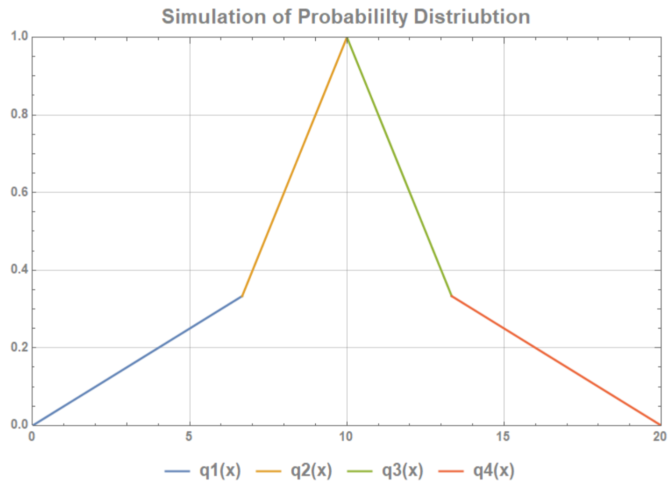
The purpose of the Dynamic Probability Distribution Algorithm is to provide a probability calculation weighted towards a specified mean, facilitating uneven distributions such as left or right tailed curves.

To provide this behavior, this algorithm takes inputs for the min, max, and mean and uses a four-part piece-wise function to calculate the skewed probability.



Variables:

$$\begin{aligned} \mu = &\quad mean \\ a = &\quad min \\ b = &\quad max \end{aligned}$$

Linear functions:

$$\begin{aligned} Q1(x) = &\quad \tfrac{0.5}{\mu-a}(x-0) &= \frac{x}{2(\mu-a)} \\ Q2(x) = &\quad \tfrac{1}{\frac{\mu-a}{2}}(x-(\tfrac{\mu-a}{2})) &= \frac{2x}{\mu-a}-1 \\ Q3(x) = &\quad -\tfrac{1}{\frac{b-\mu}{2}}(x-(\mu+\tfrac{b-\mu}{2})) &= \frac{2(\mu-x)}{b-\mu}+1 \\ Q4(x) = &\quad -\tfrac{0.5}{b-\mu}(x-(b-a)) &= \frac{b-a-x}{2(b-\mu)} \end{aligned}$$

Points of intersection:

$$\begin{aligned} \text{Q1toQ2}(x) = &\quad \tfrac{x}{2(\mu-a)} == \tfrac{2x}{\mu-a}-1 &= \frac{2}{3}(u-a) \\ \text{Q3toQ4}(x) = &\quad -\tfrac{1}{\frac{b-\mu}{2}}(x-(\mu+\tfrac{b-\mu}{2})) == -\tfrac{0.5}{b-\mu}(x-(b-a)) &= \frac{1}{3}a+\frac{1}{3}b+\frac{2}{3}\mu \end{aligned}$$

Piece-wise function:

$$
\text{f(x)} = \begin{cases} 0, & \text{if } x < 0 \\ \frac{x}{2(\mu - a)}, & \text{if } 0 \geq x \leq \frac{2}{3}(\mu - a) \\ \frac{2x}{\mu - a)} - 1, & \text{if } \frac{2}{3}(\mu - a) \leq x \leq \mu \\ \frac{2(\mu - x)}{b - \mu} + 1, & \text{if } \mu \leq x \leq \frac{1}{3}a + \frac{1}{3}b + \frac{2}{3}\mu \\ \frac{b - a - x}{2(b - \mu)}, & \text{if } \frac{1}{3}a + \frac{1}{3}b + \frac{2}{3}\mu \leq x \leq b \\ 0, & \text{if } x > b \end{cases}
$$

Or,

$$
\text{f(x)} = \begin{cases} 0, & \text{if } x < 0 \\ q1(x), & \text{if } 0 \geq x \leq \text{Q1toQ2}(x) \\ q2(x), & \text{if } \text{Q1toQ2}(x) \leq x \leq \mu \\ q3(x), & \text{if } \mu \leq x \leq \text{Q3toQ4}(x) \\ q4(x), & \text{if } \text{Q3toQ4}(x) \leq x \leq b \\ 0, & \text{if } x > b \end{cases}
$$

This setup allows for the probability of a value to be skewed towards the mean while still allowing outliers. For example, with a min of 0, a mean of 7, and a max of 50, the following distributions are generated using 1,500 random samples.