

Game Graphic Programming

Homework1

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Goal

Goal

- Render three objects (cube, person, and teapot).
- Animate the rendered objects.

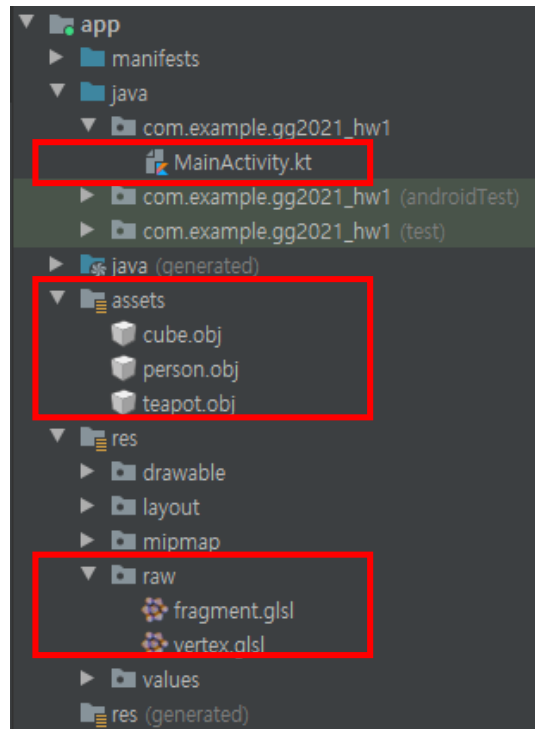
Detail

- Render three objects in a single scene.
- Compute world matrix.
- Compute view matrix and projection matrix via appropriate functions.
- Write and load the vertex.glsl and fragment.glsl.
- Animate the objects every frame. (rotation and scaling)

Problem

1. Project setting

- Project name: GG2021_HW1_학번 (ex. GG2021_HW1_2017103754)
- Project directory:



Problem

2. Object class

- Modify an object class to manage all three objects.

```
class MyGLRenderer(context: Context): GLSurfaceView.Renderer {
    private val mContext: Context = context
    private val vPMatrix = FloatArray( size: 16)
    private val projectionMatrix = FloatArray( size: 16)
    private val viewMatrix = FloatArray( size: 16)
    //P. model matrix & 매 프레임 변화 matrix 선언

    //P. object 선언
    private lateinit var cube: Cube

    override fun onSurfaceCreated(p0: GL10?, p1: EGLConfig?) {
        GLES20.glClearColor(0.0f, 0.0f, 0.0f, 1.0f)
        //P. object 초기화
        cube = Cube(mContext)

        //P. model matrix & 매 프레임 변화 matrix 초기화
    }

    override fun onDrawFrame(p0: GL10?) {
        GLES20.glClear(GLES20.GL_COLOR_BUFFER_BIT)

        //P. 아래 구현한 mySetLookAtM function 으로 수정
        Matrix.setLookAtM(viewMatrix, 0, eyeX: 1.0f, eyeY: 1.0f, eyeZ: -3f, centerX: 0f, centerY: 0f, centerZ: 0f)

        //P. 각 object 별 매 프레임 변화 matrix 와 model matrix 를 multiply
        Matrix.multiplyMM(vPMatrix, 0, projectionMatrix, 0, viewMatrix, 0)

        //P. object draw
        cube.draw(vPMatrix)
    }
}
```

```
//PP. cube, person, teapot 모두 포함할 수 있는 Object class 로 수정
class Cube(context: Context) {

    //P. 아래 shader code string 지우고, res/raw 에 위치한 vertex.glsl , fragment.glsl 로드해서 vertexShaderCode 에 넣어주면 됨
    private val vertexShaderCode =
        "uniform mat4 uMVPMatrix;" +
        "attribute vec4 vPosition;" +
        "void main() {" +
        "    gl_Position = uMVPMatrix * vPosition;" +
        "}"

    private val fragmentShaderCode =
        "precision mediump float;" +
        "uniform vec4 vColor;" +
        "void main() {" +
        "    gl_FragColor = vColor;" +
        "}"

    //P. model matrix handle 변수 추가 선언
    private var vPMatrixHandle: Int = 0

    val color = floatArrayOf(1.0f, 0.980392f, 0.980392f, 0.3f)

    private var mProgram: Int

    private var vertices = mutableListOf<Float>()
    private var faces = mutableListOf<Short>()
    private lateinit var verticesBuffer: FloatBuffer
    private lateinit var facesBuffer: ShortBuffer
}
```

The part that starts with "//PP" means that you need to find and modify some of the codes in the class under that comment.

