CS3570 Introduction to Multimedia Technology
Homework #4
Due: 11:59pm, 2023/05/26

1. Bézier curve (50%)

You are given 1 raster image (bg.png) and 1 path object (Bézier curve, extracted as points.txt) and a sample script to draw the point and line (problem1.py).


bg.png

a. Plot curve and point on the bg.png by using 2 different settings.
   I. Low detail curve: t = {0, 0.5, ..., 1.0}; High detail curve: t = {0, 0.01, 0.02, ..., 1.0}, and save the result as **1a.png with 2 curves on bg.png.**
   II. Discuss how you implement the Bézier curve and the differences between high and low detail curves.
b. Scale up the img by 4 and plot it.
   I. bg.png is scaled using Nearest-neighbor interpolation.
   II. the coordinates of the curve is scaled before the curve is drawn, also you should use the setting of high detail curve.

2. 3D Models (50%)

Launch the script (problem2.ipynb) to implement the translation and illumination of bunny.obj and a 3D surface respectively. Here, we use plotly, a python graphing library, to help us render 3D graphics.
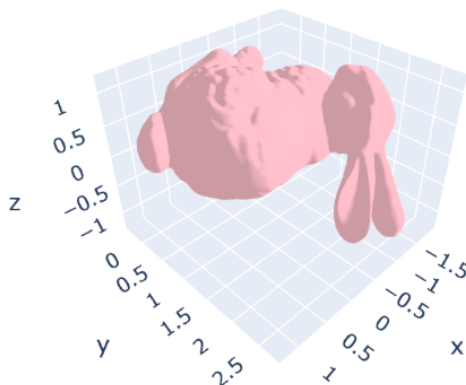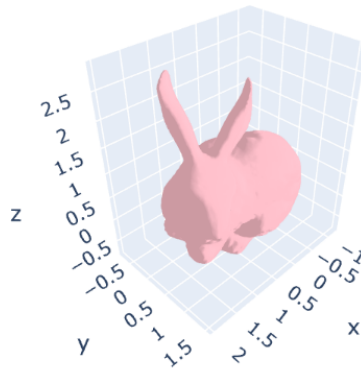

bunny.obj   3D surface
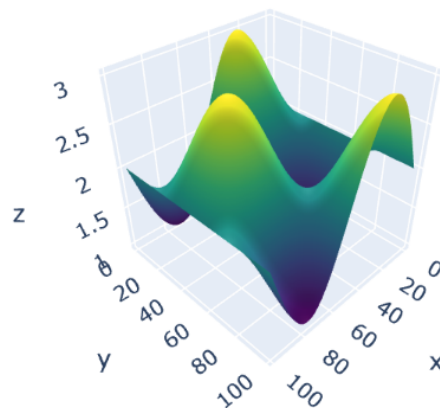
a. Shift the center of the bunny to (0, 0, 0) and save the figure as **2a.png**. Center is defined as `[(max(x) + min(x)) / 2, (max(y) + min(y)) / 2, (max(z) + min(z)) / 2]` where x, y, z are the vertices of the object.

b. Based on (a), implement the rotation matrix to rotate the bunny to face the screen(like the following example). Discuss how you implement the rotation matrix and save the 3D figure as **2b.png**.

c. Based on (b), try to put a cubic under the foot of the bunny and save the result as **2c.png**.

d. Given a surface, try different <u>ambient</u> strength k_a, <u>diffuse</u> strength k_d, <u>specular</u> strength k_s in the following settings:
   I. $(k_a, k_d, k_s) = (0.1, 0.8, 0.05)$ and $(k_a, k_d, k_s) = (0.9, 0.8, 0.05)$
   II. $(k_a, k_d, k_s) = (0.8, 0.1, 0.05)$ and $(k_a, k_d, k_s) = (0.8, 0.9, 0.05)$
   III. $(k_a, k_d, k_s) = (0.8, 0.8, 0.2)$ and $(k_a, k_d, k_s) = (0.8, 0.8, 2.0)$
   Plot the result for each condition with 2 subplots and discuss the difference between each setting. Results are saved as **2d_1.png, 2d_2.png, 2d_3.png** respectively. You can refer to the following link for more information.

plotly lighting reference:<u>https://plotly.com/python/reference/#surface-lighting</u>

Reminder
- Your code should display and output your results so that we can judge if your code works correctly.
- You should provide a README file about your execution instructions.
- Please compress your code, input images, result images, report and README in a zip file named HW4_{Student-ID}.zip and upload it to eeclass.
- If you encounter any problem, please post your problems/questions on eeclass.
- Please follow the file structure below:

```
\---HW4_123456789
    |   README.md
    |   report.pdf
    |
    +---Q1
    |   |   1.py
    |   |   vis.svg
    |   |   bg.png
    |   |   points.txt
    |   |
    |   \---output
    |           1a.png
    |           1b.png
    |
    |
    +---Q2
        |   2.ipynb
        |   bunny.obj
        |
        \---output
                2a.png
                2b.png
                2c.png
                2d_1.png
                2d_2.png
                2d_3.png
```