CEE 5390 - Modeling and Simulation in CEE

Homework 3

*Arguments derived from probabilities are idle*  
~ Plato

January 31, 2008

**Question 1**

Show that the following relationship generally holds true for any queue when it is in steady state:

\[ W = W_q + \frac{1}{\mu} \]  

(1)

Where all the symbols have their usual meanings.

**Question 2**

Derive the Poisson process by using the assumption that the number of arrivals in non-overlapping intervals are statistically independent and then applying the binomial distribution.  
*Hint: Consider the following approximation:*

\[ [1 - \frac{\lambda}{n}]^n \approx e^\lambda \]  

(2)

*for very large values of $n$ and moderate values of $\lambda$.]*

**Question 3**

You are given two Poisson processes with intensities $\lambda_1$ and $\lambda_2$. Find the probability that there is an occurrence of the first stream before the second, starting at time $t = 0$.  
*Hint: Use the memoryless property.*