1. Due to Bruce Hajek.
Consider a Poisson process with intensity $\lambda > 0$.

1. Find the probability that there is (exactly) one event in each of the three intervals $[0, 1]$, $[1, 2]$, and $[2, 3]$.

2. Find the probability that there are two events in the interval $[0, 2]$ and two events in the interval $[1, 3]$.
   (Note: your answer should be larger than the answer to part (a)).

3. Find the probability that there are two events in the interval $[1, 2]$ given that there are two events in $[0, 2]$ and two events in $[1, 3]$.

2. A zero-mean WSS process $X(t)$ has autocorrelation function $R_X(\tau) = e^{-2|\tau|}$. Find the best linear MSE estimate of $X(t_0 + 1)$ given $X(t_0) = 2$. What is the MSE of the best linear estimate?

3. AM modulation.
Consider the AM modulated random process
\[ X(t) = A(t) \cos(2\pi t + \Theta), \]
where the amplitude $A(t)$ is a zero-mean WSS process with autocorrelation function $R_A(\tau) = e^{-\frac{1}{2}\tau}$, the phase $\Theta$ is a $U[0, 2\pi)$ random variable, and $A(t)$ and $\Theta$ are independent. Is $X(t)$ a WSS process? Justify your answer.