End of Semester 2, 2019

Curtin University

# EXAMINATION PAPER CHECKLIST

for examination CNCO2000 Computer Communications

This page is to remain part of your examination file and is to be submitted with your Examination Cover Sheet and content. This page is for information only and will not be printed.

☐ Questions for the examination commence on page 3 (following the Examination Paper Checklist and Examination Cover Sheet) – Questions page should state page 1 of X.

☐ Ensure type of examination is correct 'CLOSED, OPEN OR RESTRICTED'
- CLOSED - no text books or written materials permitted
- OPEN - any text books or written materials permitted
- RESTRICTED - specified text book or written material only permitted

☐ All pages, sections and questions are numbered sequentially i.e. pages, Part A, B, C, … etc. Questions 1, 2, 3, … Subsections to question numbering is to be consistent throughout the examination paper i.e. (a), (b), (c), …

☐ General instructions to students are to be entered in the 'Instructions to Students' area of the online exam request and is reflected on the Exam Cover Sheet

☐ If there is insufficient space to enter all the general instructions to students in the 'Instructions to Students' section of the Exam Cover Sheet, the top section of page 2 may be used, preceding the commencement of the examination questions

☐ Instructions regarding the answering of questions are communicated clearly to students. e.g. Answer Part A in the answer book provided and Part B on the examination paper

☐ All questions, including subsections and parts of questions are to have marks allocated clearly. The total of all marks is to agree with the Total marks on the Exam Cover Sheet

☐ 'END OF EXAMINATION PAPER' is to be stated on the last page of the examination paper

☐ Student Name and ID is only required if the student answers on the examination paper or if the School wishes the paper to be returned

☐ Exam paper is of a high quality readable format, e.g. consistent formatting through entire document, no blurred text, images clear and printable.

The examination paper has been proof read, the above checks completed, and approved for submission.

| | NAME OR ELECTRONIC SIGNATURE | DATE |
|---|---|---|
| EXAMINER | | |
| CO-EXAMINER | | |
| HEAD OF SCHOOL/DEPARTMENT (OR DELEGATE) | | |

End of Semester 2, 2019

Venue _____

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

Family Name _____

First Name _____

**School of Electrical Engineering, Computing and Mathematical Sciences**

# EXAMINATION

End of Semester 2, 2019

## CNCO2000 Computer Communications

*This paper is for Bentley Campus students*

This is a RESTRICTED BOOK examination

Examination paper IS NOT to be released to student

**Examination Duration** 2 hours

## Reading Time

10 minutes

Students may write notes in the margins of the exam paper during reading time

## Total Marks

100

## Supplied by the University

None

## Supplied by the Student

### Materials

One A4 sheet of handwritten notes (both sides)

### Calculator

A non-programmable calculator is permitted in this exam

## Instructions to Students

Answer all questions in the space provided on the question paper

**For Examiner Use Only**

| Q | Mark |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |
| 14 | |
| 15 | |
| 16 | |
| 17 | |
| 18 | |

