THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

This exam paper must not be removed from the venue

Venue _____

Seat Number _____

Student Number |__|__|__|__|__|__|__|__|

Family Name _____

First Name _____

School of Information Technology and Electrical Engineering

EXAMINATION

Semester One Final Examinations, 2019

COMS3200 Computer Networks I

This paper is for St Lucia Campus students.

Examination Duration: 120 minutes

Reading Time: 10 minutes

Exam Conditions:

This is a Central Examination

This is an Open Book Examination

During reading time - write only on the rough paper provided

This examination paper will be released to the Library

Materials Permitted In The Exam Venue:

(No electronic aids are permitted e.g. laptops, phones)

Calculators - Any calculator permitted - unrestricted

Materials To Be Supplied To Students:

None

Instructions To Students:

Additional exam materials (eg. answer booklets, rough paper) will be provided upon request.

Answer ALL questions.
100 marks total on the paper.
Marks for each question are as indicated.
Questions are to be answered in the spaces provided on this exam paper.

For Examiner Use Only

Question	Mark

Total _____

Question 1. [HTTP GET] Suppose that a server receives the following HTTP GET message from a client browser:

```
GET /kurose_ross/interactive/quotation4.htm HTTP/1.1
Host: www.univ1.edu.au
Accept: text/plain, text/html, image/jpeg, image/gif, audio/mp4, audio/vnf.wave, video/mp4, video/mpeg, application/*, */*
Accept-Language: en-us, en-gb;q=0.5, en;q=0.4, fr, fr-ch, zh, fi
If-Modified-Since: Thu, 25 April 2019 15:20:19 -0700
User Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_7_3) AppleWebKit/534.53.11 (KHTML, like Gecko) Version/5.1.3 Safari/534.53.10
```

Q1-1. [2 marks] What is the name of the file that is being retrieved in this GET message?

Q1-2. [2 marks] What formats of text, images, audio, and video does the client browser prefer to receive?

Q1-3. [2 marks] Does the browser sending the HTTP message prefer Swiss French over traditional French? Explain.

Q1-4. [4 marks] Does the client already have a (possibly out-of-date) copy of the requested file? Explain. If so, approximately how long ago did the client receive the file, assuming the GET request has just been issued?

Question 2. [HTTP Response] Suppose the server-to-client HTTP response message is the following:

```
HTTP/1.1 404 Not Found
Date: Mon, 24 Sep 2018 22:23:34 +0000
Server: Apache/2.2.3 (CentOS)
Content-Length: 74396
Keep-Alive: timeout=39, max=82
Connection: Keep-alive
Content-type: image/html
```

Q2-1. [2 marks] Was the server able to send the document successfully? Explain.

Q2-2. [2 marks] When was the file last modified on the server?

Q2-3. [2 marks] What is the type of file being sent by the server in response?

Q2-4. [4 marks] What is the default mode of connection for HTTP protocol? Is the connection in the reply persistent or non-persistent? Explain.

Question 3. [Transport layer]

Q3-1. [3 marks] How does TCP support reliable delivery of packets? Briefly explain three mechanisms.

Suppose that nodes A and B want to establish a TCP connection via the three-way handshake. A sent the following TCP segment to B. The following is a dump (contents) of the TCP header in hexadecimal format. Ignore the space between hexadecimal numbers.

D201 0043 0000 2711 0000 0000 4002 06EE …

Q3-2. [2 marks] What is the destination port number? Show your working.

Q3-3. [2 marks] What is the sequence number? Show your working.

Q3-4. [2 marks] What is the length of header? Show your working.

Q3-5. [2 marks] What is the window size? Show your working.

