Project 5

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Data Structures

Arrays [ ]

- V = V-table
  - Simple array to store all the vertex IDs, and vertices for 1 triangle are consecutive
  - Ex: [1, 2, 3, 4, 5, 6]
    - Vertex IDs 1, 2, 3 belong to first triangle, and 4, 5, 6 belong to 2nd triangle

- G = Geometry-table
  - Multi-dimensional array to store the actual 3D coordinates of a vertex
  - Ex: [[x1, y1, z1], [x2, y2, z2]]
    - G[0] = the actual coordinates corresponding to vertex 0 [x1, y1, z1]
    - So, if you want the actual coordinates corresponding to a specific corner, use:
      - G[V[c]]

Dictionary { }

- O = Opposite-table
  - For each index, c, in O
  - Key: V[c]
  - Value: the computed value (use helper function to compute O table)

Variables

- currentCorner (integer)
- Flags (boolean)
  - currentCornerVisible
  - showRandomColors

Helper Functions

- See slide 6 in Rossignac's slides

def nextCorner(cornerNum)

- triangleNum = cornerNum // 3
  - Find triangle number based on cornerNum
  - Note: the // is floor division in python
- Return 3 * triangleNum + ((cornerNum + 1) % 3)

def previousCorner(cornerNum)

- Use same idea as nextCorner function
- But, instead of adding 1 to cornerNum in the return statement, you should subtract
- Return 3 * triangleNum + ((cornerNum - 1) % 3)

def oppositeCorner(cornerNum)

- Use the opposite-table dictionary
- Return O[cornerNum]

def swingCorner(cornerNum)

- Return nextCorner(oppositeCorner (nextCorner(cornerNum)))

Note: in the keyPressed section, update currentCorner with the new corner value for each of the 4 corresponding key presses (n, p, o, s) using the above 4 functions

def computeOTable(G, V)

- Temporary variable to store triplets
- For loop: iterate from 0 to len(V)
    - Append (min(V[nextCorner(i)], V[previousCorner(i)]), max(…), i) to triplets
        - See slide 8
- Sort the triplets (see slide 8)
- For loop: iterate from 0 to len(sortedTriplets), add 2 to iterator each time
    - cornerA = sortedTriplets[i][2]
    - cornerB = sortedTriplets[i+1][2]
    - Assign O[cornerA] = cornerB and vice versa

def inflate()

- Normalize each array in G and return this new normalized version
    - Then, in keyPressed section, when the inflate key is pressed, update G table by calling this function

Modifying the read_mesh function

- In for loop iterating from 0 to num_vertices,
    - Update G table by appending (x, y, z)
- In for loop iterating from 0 to num_faces,
    - Update V table by extending it by (index1, index2, index3)
- Outside of these loops, instantiate the O table by calling the helper function you wrote

Modifying the Draw Function

- Use for loop. Iterate starting from 0 to len(V-table), adding 3 to the iterator each time (eg 0, 3, 6, …)
    - Let iterator variable be c
- beginShape()
- Use if/else block to fill with random colors if showRandomColors flag is turned on
    - fill(random(255), … , …)
    - Otherwise, normal fill is fill(255, 255, 255)
- Use vertex function to draw 3 vertices
    - vertex(G[V[c]].x, G[V[c]].y, G[V[c]].z)
    - vertex(G[V[c + 1]].x, G[V[c + 1]].y, G[V[c + 1]].z)
    - 3rd is similar
- endShape()
- Logic to make the current corner visible if currentCornerVisible is turned on
    - pushMatrix()
    - currentVertex = G[V[currentCorner]]
    - translate(currentVertex.x, …, …)
    - sphere(0.1)
    - popMatrix()

Create a function for subdivision

- Variable for numEdges, which is len(V) // 2

- Make a temporary data structure for the newGTable and newVTable
- Initialize empty dictionary for midpoints

- For loop: going through the O table. Need to have a and b as iterators
    - Endpoint1 = G[V[previousCorner(a)]]
    - Endpoint2 = similar but use nextCorner function
    - Calculate midpoint which is endpoint1 + endpoint2 * 1/2
        - Use Pvector mult
    - Find midpointIndex which is len(newGTable)
    - Append the midpoint to the newGTable
    - Update the midpoints dictionary with the midpointIndex
        - Midpoints[a] = midpointIndex
        - Do the same for midpoints[b]

- For loop: go from 0 to len(V) and add 3 each time to the iterator x
    - Make 2 new index variables to make your life easier
        - y = x + 1
        - z = x + 2
    - Note that newVTable is a list in Python. So you can use the extend function to attach more items to this list
        - We need to add 4 sets of items to newVTable
        - (V[x], midpoints[z], midpoints[y])
        - (midpoints[z], V[y], midpoints[x])
        - (midpoints[y], midpoints[x], V[z])
        - (midpoints[x], midpoints[z], midpoints[y])

- Return newGTable, newVTable, computeOTable(newGTable, newVTable)
    - In the handleKeyPressed section, for key 'd', you can update the global variables you made for G, V, and O by calling this subdivide helper function