Extra questions, tutorial 1 Internet protocols

1. Someone complained about a throughput of 120,000 bits/sec on a 256,000 bits/sec link with a 128-ms delay (47% utilization), and a throughput of 33,000 bits/sec when the link was routed over a satellite (13% utilization). What does the window size appear to be for both cases? (Assume a 500-ms delay for the satellite link.) How big should the window be for the satellite link to achieve full utilisation?

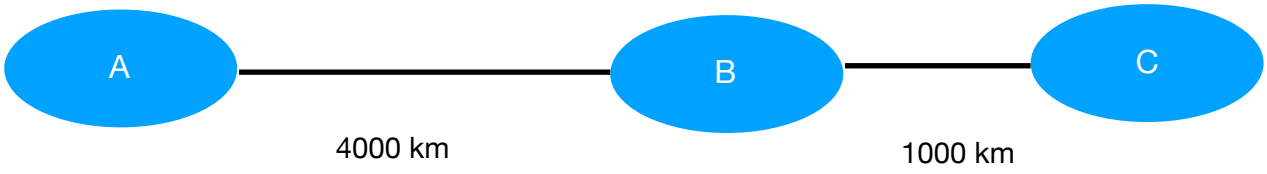
2. Let's compare three different network topologies

   1) A star topology, all nodes are connected through a central router
   2) A fully connected mesh topology, all nodes have direct links with each other
   3) A circle topology where all nodes are arranged in a ring

What is the average number of transmissions needed to get a message from a randomly selected node A to another randomly selected node B?

3.In the given figure, frames are generated at node A and sent to node C through node B. Determine the minimum data rate required between node B and C so that the buffers of node B are not flooded, based on the following:

- The data rate between A and B is 100 Kbps.
- The propagation speed is 200 m/μs for both links.
- There are full-duplex lines between the nodes.
- All data frames are 1000 bits long; ACK frames are separate frames of negligible length.
- Between A and B, a sliding window scheme with a window size of 3 is used.
- Between B and C, stop-and-wait is used.
- There are no errors.



Hints: In order not to flood the buffers of B, the average number of frames entering and leaving B must be the same over a long interval. Utilisation for stop and wait protocols = 1 / (2a + 1) where a = propagation time / transmission time and utilisation for Sliding windows protocols = window size / (2a + 1)