3 luxury watches one time

(a) $L_0 = 3$ $\lambda = 1$ Poisson $\frac{e^{-\lambda} \lambda^k}{k!}$

$\{L_k\} = \{0, 1, 2, 3\}$

$P_{00} = 1 - \frac{5}{2}e^{-1}$ $P_{01} = \frac{e^{-1}}{2}$ $P_{02} = e^{-1}$ $P_{03} = e^{-1}$

$P_{10} = 1 - e^{-1}$ $P_{11} = e^{-1}$ $P_{12} = 0$ $P_{13} = 0$

$P_{20} = 1 - 2e^{-1}$ $P_{21} = e^{-1}$ $P_{22} = e^{-1}$ $P_{23} = 0$

$P_{30} = 1 - \frac{5}{2}e^{-1}$ $P_{31} = \frac{e^{-1}}{2}$ $P_{32} = e^{-1}$ $P_{33} = e^{-1}$

$$P = \begin{bmatrix} 1-2.5e^{-1} & 0.5e^{-1} & e^{-1} & e^{-1} \\ 1-e^{-1} & e^{-1} & 0 & 0 \\ 1-2e^{-1} & e^{-1} & e^{-1} & 0 \\ 1-2.5e^{-1} & 0.5e^{-1} & e^{-1} & e^{-1} \end{bmatrix}$$

(b)

$$T_{00} = \frac{1}{1-P_{00}} = \frac{1}{2.5e^{-1}} = 1.087$$

$$T_{11} = \frac{1}{1-e^{-1}} = 1.582 = T_{22} = T_{33}$$

state 0 will be the least amount of time

(c)

$$\{L_K\} = \{0,1,2,3,\dots m\}$$

$$P_{00} = 1-\sum_{n=0}^{m-1}\frac{e^{-1}}{n!} \quad P_{01} = \frac{e^{-1}}{(m-1)!} \quad P_{02} = \frac{e^{-1}}{(m-2)!} \cdots P_{0(m-1)} = e^{-1}$$

$$P_{0m} = e^{-1}$$

$$P_{10} = 1-e^{-1} \quad P_{11} = e^{-1} \quad P_{12} = 0 \quad \dots \quad P_{0m} = 0$$

$$P_{20} = 1-2e^{-1} \quad P_{21} = e^{-1} \quad P_{22} = e^{-1} \quad P_{23} = 0 \cdots P_{0m} = 0$$

$$P_{30} = 1-\sum_{n=0}^{2}\frac{e^{-1}}{n!} \quad P_{31} = \frac{e^{-1}}{2!} \quad P_{32} = e^{-1} \quad P_{33} = e^{-1} \quad P_{34} = 0 \cdots$$

$$P_{40} = 1-\sum_{n=0}^{3}\frac{e^{-1}}{n!} \quad P_{41} = \frac{e^{-1}}{3!} \quad P_{42} = \frac{e^{-1}}{2!} \quad P_{43} = \frac{e^{-1}}{1!} \quad P_{44} = \frac{e^{-1}}{0!}$$

$$\vdots$$

$$P_{m0} = 1-\sum_{n=0}^{m-1}\frac{e^{-1}}{n!} \quad P_{m1} = \frac{e^{-1}}{(m-1)!} \quad \cdots \quad P_{mm} = \frac{e^{-1}}{0!}$$

So the matrix P is

$$P = \begin{bmatrix} 1 - \sum_{n=0}^{m-1} \frac{e^{-1}}{n!} & \frac{e^{-1}}{(m-1)!} & \frac{e^{-1}}{(m-2)!} & \cdots & \frac{e^{-1}}{1!} & \frac{e^{-1}}{0!} \\ 1 - e^{-1} & e^{-1} & 0 & \cdots & 0 & 0 \\ \vdots & & e^{-1} & \ddots & & \\ 1 - \sum_{n=0}^{m-1} \frac{e^{-1}}{n!} & \frac{e^{-1}}{(m-1)!} & \cdots & & e^{-1} & e^{-1} \end{bmatrix}$$