

## ASSIGNMENT 1

1. A point-to-point satellite transmission link connecting two computers uses a stop-and-waits ARQ strategy and has the following characteristics:

Data transmission rate = 64 kbps

Frame size,  $n = 2048$  bytes

Information bytes per frame,  $k = 2043$  bytes

Propagation delay,  $t_d = 180$  ms

Acknowledgement size,  $t_a = 10$  bytes

Round-trip processing delay,  $t_p = 50$  ms

**Determine the throughput and link efficiency**

2. A frame of data of length 2048 bits is transmitted over a link with a BER of  $10^{-4}$ .  
**Determine the probability that a frame will be received erroneously.**

3. **Calculate the latency (from first bit sent to last bit received) for the following:**

(a) A 10-Mbps link with a single store-and-forward switch in the path, and a packet size of 5,000 bits.

Assume that each section of the link introduces a propagation delay of 10 microseconds, and that the switch begins retransmitting immediately after it has finished receiving the packet.

(b) Same as (a) but with three switches

(c) Same as (a) but assume the switch implements cut-through switching: it is able to begin retransmitting the packet after the first 200 bits have been received.