1. (a) \( E[X] = \frac{1}{\lambda} \), \( \text{var}(X) = \frac{1}{\lambda^2} \) and \( P(X \geq E[X]) = \frac{1}{e} \)

(b) \( P(X > t + k | X > t) = e^{-\lambda k} \)

Note: the exponential random variable is memoryless.

2. We first compute the CDF \( F_X(x) \) and then obtain the PMF as follows

\[
p_X(k) = \begin{cases} 
F_X(k) - F_X(k - 1) & \text{if } k = 3, \ldots, 10, \\
0 & \text{otherwise}.
\end{cases}
\]

We have,

\[
F_X(k) = \begin{cases} 
0 & k < 3, \\
\frac{k-1}{10} & 3 \leq k \leq 10, \\
1 & 10 < k.
\end{cases}
\]

3. (a)

[Expression not shown]

(b) \( P(\text{error}) = 1 - 0.4 \Phi(3/2\sqrt{2}) - 0.6 \Phi(1/2\sqrt{2}) \)