Curtin University

School of Electrical Engineering, Computing and Mathematical Sciences

Discipline of Computing - Curtin University

CNCO2000 Computer Communications /

CMPE2000 Data Communications and Network Management

Final Assessment - Semester 2, 2020

Total Mark: 100

Time allowed: 4 hours (downloading the exam paper to the last uploading of your answers)

Assessment Availability: 1pm Tuesday 24 November 2020 to 1pm Wednesday 25 November 2020

Test mode: Online test, open-book: you are allowed to access your hand-written notes, lecture slides, textbooks, and printed and electronic materials in your possession.

CONDITIONS

- The assessment must be completed by yourself only. No one else should do this assessment for you. Any attempts to compromise the system are strictly prohibited. Any breaches of this policy will be considered cheating and appropriate action will be taken as per University policy.
- You are prohibited from communicating with people other than the unit coordinator / lecturer and the tutor during the assessment.
- You are prohibited from providing information about this assessment and your work to others during and outside your assessment within two days. Some students may take the assessment later than you.
- You must complete and submit the "Student Declaration Form".
- Some students taking the assessment may be invited to an online interview. In the interview, students will be asked to explain their solutions and demonstrate their knowledge for randomly selected questions. Students will be shown the questions, as well as their written answers.

INSTRUCTION

- This assessment consists of four questions with a total marks of 100. **Attempt ALL questions**.
- You can submit your answers multiple (up to 3) times during the assessment, but only the last submission would be used for marking. **NOTE: Multiple attempts (downloading the exam paper again and restarting the timer) will be caught and are NOT permitted.**

Question 1: (25 marks)

a. Given the following parameters for a switching network:

N = number of hops between two given end systems
L = message length in **bytes**
B = data rate in megabits per sec **(Mbps)** on all links
P = fixed packet size in **bytes**
H = overhead (header) in **bits** per packet
D = propagation delay per hop in **seconds**
R = processing delay for routing decisions at each node in **seconds**
S = call setup time (for circuit switching or virtual circuit) in **seconds**

Assume that there are no acknowledgements and ignore all other processing delays at the nodes.

i) Compute the end-to-end delay for Packet Switching.

(5 marks)

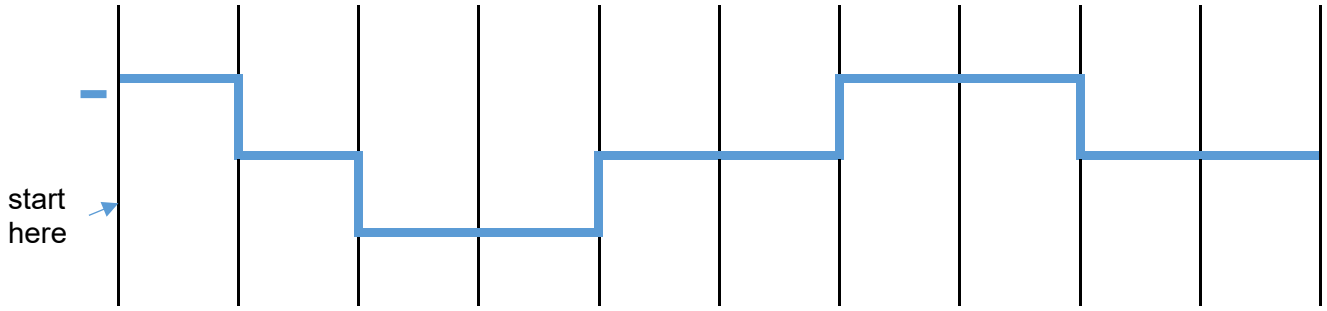
ii) Compute the end-to-end delay for Virtual Circuit Packet Switching (VCPS).

(5 marks)

iii) Under what conditions that VCPS is faster than Packet Switching? You can use the derivations obtained in i) and ii) to explain your answer.

(5 marks)

b. Consider the following MLT-3 encoded signal.



Assume 0 is indicated by a transition, and 1 is otherwise.

i) Write down the bits encoded in the signals.

(2 marks)

ii) Why does MLT-3 require less bandwidth than other encoding techniques? Explain your answer with an example.

(3 marks)

c. Explain the advantages and disadvantages of using millimetre waves in 5G.

(5 marks)

Question 2: (25 marks)

a. For a bit stream: 100110000110,
   i) Derive the **codeword** being delivered if two-dimensional parity check (odd-parity, block size: 4) is used.

   (5 marks)

   ii) Show an example of error that the derived codeword fails to detect.

   (2 marks)

b. Given a bit stream 1011000, or data polynomial $D(x) = x^6 + x^4 + x^3$ and given the generator polynomial $G(x) = x^2 + 1$,
   i) Find the **codeword** C(x) using Cyclic Redundancy Check (CRC).

   (5 marks)

   ii) Assume the received message H(x) is H(x) = C(x) + E(x), where E(x) is the error polynomial.
   Show that H(x) is not divisible by G(x) when $E(x) = x^3+1$.

