1. Let $S$ be the random variable representing aggregate claims under an insurance policy sold by Tao Incorporated.

The number of claims is distributed as a Poisson distribution with a mean of 3.

The distribution of losses for each claim is as follows:

<table>
<thead>
<tr>
<th>Amount of Loss</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.15</td>
</tr>
<tr>
<td>200</td>
<td>0.25</td>
</tr>
<tr>
<td>300</td>
<td>0.60</td>
</tr>
</tbody>
</table>

a. Calculate $F_S(300)$.

**Solution:**

$$F_S(300) = f_S(0) + f_S(100) + f_S(200) + f_S(300)$$

$$f_S(0) = \Pr(N = 0) = e^{-3}$$

$$f_S(100) = \Pr(N = 1) \Pr(X = 100) = 3e^{-3}(0.15) = 0.45e^{-3}$$

$$f_S(200) = \Pr(N = 1) \Pr(X = 200) + \Pr(N = 2) \Pr(X = 100, 100) = 3e^{-3}(0.25) + \frac{3^2 e^{-3}}{2}(0.15)(0.15) = 0.85125e^{-3}$$

$$f_S(200) = \Pr(N = 1) \Pr(X = 300) + \Pr(N = 2) \Pr(X = 100, 200) + \Pr(N = 3) \Pr(X = 100, 100, 100) = 3e^{-3}(0.60) + \frac{3^2 e^{-3}}{2}(0.15)(0.25)(2) + \frac{3^3 e^{-3}}{3!}(0.15)(0.15)(0.15) = 2.1526875e^{-3}$$

$$F_S(300) = e^{-3} + 0.45e^{-3} + 0.85125e^{-3} + 2.1526875e^{-3} = 4.4539375e^{-3} = 0.221748491$$
Tao Incorporated decides to buy stop loss insurance for this insurance policy. Rehan Reinsurance Company provided a coverage that will pay the amount of all aggregate claims in excess of 300.

b. Calculate the net stop loss premium for this stop loss reinsurance.

**Solution:**

Net Stop Loss Premium = $E[S] - E[S \wedge 300]$

$E[X] = (0.15)(100) + (0.25)(200) + (0.60)(300) = 245$

$E[S] = E[N]E[X] = (3)(245) = 735$

$E[S \wedge 300] = (0)f_S(0) + (100)f_S(100) + (200)f_S(200) + (300)(1 - F_S(200)) = 0(e^{-3}) + (100)(0.45e^{-3}) + (200)(0.85125e^{-3}) + (300)(1 - e^{-3} - 0.45e^{-3} - 0.85125e^{-3}) = 276.34$

Net Stop Loss Premium = $E[S] - E[S \wedge 300] = 735 - 276.34 = 458.66$