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Date: 18/05/2018 Deadline: Tuesday (22/05/18) Morning *Homework 1 for B.Tech ECE (VIII Sem)*

1. Let X be a random variable with mean μ and variance σ^2. A random variable Y is defined as $Y = aX + b$, where $a > 0$ and b is fixed real number. What is the mean and variance of Y.

2. Identify the following PDF

$$f_X(x) = \frac{1}{\sqrt{4\pi}\exp(x^2/4 + x/2 + 1)} \tag{1}$$

   hence find the mean and variance of a random variable with this PDF.

3. Let X be a continuous valued random variable with probability density function (pdf) given as

$$f_X(x) = e^{-x} \ , x \geq 0 \tag{2}$$

   find its mean and variance.

4. If 20 MHz of total spectrum is allocated for a duplex wireless cellular system and each simplex channel has 25kHz RF bandwidth, find:

   (a) The number of duplex channels
   (b) The total number of channels per cell site, if $N = 4$ cell reuse is used

5. In a particular cellular system, the transmit power of transmit antenna was kept at 10 dB. As the cell became congested, you as a design engineer decided to split the cell. If you use usual cell splitting strategy, i.e., new small calls are having half radius than that of previous cell, what should be the transmit power of antenna of small cell. It is given that path loss exponent is $n = 3.5$.

6. Consider a rectangular antenna with total area of 4 m^2 and operating at the frequency of 1800 MHz. Find the far-field distance for such antenna.

7. If transmit power $P_t = 10 \ W$, the antenna gains are $G_t = 0 \ dB$, $G_r = 0 \ dB$, and the carrier frequency is $f_c = 900MHz$, find P_r in watts at a free space distance of 1km. Also express the received power in dB.