Computer Networks Fall 2025

Assignment#1 (5A & 5C)

Due Date: Thursday, 4th September, 2025
Submission Mode & Time: Handwritten solutions to be submitted during the lecture.

Please note the following:

1. No exceptions to the above date and time will be allowed. Inability to submit the assignment by the required time will result in zero marks.

2. To ensure self-completion of assignments and discourage plagiarism, the instructor or the relevant TA may randomly contact you and ask for an explanation of your answers. Where plagiarism and/or cheating is evident, you will be referred to the departmental disciplinary committee. In extreme cases of plagiarism an F may be awarded immediately with further referral to the university disciplinary committee.

3. All solutions must be **hand-written.**

4. **Assignment Solution Submission**: In case of **in person / physical lectures at the campus**, hard copy of the hand-written assignment's solutions will be submitted by **hand** by each student to the Instructor / TA directly during the lecture on the due date.

PART-1

Use the following textbook for completion of this part of the assignment:
Computer Networking - A Top-Down Approach 8th Edition by Kurose & Ross.

Solve the following problems from the back of **Chapter 1**. Every Question has equal marks i.e.

Review Questions: **(4*4 = 16 marks)** **[CLO 1]**

R13, R16, R18, R19

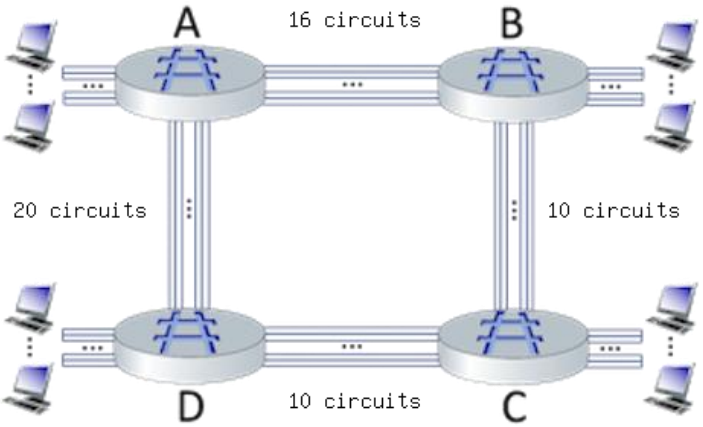
Problems: **(4*3 = 12 marks)** **[CLO 1]**

P3, P6, P31

PART - 2

Question: 01 [2*4 = 8 Marks] [CLO 1]

Consider the circuit-switched network shown below, with circuit switches A, B, C, and D. Suppose there are 16 circuits between A and B, 10 circuits between B and C, 10 circuits between C and D, and 20 circuits between D and A.



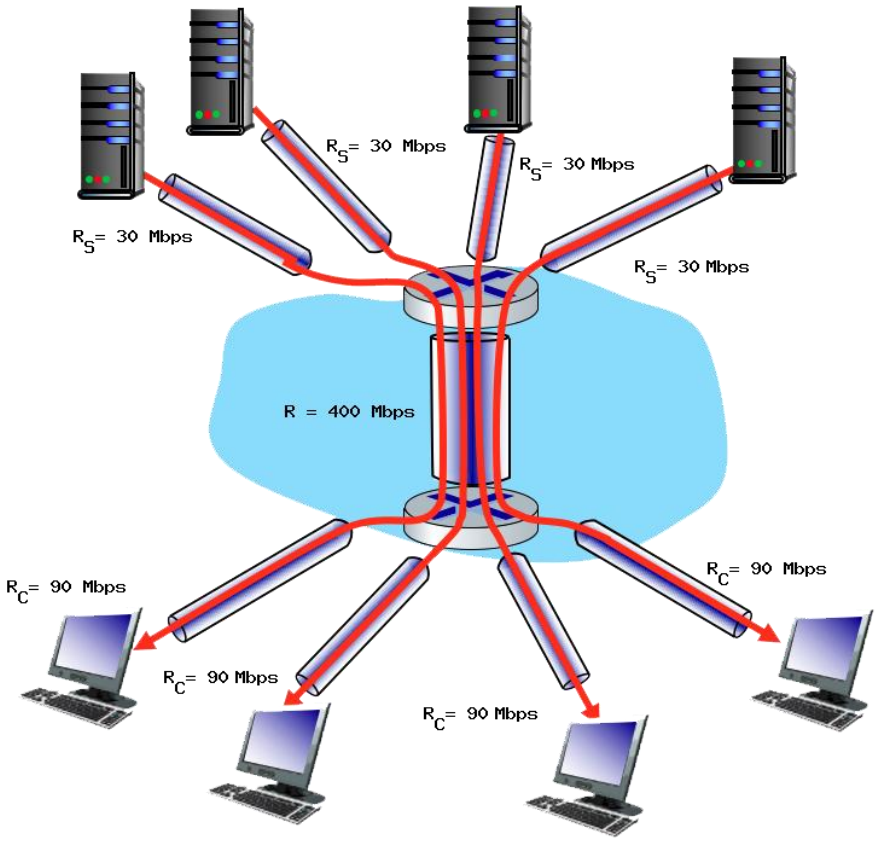
(1) What is the maximum number of connections that can be ongoing in the network at any one time?
(2) Suppose that these maximum number of connections are all ongoing. What happens when another call connection request arrives to the network, will it be accepted?
(3) Suppose that every connection requires 2 consecutive hops, and calls are connected clockwise. For example, a connection can go from A to C, from B to D, from C to A, and from D to B. With these constraints, what is the maximum number of connections that can be ongoing in the network at any one time?
(4) Suppose that 11 connections are needed from A to C, and 15 connections are needed from B to D. Can we route these calls through the four links to accommodate all connections from part 3?

Question: 02 [2*5 = 10 Marks] [CLO 1]

Consider the scenario shown below in the diagram, with four different servers connected to four different clients over four three-hop paths. The four pairs share a common middle hop with a transmission capacity of R = 400 Mbps. The four links from the servers to the shared link have a transmission capacity of R_s = 30 Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of R_c = 90 Mbps.

(1) What is the maximum achievable end-end throughput (in Mbps) for each of four client-to-server pairs, assuming that the middle link is fairly shared (divides its transmission rate equally)?
(2) Which link is the bottleneck link?
(3) Assuming that the servers are sending at the maximum rate possible, what are the link utilizations for the server links (R_s)?
(4) Assuming that the servers are sending at the maximum rate possible, what are the link utilizations for the client links (R_c)?

(5) Assuming that the servers are sending at the maximum rate possible, what are the link utilizations for the shared link (R)?



Question: 03 [1*4 = 4 Marks] [CLO 1]

In the context of switched networks, consider the following two scenarios:

- **Scenario 1:** A circuit-switching scenario in which N_{cs} users, each requiring a bandwidth of 25 Mbps, must share a link of capacity 150 Mbps.
- **Scenario 2:** A packet-switching scenario in which N_{ps} users share a 150 Mbps link, where each user again requires 25 Mbps when transmitting, but only needs to transmit 20 percent of the time.

I) When circuit switching is used, what is the maximum number of users that can be supported?
II) Suppose packet switching is used. What is the probability that a given (specific) user is transmitting, and the remaining users are not transmitting?
III) When one user is transmitting, what fraction of the link capacity will be used by this user?
IV) What is the probability that any 3 users (of the total 11 users) are transmitting, and the remaining users are not transmitting?