APMA 3100 Project 2 (Task 1)

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Honor Pledge: On my honor as a student I have neither given nor received aid on this assignment

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Introduction

A worker at an Internet Service Provider is calling customers to receive feedback on their service. She will call the customer until they answer, or until she has called 4 times, whichever is sooner. There is a 0.5 probability that the customer is available and will answer their phone in X seconds (where X is an exponential random variable), a 0.3 probability that the customer is unavailable, and a 0.2 probability that the customer is currently calling someone else. The total time spent by the worker calling a customer is denoted as W, and can be calculated by taking into account the following. It takes the worker 6 seconds to dial the customer's phone number, and 1 second for the call to end. The time in between the dialing will either take the worker 3 seconds to wait for a busy signal, or it could take 25 seconds to wait for 5 rings and then hang up the call (note that the customer can answer the call anywhere between 0 and 25 seconds).

1 Formulate a Model

1.1

$t_i = 6$: Initial time to dial and call

t = Duration of ringing {Time for busy Signal (3 s), otherwise ($0 \leq t \leq 25$)}

$t_e = 1$: Time to end call

$i = 1, 2, 3, 4$: Number of dials for customer to answer

C = State of the Customer { Customer is using the line (0.2), Customer isn't available (0.3), Customer is available (0.5)}

W: Time spent calling by representative

X: Given the customer can answer, the time it takes for the customer to answer

1.2

E[x] = 12

$\lambda = \frac{1}{E[x\}} = \frac{1}{12}$

$$F(x) = \int_{-\infty}^{x} \frac{1}{12} e^{-\frac{1}{12}u} du = 1 - e^{-\frac{1}{12}x}$$

$$y = F(x)$$

$$F^{-1}(y) = x$$

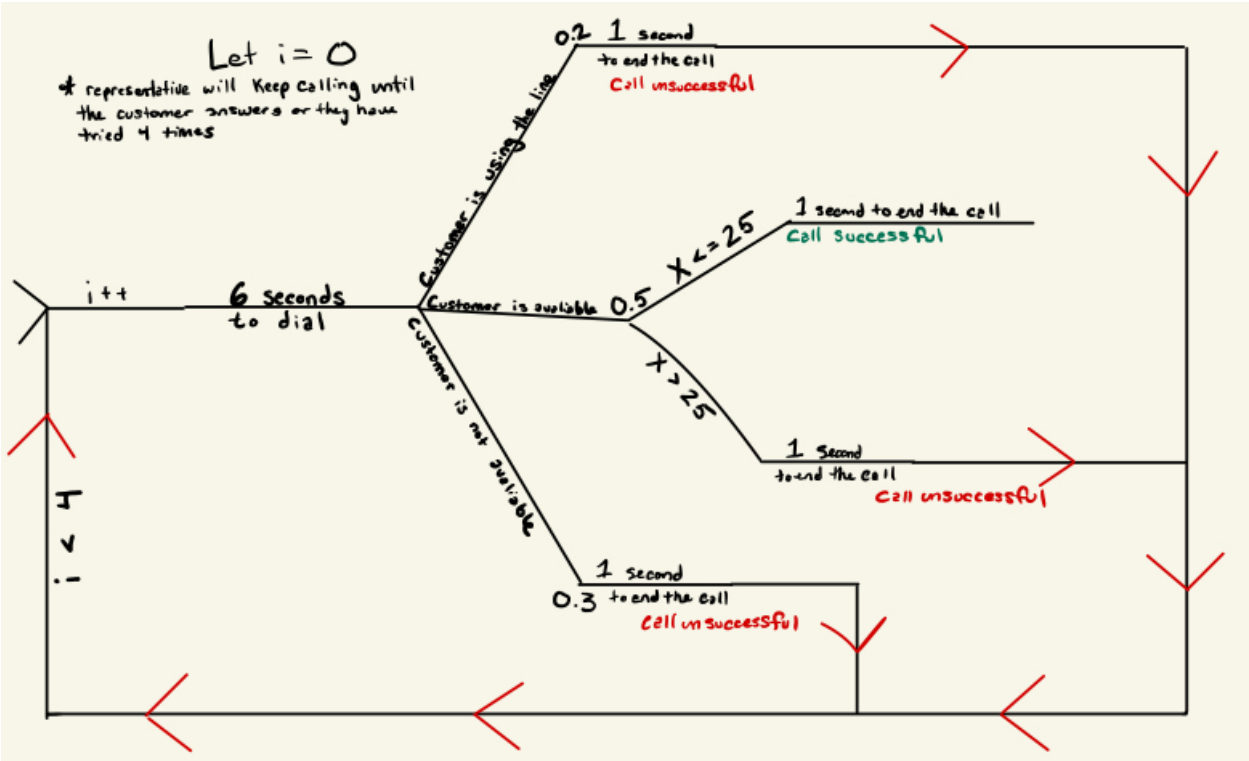
$$y = 1 - e^{-\frac{1}{12}x}$$

$$1 - y = e^{-\frac{1}{12}x}$$

$$ln(1 - y) = -\frac{1}{12}x$$

$$F^{-1}(y) = x = -12ln(1 - y)$$

1.3


Let i = 0
* representative will keep calling until the customer answers or they have tried 4 times
i++
6 seconds to dial
i < 4
Customer is using the line
0.2
1 second to end the call
Call unsuccessful
Customer is available
0.5
X <= 25
1 second to end the call
Call Successful
X > 25
1 second to end the call
Call unsuccessful
Customer is not available
0.3
1 second to end the call
Call unsuccessful