Questioning discrete equations

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I have 3 states of plants: **C**hallenged with inoculum, **S**usceptibles, and **I**nfecteds. Since it's a density dependent disease, C, S, and I are the number of individuals within those states. Let's assume

$$\frac{dC}{dt} = -\delta C - \alpha C - \beta CI$$

where δ is the rate that the inoculum decays, α is the inoculum-plant tranmission rate, and β is the plant-plant transmission rate.

With your help, I disretized these equations and came up with the following transition probabilities:

$$\begin{aligned} P_{C\to S} &= 1 - e^{-\delta} \\ P_{C\to I} &= 1 - (e^{-\alpha} + e^{-\beta I}) \\ P_{C\to C} &= 1 - P_{C\to S} - P_{C\to I} \end{aligned}$$

If we assume that $\delta = \alpha = \beta = 1$ and that there are 10 infecteds at the time, then CC ends up negative. I'm not sure if the equation for CI, CC, or all are to blame.

```
delta=alpha=beta=1
I_count=10
CS <- 1 - exp(-delta)
CI <- 1 - (exp(-alpha) + exp(-beta*I_count))
CC <- 1 - CI - CS
CC+CI+CS #sums to 1
```

```
## [1] 1
```

```
CC #negative probability :(
```

```
## [1] -0.2641957
```