ECE 466- Computer Networks II

Problem Set #4

1. Consider a sequence of arrivals as shown in Figure 1, which represent arrivals of video frames generated by a video codec.

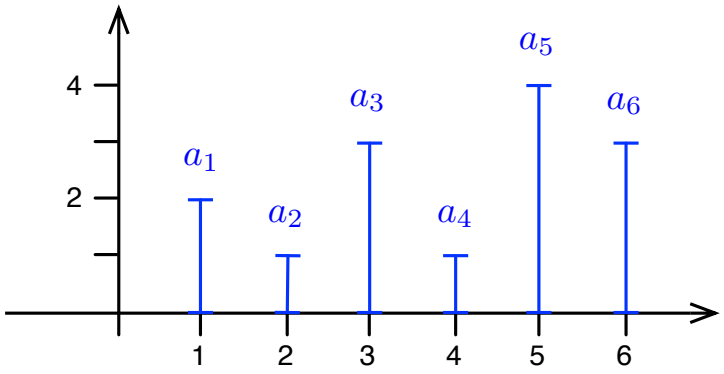

Figure 1:

   (a) Provide the values of the cumulative arrival function A and the minimal envelope $\mathcal{E}_A$ for a discrete-time domain, for times $t = 0, 1, 2, 3, 4, 5, 6$.

   (b) Sketch the cumulative arrival function A and the minimal envelope $\mathcal{E}_A$ for a continuous-time domain for the time interval $[0, 6]$.

2. Consider the following fluid-flow arrival function of a flow in continuous time

$$A(t) = \begin{cases} 0\ , & t \leq 0 \\ t + k\ , & k \leq t \leq k + 2 \\ 2(2t - k - 3) & k + 2 \leq t \leq k + 3 \\ 2t\ , & k + 3 \leq t \leq k + 5 \end{cases} \quad , k = 0, 5, 10, \ldots$$

   Provide a sketch of the arrival function A and the minimal envelope $\mathcal{E}_A$.

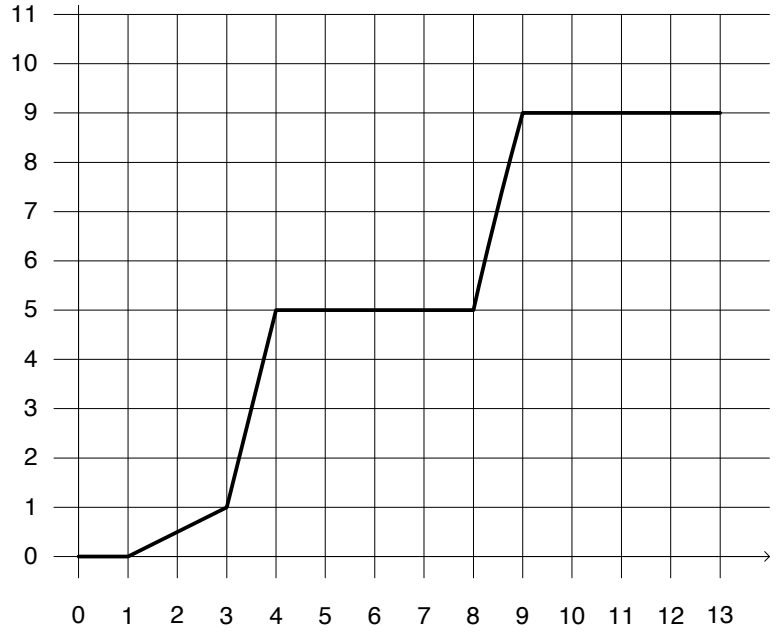

Figure 2:

3. Consider the graph of the evolution of an arrival sample path shown in Figure 2.

   (a) Suppose that the arrivals are regulated by a token bucket with parameters $\sigma = 2$ and $\rho = 1$. Indicate in the figure the cumulative amount of tokens entering the token bucket as a function $F(t)$, with initial value is $F(0) = 2$.

   (b) Indicate in the figure the maximum backlog and the maximum delay for arriving traffic.

   (c) Draw the minimal envelope for the arrivals shown in Figure 2.

   (d) Select values σ and ρ for the token bucket so that traffic is never backlogged in the buffer.