

Department of Computer Science & Engineering

University of Asia Pacific (UAP)

Program: B.Sc. in Computer Science and Engineering

Final Examination

Fall 2020

3rd Year 2nd Semester

Course Code: CSE 319

Course Title: Computer Networks

Credits: 3.0

Full Marks: 120* (Written)

Duration: 2 Hours

* Total Marks of Final Examination: 150 (Written: 120 + Viva: 30)

Instructions:

1. There are **Four (4)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1.
 - a) Consider a DHT with a mesh overlay topology (i.e., every peer tracks all peers in the system). Explain the advantages and disadvantages of such a design. 10
 - b) With a Web-based e-mail account (such as Hotmail or Gmail), suppose Alice sends a message to Bob, who accesses his mail from his mail server using POP3. Discuss how the message gets from Alice's host to Bob's host. List the series of application-layer protocols that are used to move the message between the two hosts. 10
 - c) Consider communication between a client and a web server. Illustrate the connection setup and termination between them. 10
2.
 - a) Suppose there are three routers between a source host and a destination host; ignoring fragmentation, an IP datagram sent from the source host to the destination host will travel over how many interfaces? Compute how many forwarding tables will be indexed to move the datagram from the source to the destination?
Demonstrate how a hierarchical organization of the Internet has made it possible to scale to millions of users. 5+5
 - b) Consider the following network in Figure 1. The indicated link costs use Dijkstra's shortest-path algorithm to estimate the shortest path from x to all network nodes. Use the following information to calculate the final cost of a particular link. 20
 - $a = \text{your birth month} * 7$ ----- (i)
 - $b = \text{your birthday} * 6$ ----- (ii)

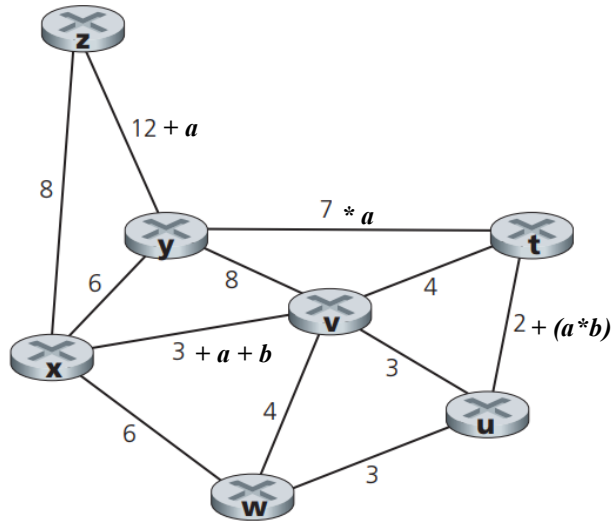


Figure 1: Network topology of final exam

OR

2. a) Consider a subnet with the prefix 128.119.40.128/26. Give an example of one IP address (of the form **xxx.xxx.xxx.xxx**) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 128.119.40.64/26. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form **a.b.c.d/x**) for the four subnets? 10
- b) Explain why an ARP query is sent within a broadcast frame and why is an ARP response sent within a frame with a specific destination MAC address? 10
- c) Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows: 10

Destination Address Range	Link Interface
11100000 00000000 00000000 00000000 through 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 through 11100000 01000000 11111111 11111111	1
11100000 01000001 00000000 00000000 through 11100001 01111111 11111111 11111111	2
otherwise	3

Illustrate how the forwarding table determines its appropriate link interface for datagrams with destination addresses:

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11001000 10010001 01010001 01010101
11100001 01000000 11000011 00111100
11100001 10000000 00010001 01110111

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3. a) Let $P = \{3, 5, 7\}$, and $Q = \{11, 13, 17\}$. 15
 Calculate RSA, where you have to choose p and q from the set P and Q , respectively.
 Encrypt the message $m = \text{"Your birthday (i.e., if January 14 is your birthday, you will encrypt 14)"} using the public key pair. Let c denote the corresponding ciphertext. Calculate all the steps, including decryption of the ciphertext c .$

- b) We know that private key encryption is much stronger and efficient than public-key cryptography. However, private key cryptography faces challenges of secret key exchange between sender and receiver. 15
 Therefore, develop a secure key exchange protocol that will help to establish the secret key for the private key encryption and decryption.

4. a) Let your organization want to provide data analytics services to its clients. Therefore, it requires sophisticated hardware and software to provide such a service. However, your organization does not want to acquire that expensive hardware and software on their own. From the above scenario, formulate a business plan that will be sustainable for your organization. Your proposal should meet the following requirements: 15
 - Capabilities of the acquired service
 - Scaling mechanism
 - Economic strategy
 - Green computing

- b) Global trade has been the single greatest creator of wealth in human history, and market friction the greatest obstacle to wealth. Over the years, businesses have overcome multiple sources of friction. Institutions and instruments of trust emerged to reduce risk in business transactions. Technology innovations helped overcome distances and inefficiencies. Still, many business transactions remain inefficient, expensive, and vulnerable. Assemble the types of primary friction of the market and propose solutions for each identified problem. 15