



Beijing-Dublin International College



SEMESTER 2 FINAL EXAMINATION - (2018/2019)

School of Computer Science

COMP2001J Computer Networks

Prof. Pádraig Cunningham
Dr. Shen Wang*

Time Allowed: 120 minutes

Instructions for Candidates:

All questions carry equal marks.
Answer all questions.

BJUT Student ID:_____ **UCD Student ID:**_____

I have read and clearly understand the Examination Rules of both Beijing University of Technology and University College Dublin. I am aware of the Punishment for Violating the Rules of Beijing University of Technology and/or University College Dublin. I hereby promise to abide by the relevant rules and regulations by not giving or receiving any help during the exam. If caught violating the rules, I accept the punishment thereof.

Honesty Pledge:_____ **(Signature)**

Instructions for Invigilators

Non-programmable calculators are permitted.

No rough-work paper is to be provided for candidates.

Question 1:

- a. Computer networks are organised as a stack of layers. List each of the 5 layers introduced in our module and briefly explain their main objectives.
(5%)
- b. Resource sharing is among the design objectives of computer networks. Briefly compare the two resource sharing methods: multiplexing and switching. In particular, describe the characteristics of datagram packet switching.
(5%)
- c. Consider a route in a store-and-forward network going through 5 intermediate nodes. The packets contain 1200 bits and are transmitted at 64 kbps. Assume processing delay for each packet is 3msec and propagation delay on one link is 10msec. As a packet travels along the route, it encounters an average of 6 packets when it arrives at each node. How long does it take for the packet to get to the receiver if the nodes transmit on a “first come first served” basis?
(5%)
- d. Briefly explain what are MAC address, IPv4 address, and Port numbers? How many bits are used to represent each? Explain how each can be used for addressing in the existing computer network layered stack?
(5%)
- e. Name 3 different wired physical transmission medium types? Briefly outline the positives and negatives of using each type.
(5%)
- (Question Total 25%)**

Question 2:

- a. What is the purpose of the Address Resolution Protocol (ARP)? Explain the mechanics of ARP.
(6%)
- b. In Carrier Sense Multiple Access/Collision Detection (CSMA/CD) a node must sense if the channel is busy before sending a message. In CSMA/CD describe with the aid of a diagram what a node will do if the channel is busy if it is:
- 1-persistent CSMA/CD
 - non-persistent CSMA/CD
 - p-persistent CSMA/CD
- (6%)**
- c. Why is flow control necessary in computer networks? Compare 3 flow control schemes in data link layer: Stop-and-Wait, Go-back-N, and Selective Repeat. What are the differences comparing flow control implementations in data link layer and transport layer?
(8%)

- d. What are the two mechanisms along with the sequence number used for implementing reliable transmission in computer networks? Compare the differences of these two mechanisms in both data link layer and transport layer (you may use some typical unreliable transmission cases to explain how these two mechanisms work).

(5%)

(Question Total 25%)

Question 3:

- a. A long message has to be chopped into multiple short messages to be transmitted over computer networks. In the network layer, suppose the Maximum Transmit Unit is 1500 bytes, IP header is 20 bytes, we need to send 2900 bytes datagram, as shown in the following Figure 1. Draw diagrams to show how this IP fragmentation is working (i.e. showing length, ID, MF, and offset for each small fragment).

(5%)

Length = 2900	ID = x	MF = 0	Offset = 0
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Figure 1: A large IP fragment to be sent.

- b. The routing table of a certain router is shown in Table 1.
- Suppose this router receives a packet whose destination address is 131.128.55.38, determine its next hop with explanations;
 - Add a routing entry whose destination address is 131.128.55.33 and the next hop is "A". This new routing entry should NOT impact other existing forwarding rules;
 - Add a routing entry that can forward all unmatched packets to the next hop "E";
 - Divide the first network prefix, 131.128.56.0/24, into 4 equal-sized subnets. Describe your results in a table with network prefix and the range of available host addresses.

Table 1: A sample routing table.

Network Prefix	Next Hop
131.128.56.0/24	A
131.128.55.32/28	B
131.128.55.32/30	C
131.128.0.0/16	D

(10%)

- c. Compare two commonly used interior dynamic routing algorithms in computer networks, by referring to their key characteristics.

(5%)

- d. What is Software Defined Network? Explain how it can largely simplify the network configuration.

