

TDT4195: Visual Computing Fundamentals
Computer Graphics - Assignment 1

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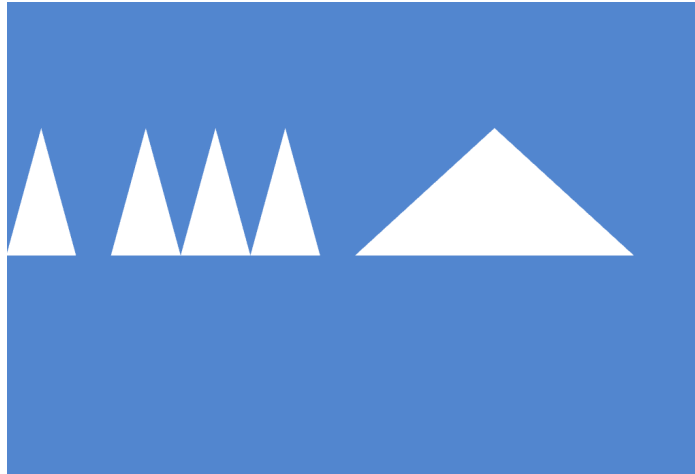
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Task 1c)

Screenshot:



Task 2a)

i) What is the name of this phenomenon?

This phenomenon is called "clipping".

ii) When does it occur?

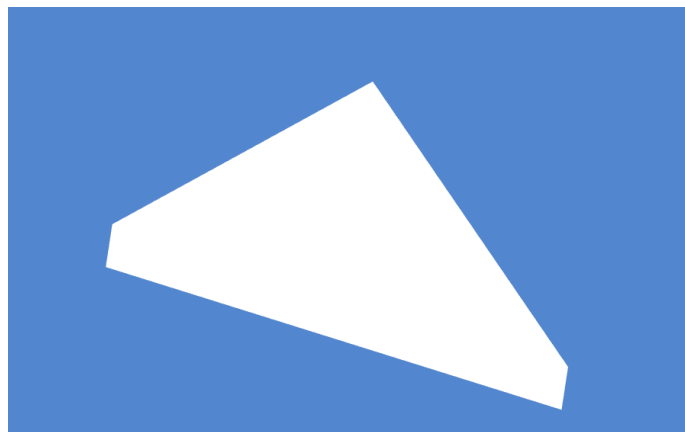
If some parts of a triangle appear outside from the clipping window they will not be drawn.

iii) What is its purpose?

The reason behind this behavior is performance because these parts don't need to be rendered which saves a lot of computation work.

Screenshot and explanation:

In this example, there are two z-coordinates (1.2 and -1.2) outside of the clipping window which cuts the right and left corners of the triangle.



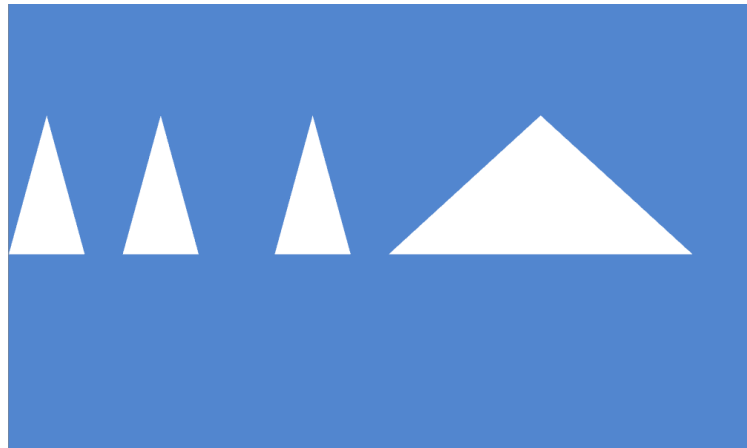
Task 2b

i) What happens?

After inverting the indices, the third triangle is vanished.

ii) Why does this happen? iii) Whats is the condition under which this effect occurs? Determine a rule.

According to lecture notes (chapter 1, page 14), the vertices of a triangle have a clear sequence. When the vertices are ordered counter-clockwise we can see the front side of the triangle towards to the viewer view. In the other case (clockwise), the front side is moved away from the viewer view looking at its back. This is the reason why the triangle dissapears using clockwise ordering.



Task 2c

i) What is the purpose of the depth buffer?

The distances of an object in a 3D image can be determined using a z-buffer. The z-buffer represents the nearest objects using dark colors in the grey scale, otherwise objects located further back will be colored in brighter colors.

ii) OpenGL makes a distinction between a Program Object and a Shader Object. What is the difference?

OpenGL has a pipeline with several stages attached. Shaders are the stages of this pipeline. These can be individually created and compiled to be linked to the program object. The program object contains the necessary code to execute the shader stages.

iii) What are the two most commonly used types of Shaders? What are the responsibilities of each of them?

There are Vertex Shader and Fragment Shader. The responsibilities of the Vertex Shader is to realize the transformation of each vertices (translating, scaling, rotating, sheering). This ensures that the points are in the correct position, so a model is able to move around. Vertex shaders also project the scene onto the camera to describe the world seeing through it.

The responsibilities of the Fragment Shader is to determine the desired colour. After determining the fragment shader assign a colour to a rasterised pixel.

iv) The index buffer has a special status within the vertex array object, and is thus stored as a separate reference. Why is the index buffer kept separate from the vertex attributes?

The purpose behind this is that points have coordinates that can be shared by other multiple forms and accessed by the index. Therefore, the image buffer contains the indices of the elements from the Vertex Buffer Object.

v) What is the relation between shader input variables and vertex attributes?

The relation between these components is that the vertex attributes works as a specification for the shader input variables. It is necessary to match the vertex attributes with the shader input variables.

Task 2d

i) Mirror the whole scene horizontally and vertically at the same time.

The function `gl_Position = vec4(position, 1.0f)` in the file "simple.vert" takes "position" as parameter. It is also possible to write „position“ in this form `gl_Position = vec4(-position.x, -position.y, position.z, 1.0f)` to access the coordinates. Changing the x and y coordinates (-x, -y, z) cause mirroring along the x and y axes.



ii) Change the colour of the drawn triangle(s) to a different colour.

In the file "simple.frag" there is an assignment to the color object. By changing the first three values from `vec4(1.0f, 1.0f, 1.0f, 1.0f)` to `vec4(1.0f, 0.0f, 0.9f, 1.0f)` the colour will change from white to lila/pink.