Problem

2. Object class

- Modify an object class to manage all three objects.

```
//PP. cube, person, teapot 의 world transform 및 매 프레임 변화를 반영할 수 있는 draw function 으로 수정
fun draw(mvpMatrix: FloatArray){
    GLES20.glUseProgram(mProgram)

    positionHandle = GLES20.glGetAttribLocation(mProgram, "vPosition").also { it Int
        GLES20.glEnableVertexAttribArray(it)
        GLES20.glVertexAttribPointer(
            it,
            COORDS_PER_VERTEX,|
            GLES20.GL_FLOAT,
            normalized: false,
            vertexStride,
            verticesBuffer
        )

        mColorHandle = GLES20.glGetUniformLocation(mProgram, "vColor").also { colorHandle ->
            GLES20.glUniform4fv(colorHandle, 1, color, 0)
        }

        vPMatrixHandle = GLES20.glGetUniformLocation(mProgram, "uMVPMatrix")
        GLES20.glUniformMatrix4fv(vPMatrixHandle, 1, false, mvpMatrix, 0)

        GLES20.glDrawElements(GLES20.GL_TRIANGLES, faces.size, GLES20.GL_UNSIGNED_SHORT, facesBuffer)

        GLES20.glDisableVertexAttribArray(it)
    }
}
```

The part that starts with "//PP" means that you need to find and modify some of the codes in the function under that comment.

Problem

3. World matrix

- Compute the world matrix for each object based on the following conditions:

	Scale	Translate	rotate
Cube	x(0.5), z(0.5)	X	X
Person	X	x(2)	X
Teapot	x, y, z(0.2)	x(1.25), y(0.4)	Y-axis(180 degree)

```
class MyGLRenderer(context: Context): GLSurfaceView.Renderer {
    private val mContext: Context = context
    private var vPMatrix = FloatArray( size: 16)
    private var projectionMatrix = FloatArray( size: 16)
    private var viewMatrix = FloatArray( size: 16)
    //P. model matrix & 매 프레임 변화 matrix 선언

    //P. object 선언
    private lateinit var cube: Cube

    override fun onSurfaceCreated(p0: GL10?, p1: EGLConfig?) {
        GLES20.glClearColor(0.0f, 0.0f, 0.0f, 1.0f)
        //P. object 초기화
        cube = Cube(mContext)

        //P. model matrix & 매 프레임 변화 matrix 초기화
    }
}
```

```
override fun onDrawFrame(p0: GL10?) {
    GLES20.glClear(GLES20.GL_COLOR_BUFFER_BIT)

    //P. 아래 구현한 mySetLookAtM function 으로 수정
    Matrix.setLookAtM(viewMatrix, 0, eyeX: 1.0f, eyeY: 1.0f, eyeZ: -3f, centerX: 0f, centerY: 0f, centerZ: 0f)

    //P. 각 object 별 매 프레임 변화 matrix 와 model matrix 를 multiply

    Matrix.multiplyMM(vPMatrix, 0, projectionMatrix, 0, viewMatrix, 0)

    //P. object draw
    cube.draw(vPMatrix)
}
```

Problem

4. Camera & Projection matrix

- Implement function that computes view matrix & projection matrix.
- Do not use Matrix library function like setLookAtM() and frustum() (multiplyMM () can be used).
- Condition:
 - View: eye(1.5f, 1.5f, -9f), at(0f, 0f, 0f), up(0f, 1f, 0f) /
 - projection: aspect(screen with/height), fov(60 degree), near(2f), far(12f)

