

UNIVERSITY OF VICTORIA

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 363

Communication Networks

Spring 2026

MIDTERM TEST

INSTRUCTIONS:

Answer all questions in the space provided on the test paper.

If necessary, continue on the back of the page.

Written material and a calculator are allowed. There are 20 marks total.

State any assumptions that may be necessary.

Please write clearly.

NAME: _____

STUDENT NUMBER: _____

Question	1	2	3	4	5	Total
Earned Marks						

Question 1 [4 marks total]

Consider a communication link with data rate $R = 200$ Mbps connecting two hosts A and B. The link length is $d = 10$ kms. The propagation speed is assumed to be $v = 2 \times 10^8$ meters/sec.

- (a) [2 marks] What is the propagation delay t_{prop} of the communication link?
- (b) [2 marks] What is the transmission time t_{trans} of a packet of 1000 bytes ($L = 8000$ bits) over the link?

$$(a) \quad t_{prop} = d/v = \frac{10 \times 10^3}{2 \times 10^8} = 50 \mu\text{sec}$$

$$(b) \quad t_{trans} = L/R = \frac{8000}{200 \times 10^6} = 40 \mu\text{sec}$$

Question 2 [4 marks total]

Consider a 100 Mbps link and 2 users accessing this link using statistical multiplexing. Each user accesses the link 50% of the time with a data rate of 100 Mbps.

- (a) [2 marks] What is the probability that both users will access the channel at the same time?
(b) [2 marks] Determine the statistical multiplexing gain.

(a) the probability that both users access the channel at the same time is $(.5)^2 = .25$

(b) the statistical multiplexing gain is 2

Question 3 [4 marks total]

Consider a system with a link bandwidth of 10 kHz.

- (a) [2 marks] If 64-QAM modulation is employed, what is the maximum achievable data rate assuming a noiseless channel?
- (b) [2 marks] If the link signal-to-noise ratio (SNR) is 20 dB, what is the maximum achievable data rate?

$$\begin{aligned} (a) \quad R &= 2B \log_2 V \\ &= 2 \times 10^4 \times \log_2 64 \\ &= 120 \text{ kbps} \end{aligned}$$

$$\begin{aligned} (b) \quad C &= B \log_2 (1 + S/N) \\ &= 10^4 \log_2 (101) \\ &= 66.6 \text{ kbps} \end{aligned}$$

Question 4 [4 marks]

The bit string 101100 is to be transmitted using a CRC trailer. Using generator polynomial $G(x) = x^2 + x + 1$, determine the transmitted bit string.

append 2 0s 10110000

divide by $G(x)$

$$\begin{array}{r} 111101 \\ 111 \overline{) 10110000} \\ \underline{111} \\ 10100000 \\ \underline{111} \\ 1000000 \\ \underline{111} \\ 11000 \\ \underline{111} \\ 100 \\ \underline{111} \\ 11 \end{array}$$

the transmitted bit string is

10110011

Question 5 [4 marks]

A channel has a rate of $R = 10$ kbps and a propagation delay of $t_{prop} = 50$ msec. For what frame size does the stop-and-wait protocol give an efficiency of 80%?

$$\text{efficiency} = \frac{t_{trans}}{t_r + t_{trans}} \quad t_{trans} = \frac{L}{R}$$

$$t_r = 2 \times t_{prop} = 100 \text{ msec}$$

$$.80 = \frac{t_{trans}}{100 + t_{trans}}$$

$$80 + .80 t_{trans} = t_{trans}$$

$$t_{trans} = 400 \text{ msec}$$

$$L = R \times t_{trans} = 10 \times 400 = 4000 \text{ bits}$$