1.

$$e^{-\lambda} = 1 - 0.2 = 0.8$$

$$1 - \sum_{i=0}^{2} e^{-\lambda} \frac{\lambda^i}{i!} = 0.00157$$

2.

$$
\begin{aligned}
E[X] &= E[X|Y=0]\cdot P(Y=0) + E[X|Y>0]\cdot P(Y>0) \\
&= E[Y\cdot 8000|Y=0]\cdot P(Y=0) + E[(Y-1)\cdot 8000|Y>0]\cdot (1-P(Y=0)) \\
&= 8000E[Y|Y=0]\cdot P(Y=0) + (8000E[Y|Y>0]-8000)\cdot (1-P(Y=0)) \\
&= 8000\cdot E[Y] - 8000\cdot (1-P(Y=0)) \\
&= 8000\cdot 4 - 8000\cdot (1-e^{-4}) \\
&= 24146.525
\end{aligned}
$$

3.

a.

We have that the probability that the fire appears in any specific quadrant follows a poisson distribution with mean $10^{-3} \cdot (10 \cdot 10/4) = 0.025$. Hence, the probability that fire appears in any quadrant is

$$1 - \frac{0.025^0 e^{-0.025}}{0!} = 1 - e^{-0.025}$$

Hence, the probability that fire appears in three or more quadrant is

$$C_3^4 (1 - e^{-0.025})^3 (e^{-0.025}) + C_4^4 (1 - e^{-0.025})^4 = 0.0000590895$$

b.

The number of fires appears in the city follows a poisson distribution with mean $10^{-3} \cdot 10 \cdot 10 = 0.1$. Hence, the expected value of fire happens in the city is 0.1

4.

Since the number of jobs arrive in 1 minute follows a poisson distribution with mean 1, N, the number of jobs arrive in 15 minutes follows a poisson distribution with mean 15.

$$
\begin{aligned}
P(\text{there will be lost job}) &= 1 - P(\text{there will not be lost job}) \\
&= 1 - \sum_{i=1}^{\infty} P(N = i, B > N) \\
&= 1 - \sum_{i=1}^{\infty} P(N = i) P(B > i) \\
&= 1 - \sum_{i=1}^{\infty} \frac{15^i e^{-15}}{i!} 2^{-i} \\
&= 1 - e^{-15/2} \sum_{i=1}^{\infty} \frac{\left(\frac{15}{2}\right)^i e^{-15/2}}{i!} \\
&= 1 - e^{-15/2} \\
&= 0.999447
\end{aligned}
$$