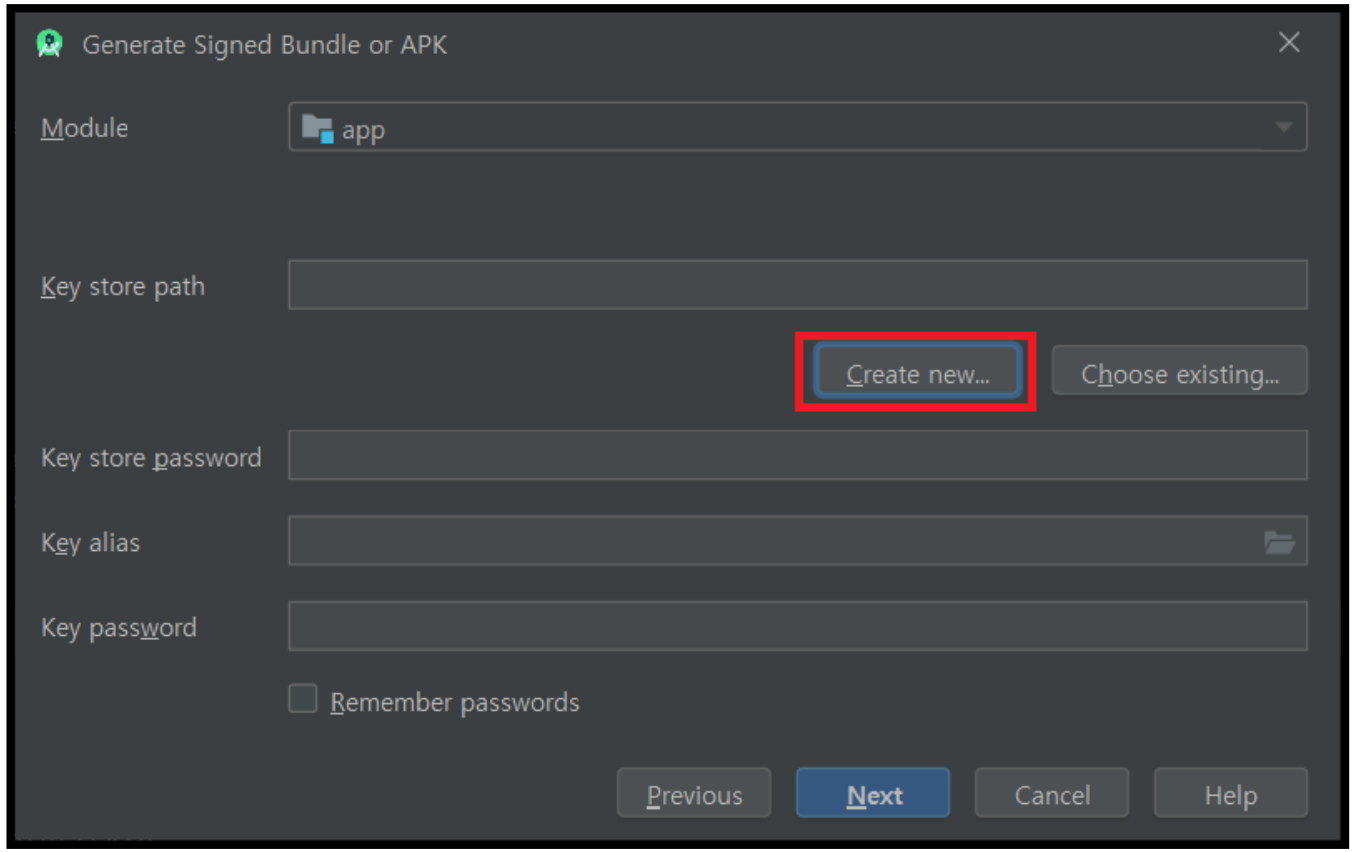
Note: do not use rotate() function!

