University of Victoria
CSC 361: Computer Communications and Networks
Midterm 3
Date: December 2, 2025
Instructor: Prof. Jaya Prakash Champati

UVic ID _____ First Name: _____ Last Name: _____

Please read the following instructions carefully.

- You have 50 minutes to complete this exam. This question booklet contains 3 questions, 5 pages (including the cover) for the total of 15 points/marks. Check to see if any pages are missing.
- All the questions are compulsory and all the notations have their usual meaning. **Read the instructions for individual questions carefully** before answering the questions.
- Calculator can be used.
- Students can bring one letter-sized, double-sided cheatsheet.
- Use of phones is not allowed. If you need to use the washroom, please DO NOT carry any device with you.

Question	Points	Score
1	10	
2	2	
3	3	
Total:	15	

1. (10 points) Please circle the correct answer in the following questions.

   (i) Host A has MAC address 00:1A:2B:3C:4D:5E and receives a frame with destination MAC address 00:1A:2B:3C:4D:5F. What action does Host A's network interface card take?

   A. Accept the frame and pass it to the network layer

   B. Discard the frame silently since the destination MAC does not match

   C. Forward the frame to the correct destination

   D. Send an error message back to the source

   (ii) A switch receives a frame with source MAC 00:AA:BB:CC:DD:EE on port 3. The switch's MAC address table currently shows:

MAC Address	**Port**
00:AA:BB:CC:DD:EE	1
00:11:22:33:44:55	2

   A. Ignore the source MAC since it already exists in the table

   B. Add a duplicate entry associating the MAC with port 3

   C. Update the existing entry to associate the MAC with port 3

   D. Delete the entry and flood all future frames to this MAC

   (iii) Consider a subnet with 10 hosts. Say Host A needs to send data to Host B for the first time. Host A's ARP cache is empty. As an external observer, how many frame transmissions will you observe on the subnet to complete ARP resolution of B at A?

   A. 1 frame

   B. 2 frames

   C. 10 frames

   D. 3 frames

   (iv) Consider the following statements and choose the correct answer.

   1. In a Time Division Multiple Access (TDMA) system, at each time slot, only one node transmits data
   2. In a Frequency Division Multiple Access (FDMA) system, on each frequency subband, only one node transmits data

   A. Both statements are true

   B. Both statements are false

   C. Statement 1 is true and Statement 2 is false

   D. Statement 1 is false and Statement 2 is true

   (v) What action does a device take when it detects a collision in CSMA/CD?

   A. It immediately retransmits the same frame without waiting

B. It sends a jamming signal and waits for a random backoff time before retrying

C. It switches to a different communication protocol

D. It permanently stops transmitting to avoid further collisions

(vi) Which of the following statements is NOT true about Ethernet?

A. uses preamble to synchronize the receiver with the sender's clock

B. uses unslotted CSMA/CD to share the medium

C. is connection-oriented and reliable

D. uses cyclic redundancy check for error detection

(vii) What is the primary difference between a router and a switch?

A. A router operates at the Physical Layer (Layer 1), while a switch operates at the Network Layer (Layer 3).

B. A router forwards data based on IP addresses (Layer 3), while a switch forwards data based on MAC addresses (Layer 2).

C. A switch connects multiple networks (WAN), while a router connects devices within a single LAN.

D. A router increases collision domains, while a switch reduces broadcast domains.

(viii) Packets sent by two stations in 802.11 can collide because:

A. the two stations could be hidden from each other.

B. at a given time, the random backoff values of the two stations are the same.

C. the packets are sent to different APs, but on the same channel.

D. all of the above.

(ix) Why does CSMA/CA (used in WiFi) use collision avoidance rather than collision detection?

A. Collision detection is patented and cannot be used in wireless

B. Wireless stations cannot detect collisions while transmitting due to the significant difference between transmitted and received signal strength

C. Collision detection requires full-duplex communication

D. CSMA/CA is faster than CSMA/CD

(x) A company has a single 24-port switch. Ports 1-12 are assigned to VLAN 10 (Sales) and ports 13-24 are assigned to VLAN 20 (Engineering). Without any router connected, host on port 5 (VLAN 10, IP: 192.168.10.5) tries to ping a host on port 15 (VLAN 20, IP: 192.168.20.15). What happens?

