Recitation Session 9

Problem

1. *Sinusoidal Signal.* Find mean, autocorrelation and autocovariance of:
   a. Define $X(t) = A\cos(2\pi t)$ where $t \geq 0$ and A some R.V.
   b. Define $Y(t) = \cos(ct + \Theta)$ where $t \geq 0$, $\Theta \sim Unif[0, 2\pi]$ and c is constant.
2. *Random Walk with Two People.* Two people each move in a one-dimensional random walk. The properties of the random walks are identical and independent for the two, that is, each takes a forward step with probability p and a backward step with probability $q = 1 - p$. The steps are of equal size and are taken at the same times. Assume that the two people start in the same location.
   a. For each person, what is the distribution of being D steps away (to the right) from the origin?
   b. Given that the two start their random walk at the same location, what is the probability that they meet back at that location after they have each taken n steps? Assume each direction has an equal probability.
3. *Poisson Process* Suppose an office receives two different types of inquiry: persons who walk in off the street, and persons who call by telephone. Suppose the two types of arrivals are described by independent Poisson process, with rate λ_w for walk-ins, and rate λ_c for the callers. What is the distribution of the number of telephone calls received before the first walk-in customer?