KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
COLLEGE OF COMPUTER SCIENCES & ENGINEERING

COMPUTER ENGINEERING DEPARTMENT

CSE 642 – Computer Systems Performance
Assignment 1

Problem 1:

Let the number of message transmissions by a computer in 1 hour be a binomial random variable with parameters n and p. Suppose that the probability of a message transmission error is ε. Let S be the number of transmissions errors in a 1 hour period.

a) Find the mean and variance of S.

b) Find $N_S(z) = E[z^S]$.

Problem 2:

Calculate the expected value for a bounded Pareto distribution in terms of α(the shape parameter), β (the scale parameter), and Smax, the maximum packet size in bytes.

Problem 3:

Let Z = X + Y where X and Y are two independent continuous uniform random number distributions defined on the interval [-a, a]. Find the PDF for the Z and its characteristic function.

Problem 4:

Compare the Chebyshev bound and the exact probability for the event $\{|X - m| \geq c\}$ as a function of c for

a) X is a uniform random variable in the interval [-b, b].

b) X is a Laplacian random variable with parameter a.

c) X is a zero-mean Gaussian random variable.

Problem 5:

Prove that for a Poisson arrival process of mean λt, the interarrival time is an exponential random variable of mean 1/λ.

Problem 6:

Let $X_1, X_2, \ldots, X_N$ be a sequence of independent integer-values random variables, let N be an integer-valued random variable independent of the Xj's, and let $S = \sum_{k=1}^{N} X_k$:

a) Find the mean and variance of S.

b) Show that $N_S(z) = N_N(N_X(z))$ – where $N_\beta(z)$ is the probability generating function of β.