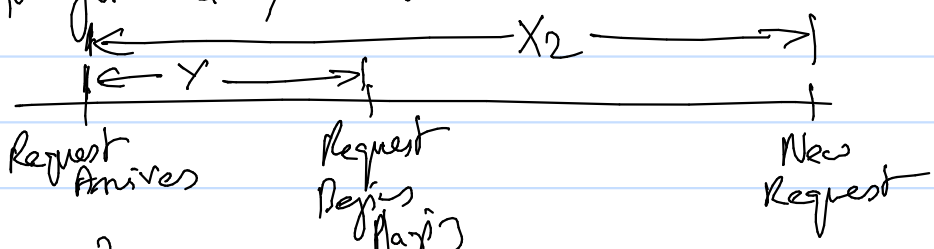
Alternate Soln for Q3, Part (c)



We want:

$$E[X_2 \mid Y < X_2]$$

$$f_{X_2, Y \mid Y < X_2}(x_2, y) = \begin{cases} 3e^{-2y} e^{-x_2} & 0 \le y \le x_2 < \infty \\ 0 & \text{otherwise} \end{cases}$$

$$E[X_2 \mid Y < X_2] = \int_0^\infty \int_0^{x_2} x_2 \, f_{X_2, Y \mid Y < X_2}(x_2, y) \, dy \, dx_2$$

$$= \int_0^\infty x_2 \left(\frac{3e^{-x_2}}{2}\right) \left[\int_0^{x_2} 2e^{-2y} \, dy\right] dx_2$$

$$= \int_0^\infty \frac{3}{2} x_2 e^{-x_2} \left(1 - e^{-2x_2}\right) dx_2$$

$$= \frac{3}{2} \int_0^\infty x_2 e^{-x_2} \, dx_2 - \frac{3}{2} \int_0^\infty x_2 e^{-3x_2} \, dx_2$$

$$= \frac{3}{2} - \frac{1}{2}\left(\frac{1}{3}\right) = \frac{1}{2}\left(3 - \frac{1}{3}\right) = \frac{1}{2}\left(\frac{8}{3}\right) = \frac{4}{3} \; //$$

$$\rightarrow = \left[\frac{1}{3} + 1\right]$$