Question 4. [Routing algorithms]

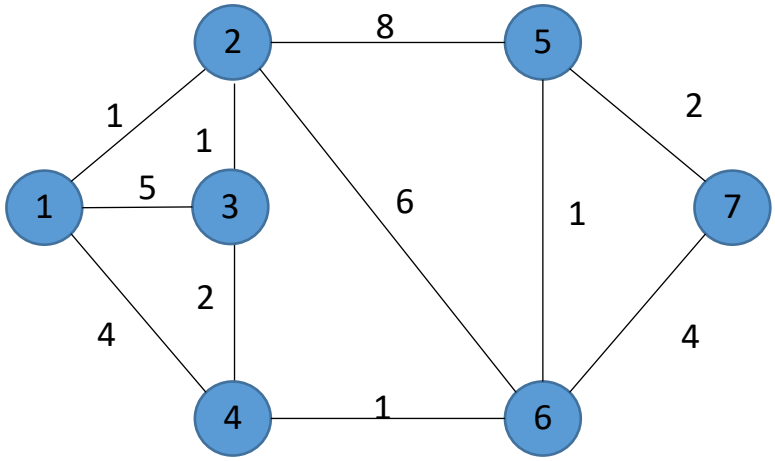


Figure 1. An example network 1

Q4-1. [10 marks] Apply the Bellman-Ford algorithm on the example network 1 given in Figure 1 to find the minimum-cost routes from station 1 to all other stations. Please make a table containing all the values. Please use "inf" to specify an infinite cost and "-" to specify no next hop respectively.

Q4-2. [10 marks] Apply the Dijkstra algorithm on the example network 1 in Figure 1 to find the minimum-cost routes from station 1 to all other stations. Please make a table for the final value. S is the set of stations whose least-cost path is known; D(v) is the current cost of path from source (i.e., station 1) to station v; p(v) is the predecessor station along path from source to v, that is next to v. Please use "inf" to specify an infinite cost and "-' to specify no predecessor respectively.

Question 5. [IP/subnet] Suppose an ISP (internet service provider) owns the block of addresses of the form 101.101.128/17. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses.

Q5-1. [5 marks] What is the maximum number of hosts can be connected to each subnet? Show your works.

Q5-2. [5 marks] What are the prefixes (of the form a.b.c.d/x) for the four subnets?

Question 6. [Checksum]

Q6-1. [6 marks] If the Internet checksum method is adopted, what message will be sent if data is 5AD3EE35? If the message received is 59D4 EF35 B6F6, will the message be accepted? (Show your workings.)

[Cyclic Redundancy Check] Suppose we chose to send 16-bit sequence "0001 0010 0011 0100" over the Bluetooth channel. In order to enhance communication reliability, we chose to attach the CRC code using CRC-8-AUTOSAR scheme, which is commonly used in automotive integration applications. It is defined as x^8 + x^5 + x^3 + x^2 + x + 1.

Q6-2. [2 marks] How many CRC bits are added? And, what is the total number of bits to be sent?

Q6-3. [5 marks] What is the CRC value? Show all your works.

Question 7. [Parity bit] The two-dimensional 'odd' parity scheme is used for the following data: 01110010100100111001.

Q7-1. [3 marks] Show how one bit error can be detected using the two-dimensional parity scheme.

Q7-2. [3 marks] Show one example of un-correctable error pattern.

Question 8 [FEC] For k=2 and n=4, we can make the following assignment.

No	Data Block	Codeword
1	00	0000
2	01	0010
3	10	1000
4	11	1110

Q8-1. [3 marks] Briefly explain two reasons why FEC is used.

Q8-2. [3 marks] Suppose that a codeword block is received with the bit pattern 1001. Can the error be detected? Can the error be corrected? (Calculate the Hamming distance d.)

Question 9. [MAC address]
The following is an example MAC address.

00:A0:C9:14:C8:29

Q9-1. [2 marks] Write down the part in hexadecimal indicating the adapter's manufacturer.

