CEE 5390 - Modeling and Simulation in CEE

Week 3

January 28, 2008

The Arrival Process

Assumptions

We will derive the probability distribution function that governs the arrival process and show that it results in the inter-arrival times being governed by the exponential distribution function. The arrival counting process is given by $\{N(t), t \geq 0\}$ where $N(t)$ denotes the total number of arrivals up to time t and $N(0) = 0$. In addition the following three assumptions will need to be satisfied.

- Probability that an arrival occurs between t and $(t+\Delta t)$ is given by $\lambda\Delta t + o(\Delta t)$ where Δt is an incremental element and the value of $o(\Delta t)$ compared to the value of Δt is negligible as Δt tends to 0:
$$\lim_{\Delta t \to 0} \frac{o(\Delta t)}{\Delta t} = 0 \tag{1}$$
- Probability of more than 1 arrival between t and $t + \Delta t = o(\Delta t)$
- Number of arrivals in non-overlapping intervals are statistically independent

We wish to calculate $p_n(t)$ the probability of n arrivals in a time interval of length t, where n is an integer ≥ 0.