(5%)

(Question Total 25%)

Question 4:

- a. Draw a diagram to show the process of TCP 3-way handshake with the values of flag bits, sequence number, and acknowledgement number. Explain why TCP does not use 2-way and 4-way for a connection establishment.

(6%)

- b. Figure 2 shows the evolution of the congestion window size in a TCP host.

- Why the congestion window size increases exponentially at the beginning?
- Why the event happened at the 13th RTT round is the worst packet loss type?
- Why this TCP congestion control is outdated now?

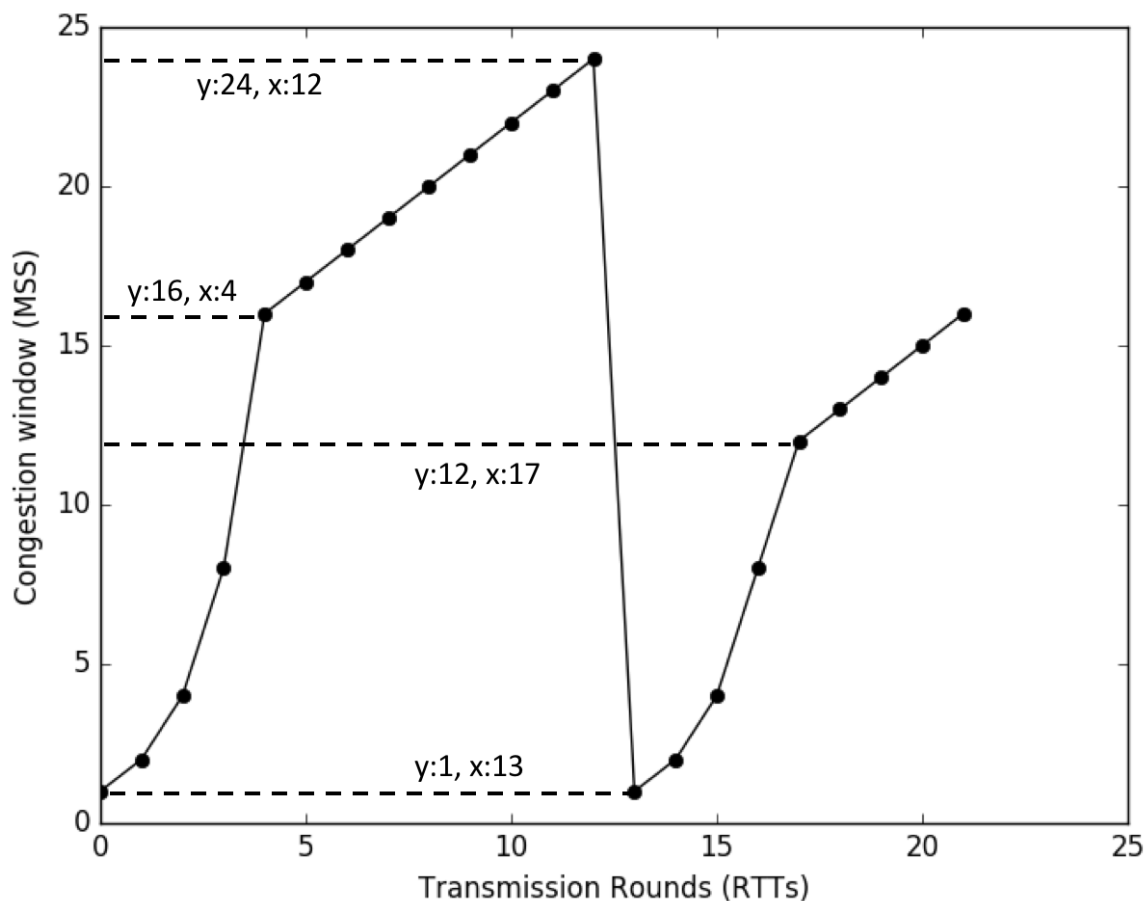


Figure 2: The evolution of congestion window size along a TCP transmission

(6%)

c. What are the advantages of HTTP 1.1 over HTTP 1.0? Why “cookies” is important for web browsing?

(4%)

d. What is the Content Delivery Network (CDN) designed for? What are the two main functionalities of the Domain Name System (DNS)? Explain with the followings:

- A typical DNS recursive and iterative process.
- An improved process with the help of CDN.

(9%)

(Question Total 25%)

Total Marks (100%)