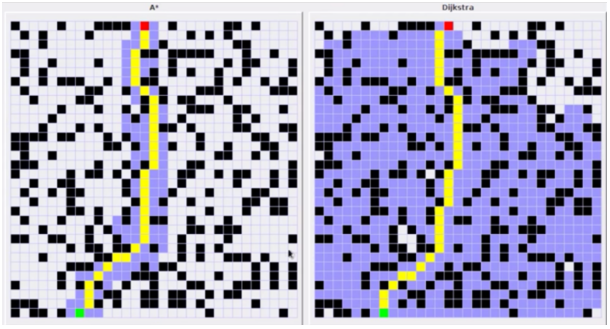
METU **Department of Computer Engineering** **Spring 2021**

CENG 789—Digital Geometry Processing

ASSIGNMENT II Apr 28, 2020
Instructor: Y. Sahillioğlu 3 Weeks

A^* Search and Remeshing via Subdivision Surfaces (start early!)

a) A^* search: 10 points Convert your Dijkstra algorithm in Assignment I into A^* in order to reduce the number of visited nodes while going from source vertex s to target t. You already know $v.d$, the estimated distance from s to v. You will now use $v.d + ||v - t||$ as the key of your queue, hence boosting keys of the vertices that are far from t, making them less likely to be visited. Paint the visited nodes in both regimes, compare the execution times, and the path lengths obtained. Find heuristics other than $||v - t||$ that produce justifiable paths, e.g., zigzags, to collect 10 bonus points.



b) Subdivision Surfaces: 30 + 30 + 30 points You will implement $\sqrt{3}$-subdivision, 4-to-1 subdivision, and Phong subdivision as described in [1], [2], and [3], respectively. My lecture slides also have the summaries. You will compare the output of each scheme by painting vertices based on their distances to the closest points in the base input mesh (normalize s.t. max distance becomes 1). Also compare the number of triangles and total surface areas. Provide results with 3 different levels of subdivisions.

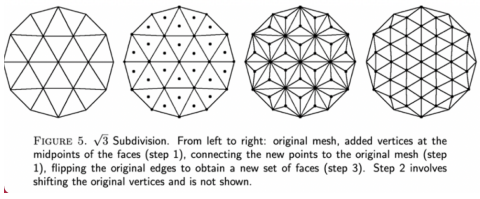
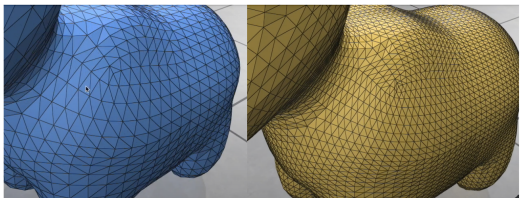
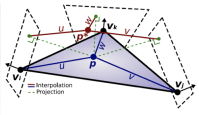


FIGURE 5. $\sqrt{3}$ Subdivision. From left to right: original mesh, added vertices at the midpoints of the faces (step 1), connecting the new points to the original mesh (step 1), flipping the original edges to obtain a new set of faces (step 3). Step 2 involves shifting the original vertices and is not shown.





[1] $\sqrt{3}$-Subdivision, Kobbelt.

[2] Remeshing lecture slide # 102, CENG 789.

[3] Phong Tessellation, Boubekeur and Alexa.

Submission This assignment constitutes 20% of your final grade. Use the meshes provided in ~ys/meshes2.zip (for part a use meshes1.zip). Send to ys@ceng.metu.edu.tr your code, executable, output screenshots, and mynotes.txt file where you mention the problems and interesting observations.