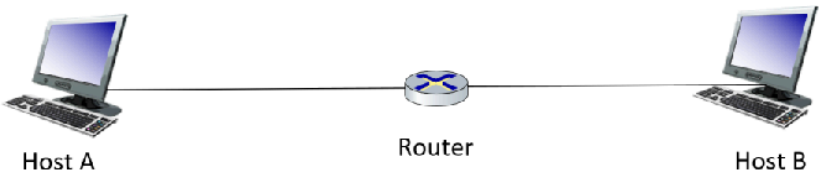
ENSF 462-02 Networked Systems: HW Assignment 1 (Fall 2024)

(Due on Sept. 30 at 11:59pm MST)

Name: _____ UCID: _____ Score: _____

Q1: Host A wants to send two packets of size 5 $Mbits$ each to host B, along a network route of two links (and therefore one router) as shown below.



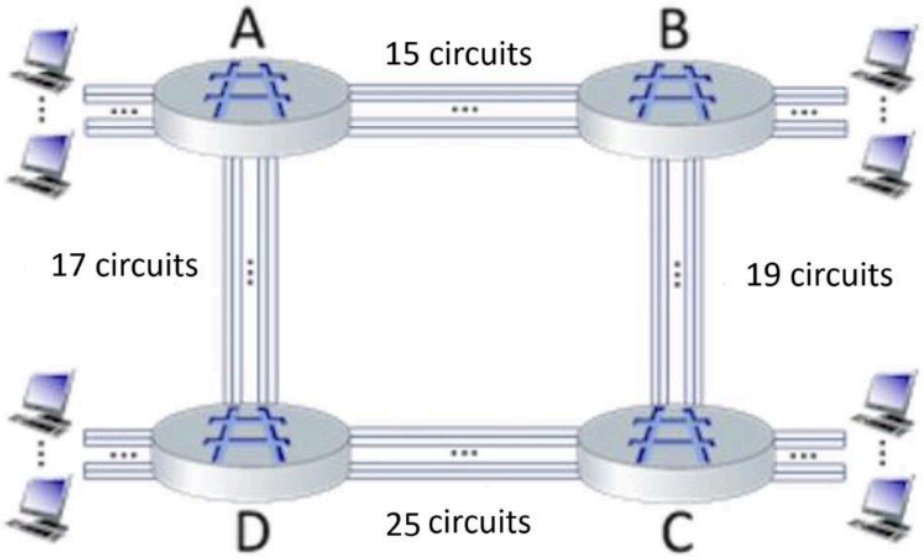
The distance between host A and the router is 200 km and the distance between the router and host B is also 200 km. Each link has transmission rate of 50 $Mbps$. Suppose that the propagation speed along the link is 2×10^8 meters/sec.

(a) Calculate the propagation delay for one packet, d_{prop} over the first link.

(b) Determine the transmission time of one packet on the first link, d_{trans}.

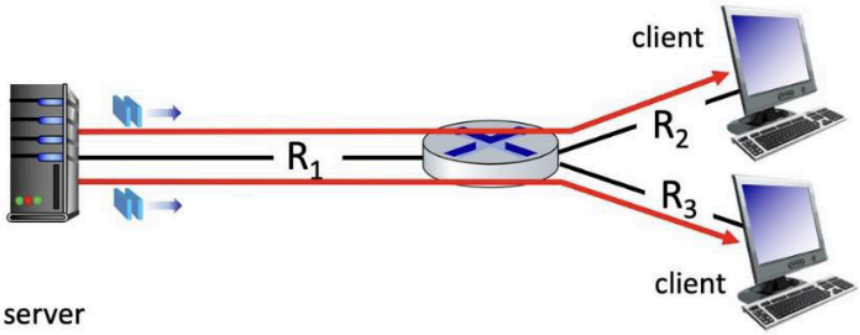
(c) Suppose start time of transmission at host A is t = 0. What is the time when both packets are completely received at host B, ignoring processing and queuing delays.

Q2: Consider a circuit-switched network as shown below.



(a) What is the maximum number of connections that can be concurrently admitted in the network?
(b) Suppose that these maximum number of connections are all ongoing. What happens when another call connection request arrives to the network, will it be accepted? Explain your answer.
(c) Suppose that every connection requires 2 consecutive hops, and calls are connected clockwise. For example, we can have a connection from A to B to C, or a connection from B to C to D, etc. With these constraints, what is the maximum number of connections that can be ongoing in the network at any one time?

Q3: As shown in the figure below, a server sends packets to two different clients via a router. Assume that R_1 = 200 $Mbps$, R_2 = R_3 = 40 $Mbps$, and each packet is 10 Mbits in size. The propagation delay is 3 msec per link.



(a) How long does it take the server to transmit a packet into its link?

(b) When the server begins sending a packet to one of the two clients, what is the end-to-end delay until it is received by the client (the answer is the same for both clients)? Consider store-and-forward packet transmission with zero queueing delay and processing delay.

(c) Assume that the link with capacity R_1 is fairly shared between the two sessions. What is the maximum end-to-end throughput achieved by each session, assuming both sessions are sending at the maximum rate possible?

(d) Assume that the link with capacity R_1 is fairly shared between the two sessions, and R_2 = 150 $Mbps$ and R_3 = 80 $Mbps$. What is the maximum end-to-end throughput achieved by each session, assuming the server is sending to receivers at the maximum rate possible?