A. The ping succeeds because both hosts are on the same physical switch

B. The ping fails because ARP requests from VLAN 10 are not forwarded to VLAN 20

C. The switch automatically routes between VLANs

D. None

2. (2 points) Refer to Figure 1 and answer the following questions.

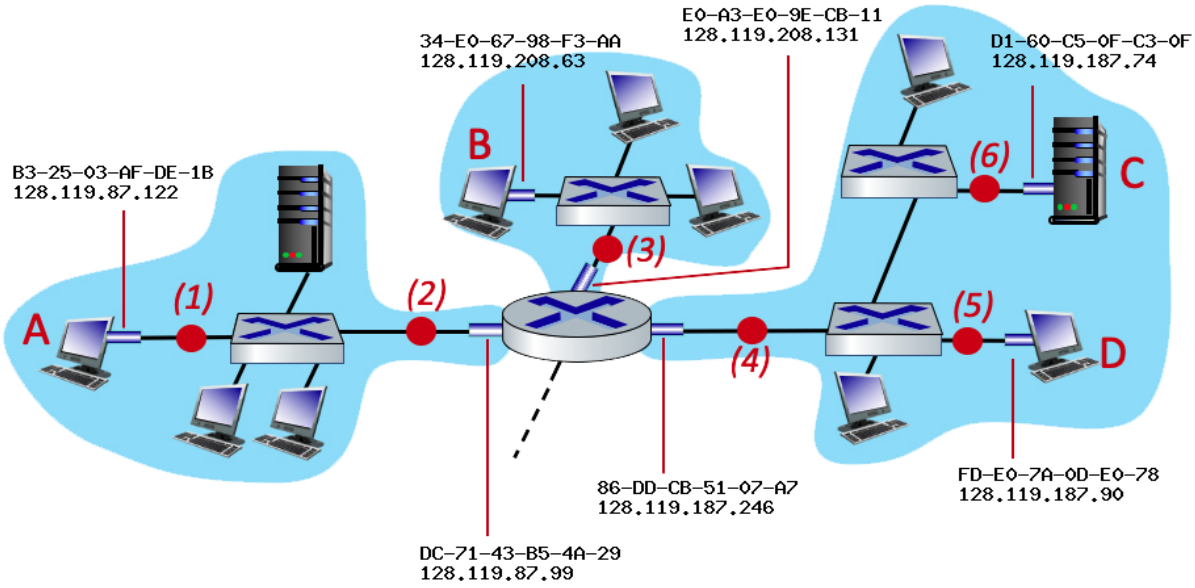

Figure 1: Routing between subnets

(a) If B sends a packet to C, what is the destination MAC address and the destination IP address of the packet on link (3)? (1 point)
Ans: MAC address of the router on interface at (3) (E0-A3-E0-9E-CB-11)
IP address of C (128.119.187.74)

(b) If D sends a packet to C, what is the destination MAC address and the destination IP address of the packet on link (5)? (1 point)
Ans: MAC address of C (D1-60-C5-0F-C3-0F)
IP address of C (128.119.187.74)

3. (3 points) Consider a slotted ALOHA network with **three** nodes, where each node is attempting to transmit with probability p at the start of each slot. Please answer the following questions, explaining the steps you use to obtain the answer.

   (a) What is the maximum efficiency (fraction of slots with successful transmissions) of the network? What is the probability p^* at which this maximum efficiency is achieved? (2 points)

   Ans: The efficiency (fraction of successful slots) of slotted ALOHA with N nodes equals $Np(1-p)^{N-1}$. We have $N = 3$.

   As explained in the lecture, $Np(1-p)^{N-1}$ is maximized at $p^* = \frac{1}{N} = \frac{1}{3}$. Substituting p^*, we get maximum efficiency 0.44.

   (b) If the nodes are using p^*, what is the fraction of slots in which collisions occur? What is the fraction of idle slots? (1 point)

   Ans: The fraction of idle slots is given by the probability that none of the nodes transmit, which is given by $(1-p)^N$. Substituting $N = 3$ and p^*, we obtain 0.296.

   The fraction of collision slots is obtained by subtracting the sum of the fractions of successful slots and idle slots from 1, which equals $1 - 0.44 - 0.296 = 0.26$.