1. Simulate TCP congestion control options. Use RFC793edu TCP agent with

   I additive increase and multiplicative decrease

   II exponential increase and multiplicative decrease

   III AIMD and slow start

   IV AIMD, slow start and fast retransmission (=TCP Tahoe)

   V TCP Reno

   VI TCP Vegas

   For each case, use a 10 s simulation time.

   (a) For each simulation,
   - plot the congestion window
   - explain the events in the congestion window plot. Specifically identify in each picture the different phases:
     - additive increase
     - exponential increase and slow start
     - time out
     - fast retransmit

   (b) Calculate the number of packet arrivals, packet drops and *throughput*,

   $$\text{throughput} = \frac{\#\text{packet\_arrivals} - \#\text{packet\_drops}}{\text{simulation\_time}}, \quad (1)$$

   for each option. Discuss the reasons and consequencies. Which throughput is the best and why?

   Target: The student understands the basic mechanisms of TCP congestion control.

2. Simulate TCP Reno and Vegas so that there is a bottleneck link with two competing TCP connections: one Reno and one Vegas. Run a long simulation and estimate the numbers of packet drops and throughput for both connections. Explain the results. What can you say about *fairness* in this situation? How is the situation different if all TCP connections use the same agent?

   Target: The student understands the problem of fairness in the Internet transport context.