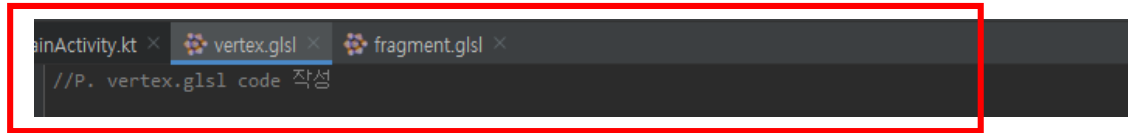
```
override fun onDrawFrame(p0: GL10?) {  
    GLES20.glClear(GLES20.GL_COLOR_BUFFER_BIT)  
  
    //P. 아래 구현한 mySetLookAtM function 으로 수정  
    Matrix.setLookAtM(viewMatrix, 0, eyeX: 1.0f, eyeY: 1.0f, eyeZ: -3f, centerX: 0f, centerY: 0f, centerZ: 0f)  
  
    //P. 각 object 별 매 프레임 변화 matrix 와 model matrix 를 multiply  
  
    Matrix.multiplyMM(vPMatrix, 0, projectionMatrix, 0, viewMatrix, 0)  
  
    //P. object draw  
    cube.draw(vPMatrix)  
}  
  
override fun onSurfaceChanged(p0: GL10?, width: Int, height: Int) {  
    GLES20.glViewport(0,0, width, height)  
  
    val ratio: Float = width.toFloat() / height.toFloat()  
  
    //P. 아래 구현한 myFrustumM function 으로 수정  
    Matrix.frustumM(projectionMatrix, 0, offset: 0, -ratio, ratio, bottom: -1f, top: 1f, near: 2f, far: 12f)  
}
```

```
//P. vecNormalize function 구현: 벡터 정규화 함수 (mySetLookAtM function 구현 시 사용)  
  
//P. mySetLookAtM function 구현: viewMatrix 구하는 함수 (Matrix library function 중 multiplyMM 만 사용 가능)  
  
//P. myFrustumM function 구현: projectionMatrix 구하는 함수 (Matrix library function 중 multiplyMM 만 사용 가능)
```