   (2 marks)

c. Show the **byte-stuffing & destuffing** steps for the following data bits if **PPP frame** is used.
   01000001011111010100001001111110010100000111000001000110

   (6 marks)

d. A data link is transmitting frames of 1,500 bits with data rate of 4,000 bits/second. The propagation delay is 0.2 second. Assume that acknowledgment packets are of negligible size, processing time at the hosts is negligible, and the link is error-free. Derive the minimum window size which will allow full utilization of the link if a sliding window protocol is used for flow control

   (5 marks)

Question 3: (25 marks)

a. A router has the following CIDR entries in its routing table:

Address/mask	**Next hop**
129.47.104.0/15	Interface 0
129.44.112.0/21	Interface 1
190.34.100.0/22	Loopback Interface 0
129.44.192.0/19	Router 1
default Router	Router 2

For each of the following IP addresses, what does the router do if a packet with the following destination address arrives?

i) 129.46.120.10
ii) 129.44.199.14
iii) 129.44.221.255
iv) 255.255.255.255
v) 190.34.104.255

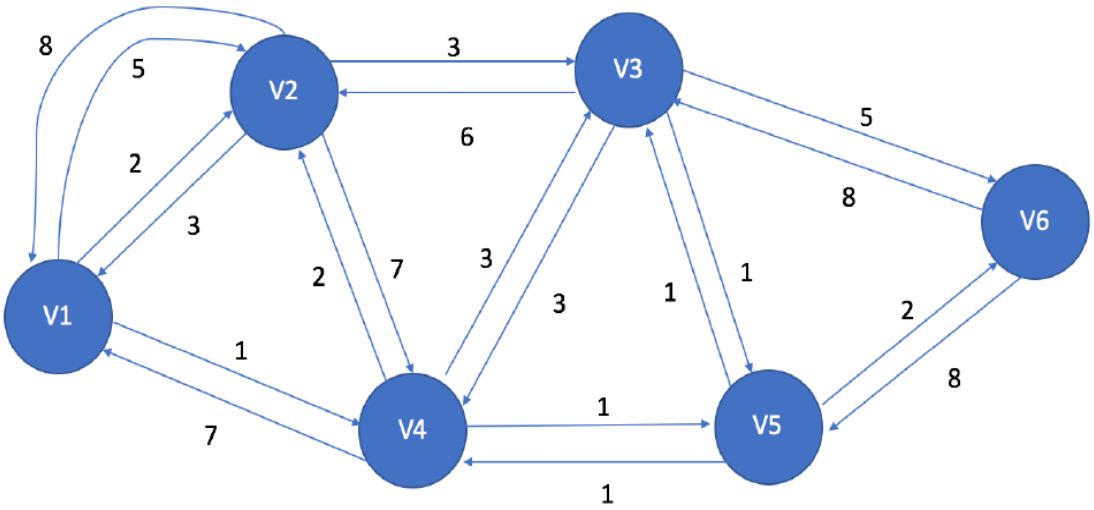
(5 marks)

b. Suppose that a network with the address 192.168.10.0 (Class C network) is to be divided into four sub networks, each with unequal number of IPv4 addresses requirements as shown below (**Subnet Specification**). Complete the rest of the table.

Subnet Specification	**Network Address**	**Subnet Mask**	**Broadcast Address**	**Total Number of Host Bits**	**Total Number of Hosts**
Subnet A: 126 IPv4 Addresses					
Subnet B: 62 IPv4 Addresses					
Subnet C: 30 IPv4 Addresses					
Subnet D: 30 IPv4 Addresses					

(8 marks)

c. Consider the following network. With the indicated link costs, use Dijkstra's shortest path algorithm to compute the shortest path from V6 to all other nodes.



(6 marks)

d. Assume that delay is used as the metric in a distance vector routing. A network consists of seven (7) nodes, Node A to Node G. Node C has three neighbour nodes: B, D, and E. The following vectors have been received by Node C:

From B: (6, 0, 5, 9, 8, 3, 3);
From D: (7, 6, 1, 0, 8, 9, 4);
From E: (3, 7, 3, 6, 0, 3, 4)

where the 1st element from Node X represents the delay from Node X to Node A, and the 2nd element represents the delay from Node X to Node B, and so on. The measured delays from Node C to B, D and E, are 4, 2, and 5, respectively.

What is C's new routing table? Both the next hop and the expected delay need to be specified in the routing table.

(6 marks)

Question 4: (25 marks)

a. In computer networking, the Network Layer can ensure correct delivery of data from source to destination (end-to-end communication). Why is Transport Layer still needed? Describe 3 reasons of having the Transport Layer.

(6 marks)

b. Discuss why the Transmission Control Protocol (TCP) uses a "four-way handshake" to close a connection. Is it completely foolproof? Why or why not?

(6 marks)

c. When a user clicks on a hyperlink (e.g. http://www.curtin.edu.au), the web server carries out a series of actions. Describe in detailed steps the operations of a Web server before and after it receives a file request from a remote host.

(6 marks)

d. In blockchain applications such as the bitcoin, explain how immutability is achieved i.e., the data cannot be altered by any of the users in the network.

(7 marks)

END OF EXAMINATION