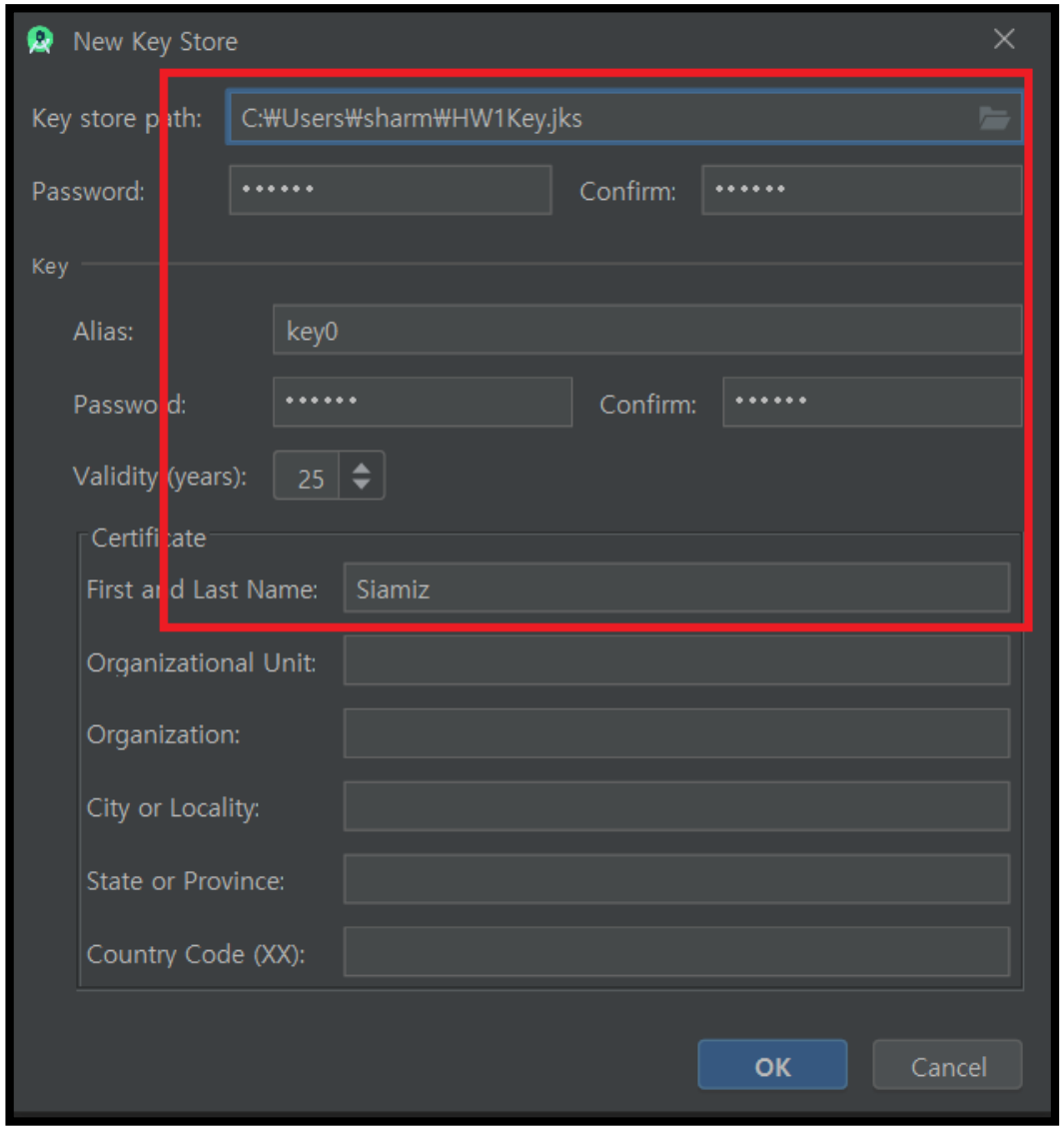
Generate APK





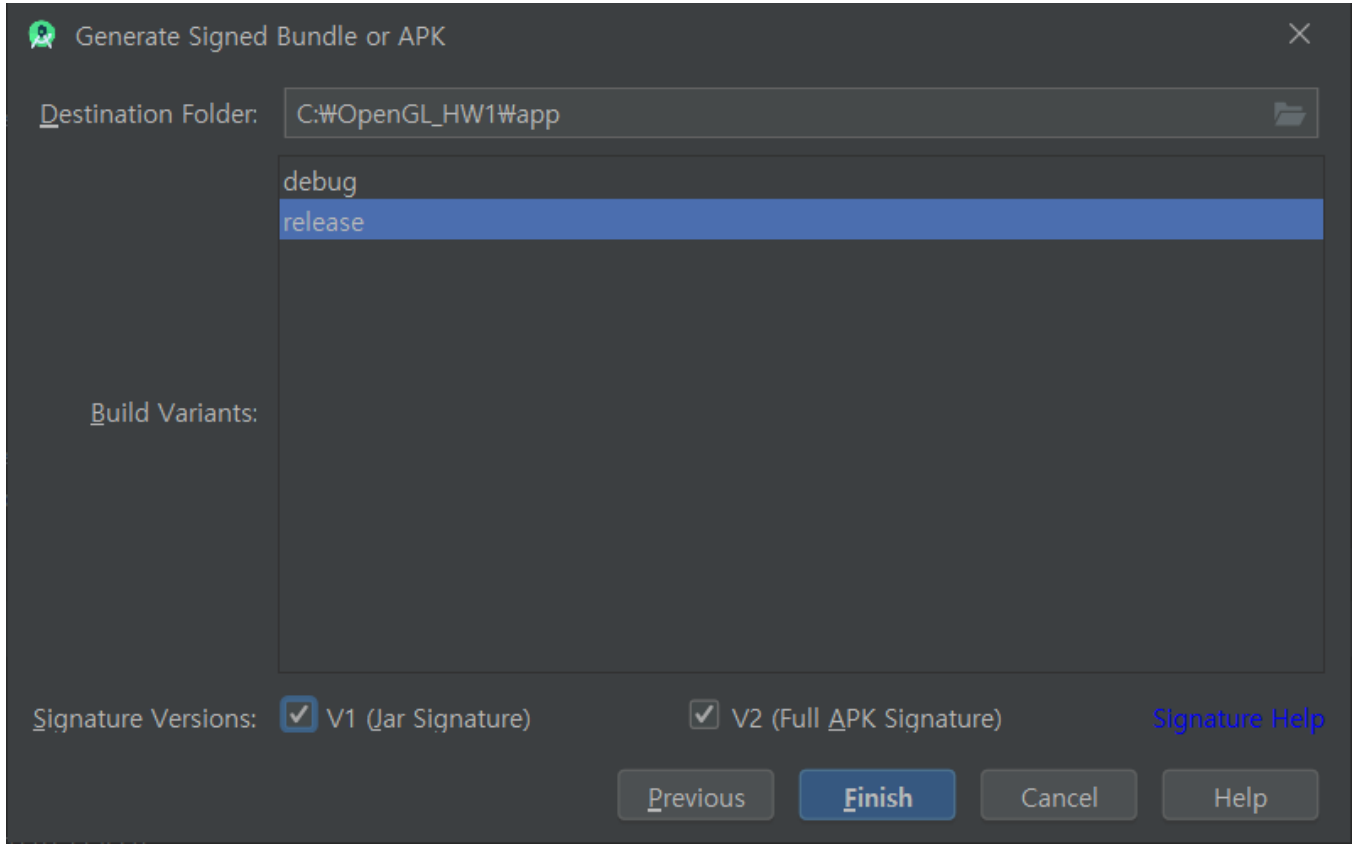
Generate APK





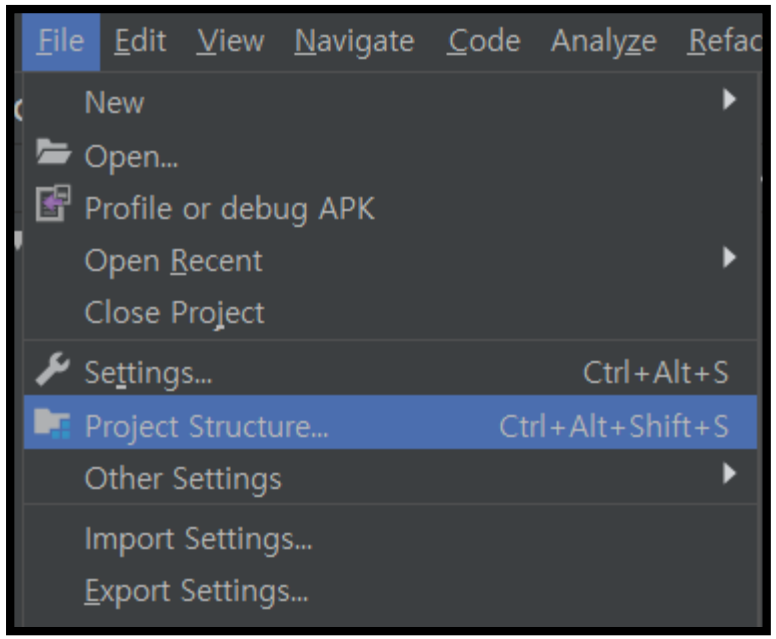
Generate APK

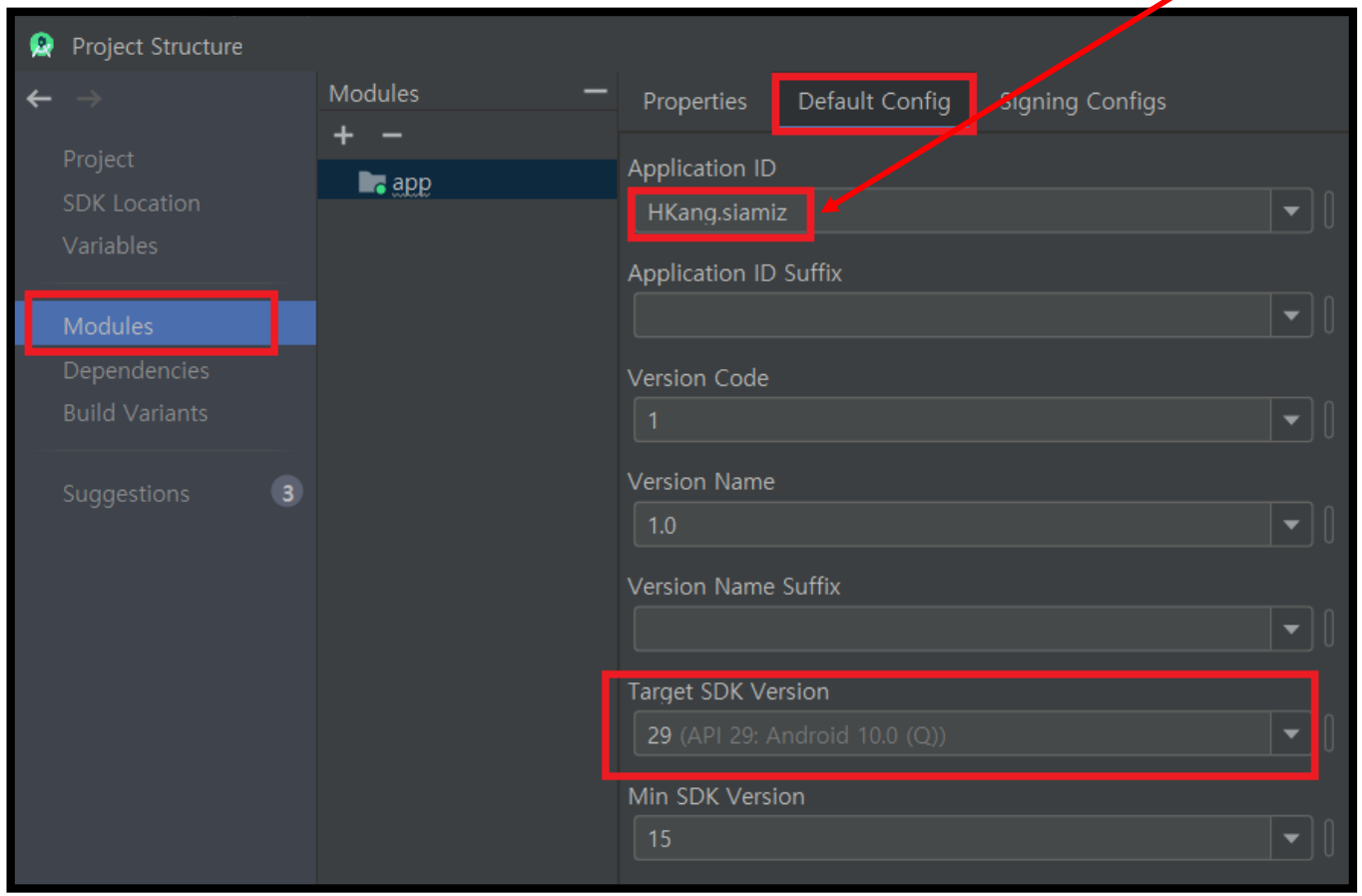
You have an error? Google may help you to generate APK ☺



Project Setting

Add your student_number to the end of the ID





Upload these to your git repository.

Submission

Deadline

- 4. 24. 23:50 (important!)

Submit followings to klas.

- Make an apk file and upload it to your git repository. Then, share your git URL.
  - ✓ APK does not work: 0 point!
- {student_number}_{name}.zip including vertex.glsl and scene.cpp.
  - ✓ does not submit code: 0 point!

TA

- 이정은 (jeunlee0306@khu.ac.kr),

Office hour

- Monday, Wednesday 2:00 PM ~ 5:00 PM
- Contact TA by email before you visit.