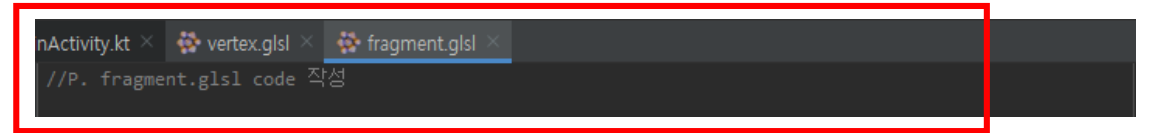
Problem

5. GLSL

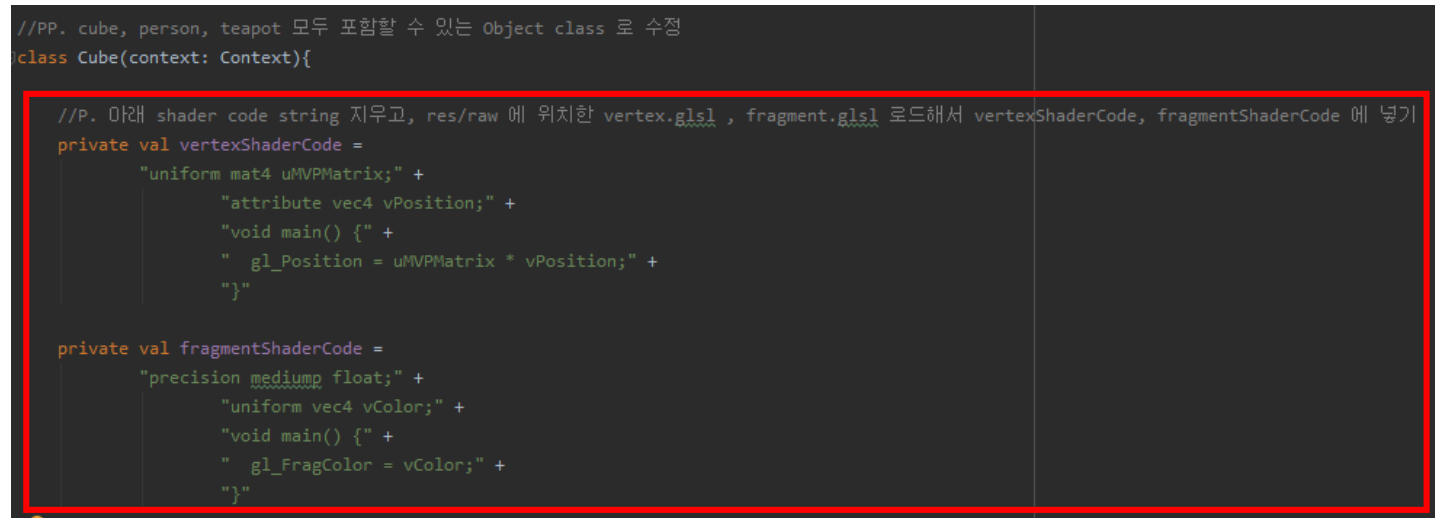
- Write and load the GLSL code(vertex.glsl and fragment.glsl).
- Please follow the comments in the mainactivity file.



```
mainActivity.kt × vertex.glsl × fragment.glsl ×  
//P. vertex.glsl code 작성
```



```
mainActivity.kt × vertex.glsl × fragment.glsl ×  
//P. fragment.glsl code 작성
```



```
//PP. cube, person, teapot 모두 포함할 수 있는 Object class 로 수정  
class Cube(context: Context){  
    //P. 아래 shader code string 지우고, res/raw 에 위치한 vertex.glsl , fragment.glsl 로드해서 vertexShaderCode, fragmentShaderCode 에 넣기  
    private val vertexShaderCode =  
        "uniform mat4 uMVPMatrix;" +  
        "attribute vec4 vPosition;" +  
        "void main() {" +  
        "    gl_Position = uMVPMatrix * vPosition;" +  
        "}"  
  
    private val fragmentShaderCode =  
        "precision mediump float;" +  
        "uniform vec4 vColor;" +  
        "void main() {" +  
        "    gl_FragColor = vColor;" +  
        "}"  
}
```


Problem

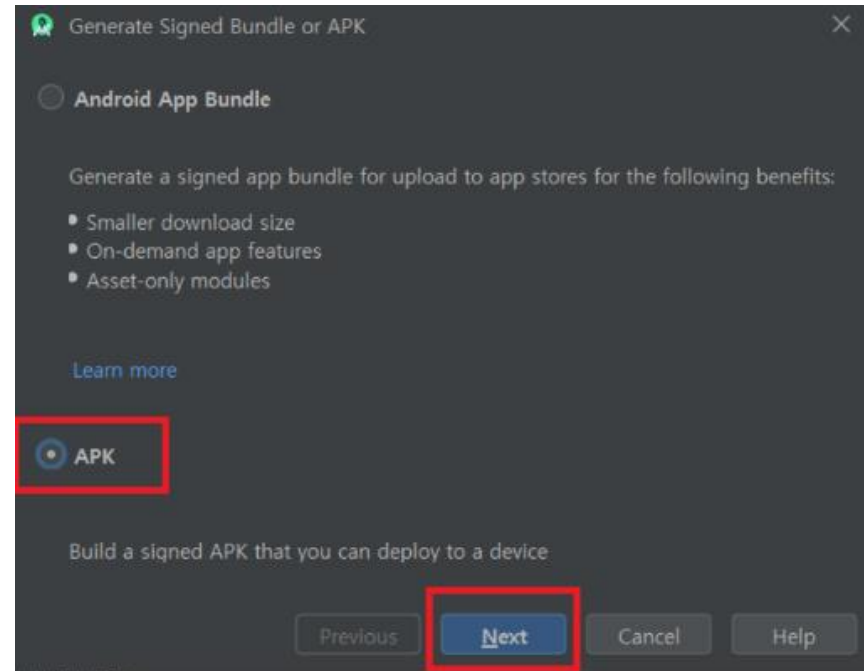
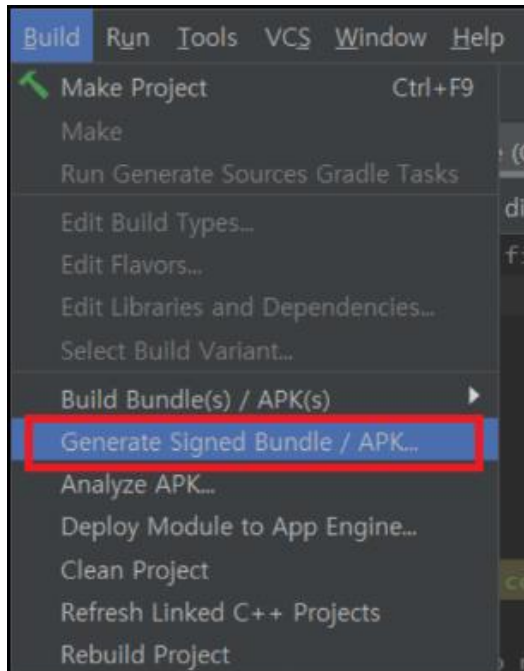
6. Animate the objects every frame.

