

1st Homework – Computer graphics and game technology

In programming language JavaScript implement a part of graphics pipeline for interactive rendering of 3D graphics. You have to implement next steps:

1st step

Implement reading of 3D object from a file. An object consists of individual triangles; its geometry is specified in text format in a file in a similar way as defined for OBJ file format ([OBJ](#)). To store vertices in memory, create standard array in JavaScript. You can check [glMatrix](#) library for idea and help.

- a) In beginning lines of file, we define vertices. Lines start with letter “v”:

```
v x1 y1 z1
v x2 y2 z2
v x3 y3 z3
--
```

- b) In the following lines, we define individual triangles with indices of vertices.

Lines start with letter “f”:

```
f v1 v2 v3
f v3 v4 v5
f v2 v4 v5
--
```

- c) An example of three sided pyramid:

```
v 0.0 0.0 0.0
v 1.0 0.0 0.0
v 0.0 1.0 0.0
v 0.0 0.0 1.0
```

```
f 1 3 2
f 1 2 4
f 1 4 3
f 2 3 4
```

2nd step

Implement methods, which transform matrix in homogeneous coordinates for basic 3D transformations: rotation (around all three axes – x, y, z), translation, scaling and perspective projection. For matrix presentation you can use [glMatrix](#). You may not use these functionalities from the package. You have to implement them yourself.

Method declarations must be:

```
<mat4> rotateX(<float> alpha);
<mat4> rotateY(<float> alpha);
<mat4> rotateZ(<float> alpha);
<mat4> translate(<float> dx, <float> dy, <float> dz);
<mat4> scale(<float> sx, <float> sy, <float> sz);
<mat4> perspective(<float> d); // primerna vrednost je d=4
```

Do not use transformation methods from glmatrix package, which have same functionality. Implement these functionalities yourself !!!

3rd step

Implement wireframe rendering of 3D object onto HTML5 canvas (2d canvas) inside the webpage. Wireframe drawing shows only edges of triangles. Put the camera at location (0, 0, -8) in the world. You may use methods implemented in 2nd step. You can also assume that borders of coordinate system of canvas are at -1 and 1 along x and y axis.

4th step

Implement interaction with the object, which allows user to rotate, translate and scale an object using mouse and/or keyboard.

Submit the homework in **ZIP** archive, which must contain source code (**html** and **js** files only). The homework is worth 10 % of the final grade.