Computer Graphics – WebGL

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# Question (a)

Describe how an index buffer object improves the use of a vertex buffer object in order to represent a 3D mesh.

An index buffer object tells the GPU which vertices (from the vertex buffer object) to join together to draw a triangle. Using an index buffer allows us to define a complete 3D mesh just by its vertices and avoids the need to repeat any of these vertex definitions. If we didn’t have an index buffer object, then we would have to repeat a vertex definition if we used the same vertex as part of a different triangle. Using the index buffer object reduces redundancy.

# Question (b)

Given a fragment shader program as follows:

void main() { gl\_FragColor = vec4(0.0, 0.0, 1.0, 1.0); }

Describe the functionality of this fragment shader program. If this fragment shader program is adopted by a WebGL program, which was supposed to support point lighting for mesh rendering, explain whether this fragment shader program will perform this job correctly. If yes, describe the rendering result produced. Otherwise, describe how you modify the program to support point lighting.

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# Question (c)

Describe the main functionality of a normal vector in terms of 3D mesh rendering. Suppose in a WebGL program, the initial normal vectors of a 3D mesh have been pre-computed. If this 3D mesh is then being rotated in the program, explain how you will update its normal vectors accordingly.

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# Question (d)

**(Reference: WebGL Prog. Guide Chapter 4, Table 4.1)**  
Suppose drawBox(m) is a function to draw a transformed matrix m. That is, if m is a rotation matrix, the function will draw a rotated box.

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## Part (i)

Explain the meaning of the following code segment and state the result obtained:

m.setTranslate(20.0, 0.0, -30.0);  
 m.rotate(angle, 2.0, 0.0, 0.0);  
 drawBox(m);

Text

## Part (ii)

Explain whether you will get the same result if m.rotate() has been replaced by m.setRotate().

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