

The Goat in the 3D City

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The 3D City are the locations that are 1 (city-distance) unit from the center; the center=(0,0,0).

$$City = \{x \in R^3 \mid \sum |x_i| \leq 1\}.$$

The goat is tethered at the City boundary, $(\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$ with a rope of length r . So, the goat can access:

$$Goat_r = \{x \in R^3 \mid \sum |x_i - \frac{1}{3}| \leq r\}.$$

The intersection, $Goat_r \cap City$, are the locations in the City accessible by the Goat.

Let $\#(City)$ denote the (3D) volume of the City. Let $\#(Goat_r \cap City)$ denote the volume of the intersection of the City and Goat.

Problem: What rope length r allows the Goat in the City to access half the City:

$$\text{Solve for } r: \#(Goat_r \cap City) = .5\#(City).$$

All Persons answering the Problem are desired to send their Solutions directed to Gib Bassett at UIC, Chicago: gib@uic.edu.

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