COMP 3725: Assignment #3

General Instruction

- To receive any credit, the answers for this assignment must be **handwritten** and need to be legible by the grader.
- When you solve a problem, show all the steps and add comments as necessary to make sure your answers are clear and unambiguous to the grader.
- You may discuss questions in broad terms with others but ultimately your answers should demonstrate your own individual thought process and effort.
- All work submitted is subject to the standards of conduct as specified in BCIT Policy 5104.

Submission

- This assignment is due on **June 25, 2019** by **1730** at the latest. No late assignments will be accepted.
- Submit your completed assignment to your lab instructor's assignment box in the SW2/SW3 connector.
- Your submissions must include a **cover page** clearly specifying your **name**, **student number** and **set**.

Marking

- This assignment consists of **5 questions** totaling **40 marks**.

Problems

(1) [12 marks] Consider a switched network between two end systems. Assume that no acknowledgements are sent and that the processing/queuing delay at the nodes are negligible. Draw the delay diagrams (space/time model) and compute the total end-to-end delays using N = 3, L = 1500, R = 25600, P = 512, H = 64, S = 1.5, D = 0.01 and T = 1 where

N = number of links between end systems
L = message length (i.e., data only) [bits]
R = data rate for each link [bps]
P = fixed packet size (i.e., packet header + data) [bits]
H = packet header [bits]
S = call setup time [sec]
D = propagation delay for each link [sec]
T = call teardown time [sec]

for the following networks. If there are multiple packets to be transmitted, clearly depict all packets in the delay diagram(s).

a) [4 marks] Circuit switching
b) [4 marks] Packet switching
c) [4 marks] Virtual-circuit switching

(2) [7 marks] Consider a generator polynomial, $g(x) = x^4 + x^2 + 1 = 10101_2$, and a 12-bit dataword with the value of 001101011110_2.

a) [3 marks] Create the CRC codeword using modulo-2 binary division.
b) [4 marks] During propagation, the two most significant bits (MSB) and the two least significant bits (LSBs) of the codeword generated in (a) are corrupted by noise. Determine whether or not the error is detected at the receiver. Substantiate your answer.

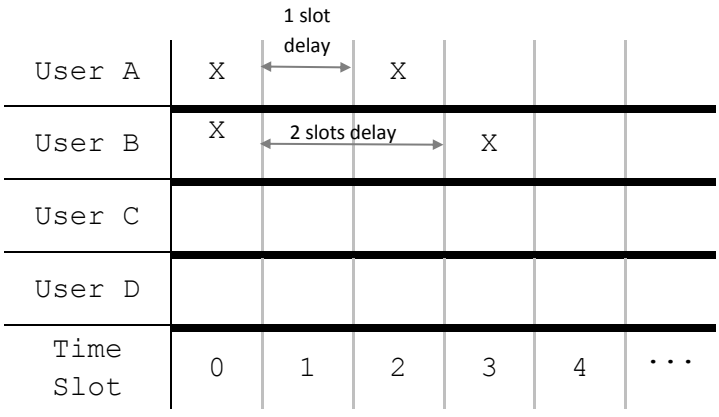
(3) [8 marks] Consider a system that uses the Stop-and-Wait protocol to send data over a 5 km coaxial cable with a data rate of 10 Mbps. The data and acknowledgement frames have sizes of 1024 bits and 256 bits, respectively. Assume no frames are lost in transmission and that the processing time is negligible. Determine the number of data frames that can be successfully transmitted every millisecond if the propagation speed through the medium is 2.3×10^8 m/s. Draw the flow diagram depicting the transmission of the data and acknowledgement frames for time t = [0, 1] ms.

(4) [6 marks] Given the following message: **$2014C0FE0114A907_{16}$**, to be transmitted at the sender.

a) [3 marks] Calculate the 16-bit Internet checksum.
b) [3 marks] Suppose, after transmission, **$2012C0FE0114A90754D9_{16}$** is received at the receiver. Determine whether or not the error is detected at the receiver. Substantiate your answer.

(5) [7 marks] Consider a 802.11 system with 4 users, A, B, C and D using a medium access control method with predefined backoff times to avoid collision. User A uses the predefined backoff time (1, 2, 3, 4), i.e., when user A encounters a collision, it will delay 1 slot before its first retry; delay 2 slots before its second retry; delay 3 slots before its third retry; and so on. The backoff times for users B, C and D are defined as (2, 3, 2, 1), (3, 1, 2, 4) and (1, 1, 2, 3), respectively. Assume users A and B both have a packet ready for transmission at timeslot = 0 and users C and D each has a packet ready for transmission at timeslot = 2 and timeslot = 3, respectively.

Using the template provided below, depict the timing diagram of this system until all 4 users successfully transmit their packets. For each user, indicate the timeslot at which it will attempt to transmit by marking with a 'X' if the transmission will result in a collision and marking with a 'O' if the transmission will be successful. The first and second attempts by users A and B are depicted below.



Summarize the results in a table by indicating the timeslot at which each user successfully transmits its packet.