- Animation detail of each object is as follow:
 - The size of the cube increases by 0.001 times for x- and z-axis, while it increases 0.002 times for the y-axis for every frame.
 - If the cube size exceeds 1.5, it will not grow larger.
 - Person and teapot rotate 0.8 degrees per frame around the y-axis.

```
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    private val mContext: Context = context  
    private var vPMatrix = FloatArray( size: 16)  
    private var projectionMatrix = FloatArray( size: 16)  
    private var viewMatrix = FloatArray( size: 16)  
    //P. model matrix & 매 프레임 변화 matrix 선언  
  
    //P. object 선언  
    private lateinit var cube: Cube  
  
    override fun onSurfaceCreated(p0: GL10?, p1: EGLConfig?) {  
        GLES20.glClearColor(0.0f, 0.0f, 0.0f, 1.0f)  
        //P. object 초기화  
        cube = Cube(mContext)  
  
        //P. model matrix & 매 프레임 변화 matrix 초기화  
    }  
}
```

```
override fun onDrawFrame(p0: GL10?) {  
    GLES20.glClear(GLES20.GL_COLOR_BUFFER_BIT)  
  
    //P. 아래 구현한 mySetLookAtM function 으로 수정  
    Matrix.setLookAtM(viewMatrix, 0, eyeX: 1.0f, eyeY: 1.0f, eyeZ: -3f, centerX: 0f, ce  
  
    //P. 각 object 별 매 프레임 변화 matrix 와 model matrix 를 multiply  
  
    Matrix.multiplyMM(vPMatrix, 0, projectionMatrix, 0, viewMatrix, 0)  
  
    //P. object draw  
    cube.draw(vPMatrix)  
}
```

Generate APK



Generate APK

Generate Signed Bundle or APK

Module: app

Key store path:

Key store password:

Key alias:

Key password:

☐ Remember passwords

New Key Store

Key store path: C:\Users\sharm\HW1Key.jks

Password: Confirm:

Key:

Alias: key0

Password: Confirm:

Validity (years): 25

Certificate

First and Last Name: Siamiz

Organizational Unit:

Organization:

City or Locality:

State or Province:

Country Code (XX):

Submission

Deadline

- 05.04. 23:59

Submit followings to e-campus

- Make an apk file and upload it to your git repository. Then, share your git URL and password via e-campus.
- Submit to e-campus (8week.Homework1): git URL text file, GG2021_HW1_학번.zip (MainActivity.kt, vertex.glsl, fragment.glsl)

TA

- 정승재 (teclados078@khu.ac.kr)

