University of Victoria
CSC 361: Computer Communications and Networks
Midterm 2
Date: November 4, 2025
Instructor: Prof. Jaya Prakash Champati

UVic ID _____ Name: _____

Please read the following instructions carefully.

- You have 50 minutes to complete this exam. This question booklet contains 3 questions, 6 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	9	
2	2	
3	4	
Total:	15	

1. (9 points) Please circle the correct answer in the following questions.

   (i) Which of the following is **NOT** a protocol?

   A. NAT
   B. DHCP
   C. IP
   D. None

   (ii) In Selective Repeat ARQ, what action does the sender take when an acknowledgment (ACK) for a particular packet times out?

   A. Retransmits all packets in the current window
   B. Stops transmission until ACK is received
   C. Retransmits only the specific unacknowledged packet
   D. Drops the connection

   (iii) What is the primary advantage of using TCP fast retransmit compared to relying only on timeouts?

   A. It reduces the number of duplicate ACKs
   B. It speeds up the detection and retransmission of lost packets
   C. It increases the congestion window size
   D. It helps flow control

   (iv) Which TCP header field is used for flow control, indicating the amount of data the receiver can accept

   A. Acknowledgment Number
   B. Sequence Number
   C. Window Size
   D. Flags

   (v) How does an excessively large TCP timeout value affect the throughput of a TCP connection?

   A. Throughput increases because fewer retransmissions occur.
   B. Throughput decreases because the sender waits too long before retransmitting lost segments.
   C. Throughput remains unchanged because timeout values do not affect throughput.
   D. Throughput increases because the congestion window size grows larger.

   (vi) What does the TTL field in the IP header primarily prevent?

   A. Packet duplication.
   B. Packet corruption.
   C. Packet looping indefinitely in the network.
   D. Packet fragmentation.

   (vii) What is the main principle of hot-potato routing?

A. Packets are routed through the path with the least number of inter-domain hops

B. Packets are sent to the closest exit point (gateway) out of an autonomous system, minimizing internal cost.

C. Packets are delayed to optimize overall network throughput.

D. Packets follow a fixed, predefined path irrespective of network conditions.

(viii) What is the primary administrative advantage of using DHCP protocol in a large network?

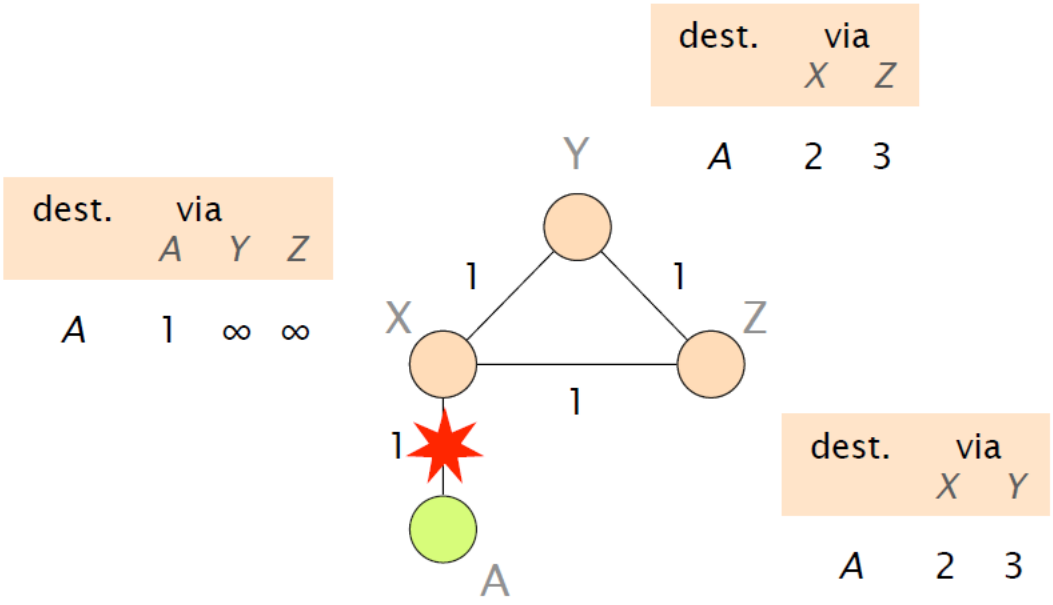
A. It provides encrypted IP address assignment, enhancing network security.

B. It automatically assigns IP addresses and other configuration parameters to clients, reducing manual configuration errors and effort.

C. It increases the routing speed of network packets by optimizing the path selection.

D. It allows for the creation of multiple, isolated virtual networks on the same physical hardware.

(ix) Consider the network in the figure below. The nodes use distance vector (DV) routing with *poison reverse* to configure the routing tables. The estimated distances to A from X, Y, and Z are shown adjacent to the nodes. If the link between X and A is broken, then in each node



A. the DV converges after 1 iteration

B. the DV converges after 2 iterations

C. the DV converges after 3 iterations

D. the DV does not converge

Explanation: The iterations at X (for routing entry A) can have the following pattern.

1. Cannot reach A
2. Can reach via Z; distance 4 (in this iteration, X will get updates from Y and Z that they can reach A with distance 3. X arbitrarily chose Z.)
3. Can reach via Y; distance 6
4. Can reach via Z; distance 8
5. so on ...

This is called a **routing loop**. Thus, poisoned reverse is not foolproof and cannot eliminate routing loops in all cases. This is the reason we need to set TTL in the IP datagram.

2. (2 points) Consider the slow start of TCP Reno: the congestion window size is $cwnd = 1$ and let $ssthresh = 8$.

   (a) Assuming that there are no timeouts or triple duplicate ack events (and the segment sizes are negligible), after how many RTTs does TCP enter congestion avoidance? Explain how *cwnd* evolves. (1 point)

   Ans: 3 RTTs. In the slow start phase, *cwnd* doubles every RTT.

   (b) If a triple duplicate ack event occurs when $cwnd = 4$, what will be the new *cwnd* and *ssthresh* values? Which state does TCP enter? (1 point)

   Ans: $cwnd = 5$ and $ssthresh = 2$. TCP enters 'fast recovery'.

3. (4 points) A company has been granted a block of IP addresses 203.128.240.0/25 (slash notation of the company network). The company wants to assign IP addresses to two subnets. One subnet is for department A, which needs 27 addresses, and another is for department B, which needs 48 addresses. Design the allocation of the IP addresses to the subnets. You should **not** leave any unnecessary address space between the two subnets.

   (a) For department A, write down the network address in the slash notation, first usable IP address, the last usable IP address, and the broadcast address. (2 points)

   Ans: Allocating the address space starting with the larger department, which is B.

   - Network address: 203.128.240.64/27
   - First usable IP address: 203.128.240.65
   - Last usable IP address: 203.128.240.94
   - Broadcast address: 203.128.240.95

   (b) Repeat part (a) for department B. (2 points)

   Ans:

   - Network address: 203.128.240.0/26
   - First usable IP address: 203.128.240.1
   - Last usable IP address: 203.128.240.62
   - Broadcast address: 203.128.240.63

   Note: If you allocate the IP address space starting from department A, then *valid* network addresses will be:

   - Network address for A: 203.128.240.0/27
   - Network address for B: 203.128.240.64/26 (You cannot allocate 203.128.240.32/26 as the network address. Why?)

   However, in this case, the address space 203.128.240.32/27 is wasted.