ECE 3614: Introduction to Communication Systems

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1. A binary source generates digits 1 and 0 randomly with probabilities 0.7 and 0.3 respectively. (a) What is the probability that four 1s and two 0s occur in a six-digit sequence? (b) What is the probability that at least two 1s occur in a four digit sequence. (10 points)
2. Show that when n is very large and p is very small that the binomial distribution can be approximated by the Poison distribution. (5 points)
3. The pdf of X is given by $f_X(x) = ke^{-ax}u(x)$, where a is a positive constant. Determine the value of the constant k, and sketch $f_X(x)$. (5 points)
4. Derive the mean of the output of an LTI system, when the mean of the input signal is $\mu_X(t)$ and the impulse response of the system is $h(t)$. (5 points).
5. What is the power spectrum density and the autocorrelation of a white noise, and also of a band limited white noise? (5 points)