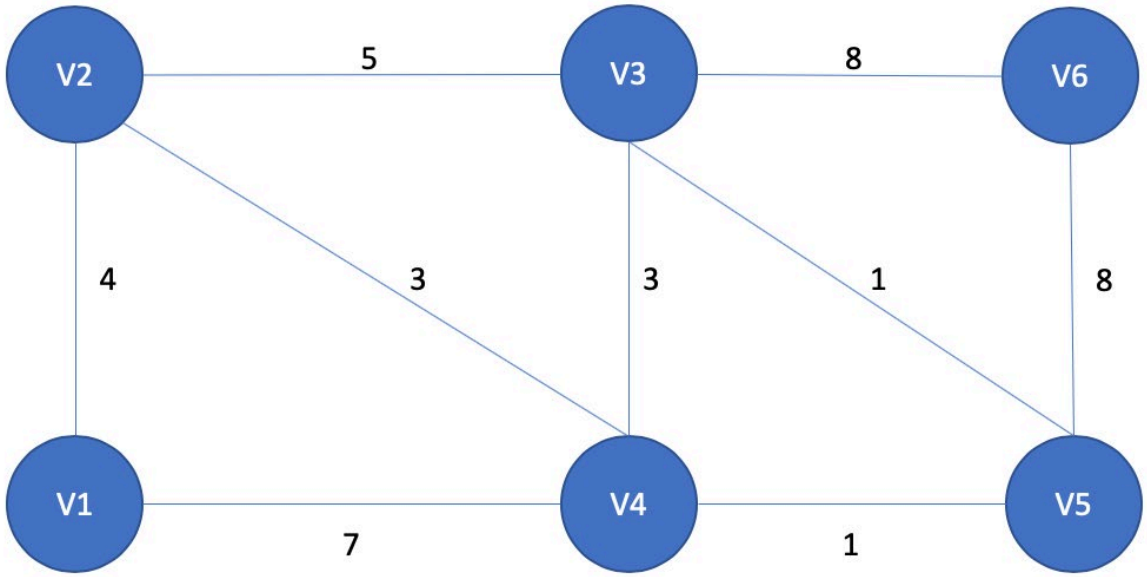
Total _____

Examination Cover Sheet

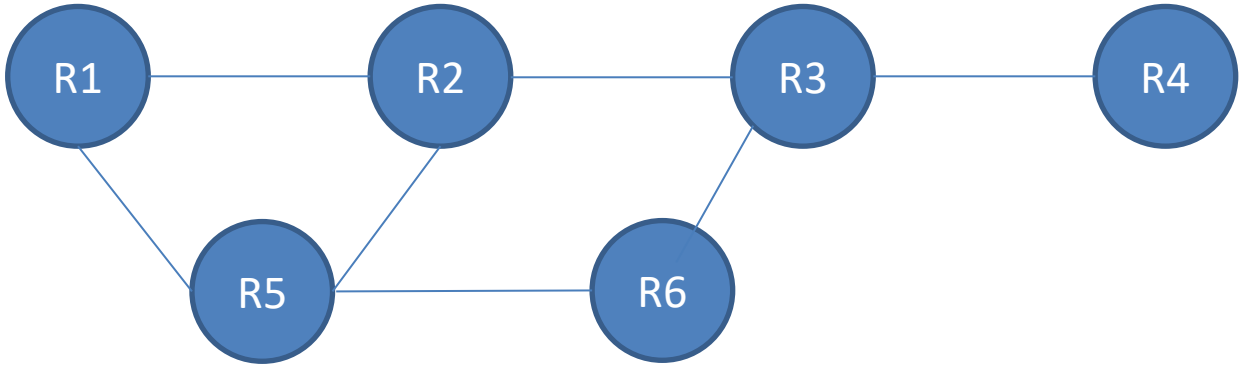
**Question 1 (20 Marks)**

a) Refer to the figure below. Use Dijkstra's algorithm to generate a least-cost route for V1 to all other nodes.

(10 marks)



b) Refer to the diagram below. The link from router R3 to router R4 fails, explain how this may cause the “count to infinity” problem in a distance vector routing protocol. Illustrate your answer with the routing tables in the effected routers.




(5 marks)

c) Explain how this problem may be overcome by the application of “split horizon” and “poison reverse”.

(5 marks)

**Question 2 (20 Marks)**

(a) Consider the case of transmitting 1000-bit frames over on a 1 Mbps link with a delay of 10ms (millisecond). The probability that a single frame is in error is 0.75

What is the *maximum link utilization* for:

i. Stop-and-wait flow control?

(3 marks)

ii. Sliding window with a window size of 24 (If selective reject ARQ is used)?

(2 marks)

iii. Sliding window with a window size of 25 (If selective reject ARQ is used)?

(2 marks)

iv. Sliding window with a window size of 1 (If Go-back-N ARQ is used)?

(3 marks)

(b) Consider the effect of using slow start on a line with a 20-msec round-trip time and no congestion. The receive window is 33KB and the maximum segment size is 2KB. How long does it take before the first full window can be sent?

(3 marks)

(c) Consider a sliding window protocol used for flow control on a given data link where the data rate is 4096 bits/second, the propagation delay is 60mS, and the frame size is 24KB per frame. Assume that acknowledgment packets are of negligible size, processing time at the hosts is negligible, and the link is error is 0.5.

i. Can the link be fully utilized? Explain?

(3 marks)

ii. What is the maximum utilization of the link that is possible?

(1 marks)

iii. What is the minimum window size which will allow the maximum utilization found in Question (ii)?

(3 marks)

**Question 3 (20 Marks) Short answer**

(a) Describe or define the significance of the following IPv4 addresses:

i. 0.0.0.0 *(Explain the significance of this address in the context of routing and using it as a host address)*

ii. 255.255.255.255

iii. 192.168.1.255

iv. 192.168.1.0/24

(5 marks)

(b) Describe or define the significance of the following IPv4 addresses:

i. ::192:168:0:1

ii. 2000::

iii. ::1

iv. 0:0:0:0:0:ffff:8607:8686

(4 marks)

(c) Describe the use and purpose of Choke packets. Provide an example.

(2 marks)

(d) Describe two (2) major differences between the Choke packet method and the RED method.

(2 marks)

(e) Compare and contrast connection-oriented and connection-less protocols (with examples of each)?

(2 marks)

(f) Explain the 3-way handshake with regard the to the connection above and show how it can solve the problem in connection establishment clearly?

(1 mark)

(g) Consider the following scenario:
Alice in Curitn University (alice@cs.curtin.edu.au) wants to send an email to bob@cs.ai.yale.edu.

Write down the steps involved in the process of sending an email including the name resolution process via the DNS Servers.

*You may assume that the DNS servers exist for curtin, edu (TLD), Yale and Yale Computing Faculty (cs)*

(4 marks)

**Question 4 (10 marks)**

Suppose that a network with address 123.132.23.0/24 is assigned to a large organization. It has 13 departments and each department has 13 devices (computers, etc.) to be configured with IP addresses. As a network engineer, you are hired to configure the IP addresses. Show how you would configure the network with multiple subnets and specify the IP address range for the hosts in each subnet.

Subnet Mask:

| # | Subnet ID | Range | Broadcast |
|---|---|---|---|
| | | | |

(10 marks)

**Question 5 (30 marks)**

(a) Given the information bits (10111101) and the generator polynomial $G(x) = x^2 + x$

Find the codeword F(x) if CRC is used?

(5 marks)

Based on the codeword F(x) above. Assume the message received at the other end of the communication is H (x):

H(x) = F(x) + E(x), where E(x) is the error polynomial

(b) When H(x) contains no errors, show that H(x) is divisible by G(x)

(3 marks)

(c) Determine whether the error is detectable when:

i. $E(x) = 1$
ii. $E(x) = x$
iii. $E(x) = x^2 + x + 1$
iv. $E(x) = x^3 + x^2 + x + 1$

(4 marks)

(d) Indicate the hamming distance for each of the errors mentioned in 4 (c)

(5 marks)

(e) Design/Draw a shift register circuit to calculate the CRC and show the calculation steps in a table.

(5 Marks)

(f) During the transmission an error inverts the 8th bit of the codeword C(x). Is the error detectable? Correctable? Or both? Explain your answer.

(5 marks)

(g) During the transmission an error inverts the $7^{th}$ bit of the codeword C(x) found above. Is the error detectable? correctable? Or both? Explain your answer.
*(Assume hamming code is used)*

(3 marks)

**END OF EXAMINATION**