**Formulating the Model**

* 1. **Defining the elements of the model**

W[C] = the total time spent calling a single customer, a function of the number of times a customer is called

t1 = The time to turn on the phone and dial a number (6 seconds in this case).

t2.1 = The time it takes for the call to be determined as no-answer, also the cutoff time

for the distribution (25 seconds).

t2.2 = The time it takes to identify that the call is busy (3 seconds).

t2.3 = The time taken for the customer to pick up, an exponential distribution with mean

μ. 0 ≤ t2.3 ≤ t2.1

μ = The mean time of an answered call (12 seconds).

t3 = The time taken to end a call (1 second).

C = the number of times a customer is called with data about how the call went (busy, no one will answer, answered)

p2.1 = The base probability of taking branch t2.1 (0.3)

P2.1 = The corrected probability of taking branch t2.1 (p2.1 + (1-p2.1-P2.2)e(-1/ μ)\*t2.1)

P2.2 = The probability of taking branch t2.2

P2.3 = The probability of taking branch t2.3 (1-p2.1-P2.2)(1-e(-1/ μ)\*t2.1)

* 1. **Write the expression for the cumulative distribution function of X, and derive the expression for its inverse**

We know the function for the cumulative distribution of an exponential variable:

Bounded over the range x є [0, INF). To invert the expression, we swap x and y:

And solve for y:

For our specific model where λ = 1/12, the equation would be as such:

Assuming we maintain the bounds of the original equation, x є [0, 1].

* 1. **Draw the tree diagram for the calling process**

Diagram

Description automatically generated with medium confidenceWhere black indicates non-decision-making guaranteed nodes, gray indicates decision making nodes, blue indicates probability-attached nodes, and green indicates terminating nodes. Note that time-consuming nodes have a probability associated with them.

Here, variable values were used to accommodate the extension of this diagram into a full Monte Carlo simulation. For a specific diagram with a counter:

Chart, box and whisker chart

Description automatically generated