Problem Set 2

Both theory and programming questions are due Tuesday, September 27 at 11:59PM. Please submit your solutions on http://alg.csail.mit.edu. The site will prompt you for your answers to the questions, so you do not need to create a solution template. The site will be open for PS2 submissions by Thursday, September 22. You don't need to wait until then to work on your solutions, and we encourage you to start early.

Remember, your goal is to communicate. Full credit will be given only to a correct solution which is described clearly. Convoluted and obtuse descriptions might receive low marks, even when they are correct. Also, aim for concise solutions, as it will save you time spent on write-ups, and also help you conceptualize the key idea of the problem.

We will provide the solutions to the problem set 10 hours after the problem set is due, which you will use to find any errors in the proof that you submitted. You will need to submit a critique of your solutions by Thursday, September 29th, 11:59PM. Your grade will be based on both your solutions and your critique of the solutions.

Collaborators: None.

Answer: 2 Answer: 4 Answer: 1 Answer: 4 Answer: 4

Answer: 2 Answer: 4 Answer: 2 Answer: 2 Answer: 4 Answer:

4 Answer: 4

Answer: 2 Answer: 4 Answer: $4((1/3)^i)$ Answer: 4 Answer:

$(4/3)^i$ Answer: 3 Answer: 3

Answer: 1 Answer: First, we can draw a recersion tree such that

there are 3 roots at level 0 representing the three edges in the initial triangle. Then every node will have 4 children at next level, simulating every fractal, i.e. the Snowflake-Edge(e,n) function call, and the nodes at that level denote the line segments, thus the number of nodes at each level is $3 \times 4^i = \Theta(4^i)$ representing the total number of line segments at that level. Those four methods rendering a snowflake differ in the cost for a node in a particular level:3D hardware version the triangle count for a node $\frac{1}{3} = \Theta(1)$

2D version: the segment count for a node $1 = \Theta(1)$ 2D software version: the length of the line segments for a node $(\frac{1}{3})^i = \Theta((\frac{1}{3})^i)$ 3D software version: the area of the triangles for a node $(\frac{1}{3})^{2i} = \Theta((\frac{1}{9})^i)$

Then,

1. $\Theta(4^i)$ at each level i, $\Theta(4^n)$ at the last and also for the total.
2. $\Theta(4^i)$ at each level i, $\Theta(4^n)$ at the last and also for the total.
3. $\Theta((\frac{4}{3})^i)$ at each level i, $\Theta((\frac{4}{3})^n)$ at the last and also for the total.
4. $\Theta((\frac{4}{9})^i)$ at each level i, $\sum_{i=0}^{n} \Theta((\frac{4}{9})^i) = \Theta(\sum_{i=0}^{n} (\frac{4}{9})^i) < \Theta(\frac{9}{5}) = O(1)$ for the total.

Note: in the former 3 methods, the cost of the last level is the total cost of the whole algorithm of LoD n, but the 4th's is the summation of all levels' cost.

Problem 2-1. [60 points] Digital Circuit Simulation

Answer: _find_min Answer: 259964 Answer: 3 Answer: 1