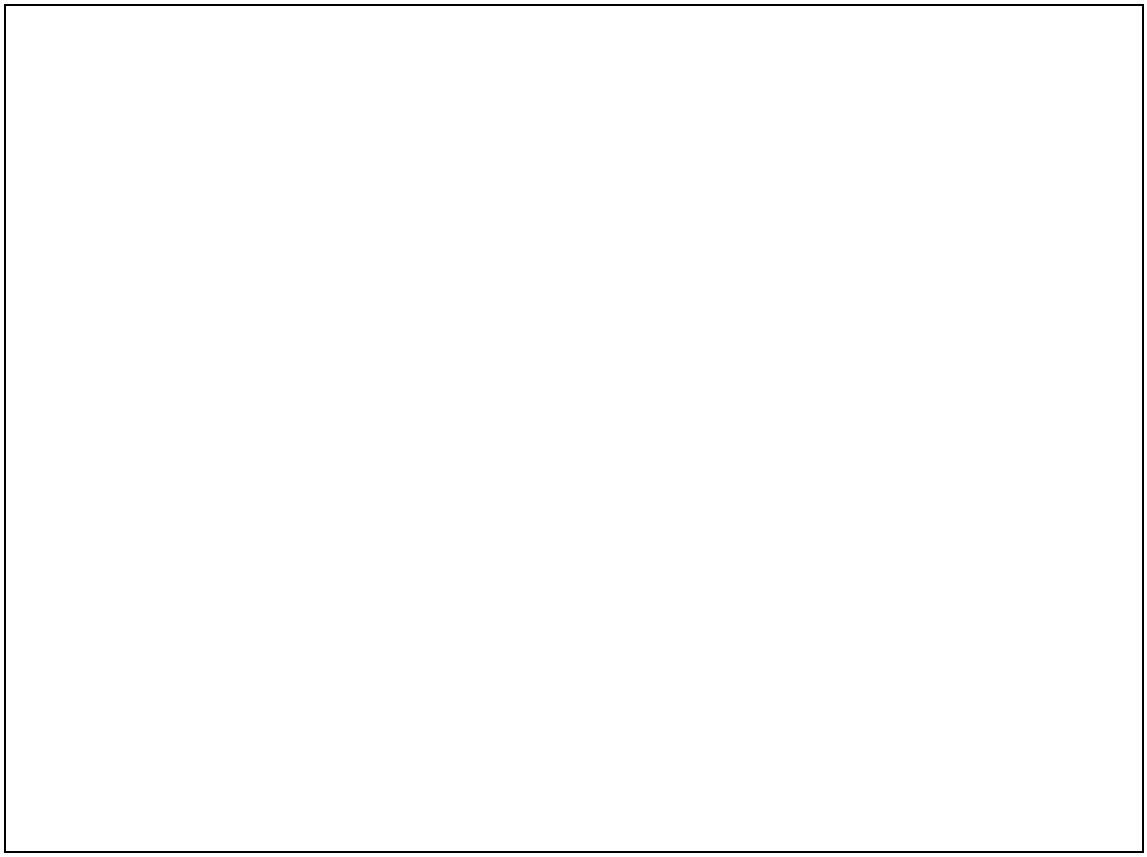
Q9-2. [2 marks] What protocol is used to find an IP address given a MAC address of a device?

Question 10.
Q10-1. [5 marks] A researcher has developed a variant of the Caesar cipher as defined in equation (1).

$$C = E(P) = k*P \bmod 26 \quad (1)$$

Where *P* denotes plaintext, *C* denotes ciphertext, *k* is the key and * means multiplication.
If *k* =5, compute the ciphertext for the following plaintext "This is a secrete message". *Ignore the space between words and the message is not a case sensitive*.

Q10-2. [5 marks] Encrypt the same plaintext in the Question Q9-1 above using the Rail fence cipher (aka, a zigzag cipher) with the depth (key) 4. *Ignore the space between words.*



Extra page 1 (Please write the question number correctly).

Extra page 2 (Please write the question number correctly).

END OF EXAMINATION