COSC2737 IT Infrastructure and Security
Assignment 1 (20%)

Question 1 (5 marks)

The modulo operation finds the remainder. If dividing *a* by *b*, and there was a remainder of *n*, then the formula can be expressed as: *a* **mod** *b* = *n*.

- Describe the 7-digit of your student ID using an array ***S***(*i*), while *i* =0, 1, 2, …, 6.
- Run **mod** 2 operation to get the reminder corresponding to each digit of ***S***(*i*).
- Represent the 7-bit output as ***D*** =

D_6	D_5	D_4	D_3	D_2	D_1	D_0

1. Give the corresponding decimal number of ***D*** and explain the effect of D_6 (leftmost bit) and D_0 (rightmost bit) while converting the binary ***D*** into a decimal number. (2 marks)

2. Draw a flowchart to show the conversion from ***S***(*i*) to ***D*** = [D_6, D_5, D_4, D_3, D_2, D_1, D_0]. (3 marks)

Question 2 (5 marks)

1. Create the even parity Hamming Code based on ***D*** = [D_6, …, D_0]. Show the detailed calculation about how you get the parity bits $\boldsymbol{r}_8$, $\boldsymbol{r}_4$, $\boldsymbol{r}_2$, and $\boldsymbol{r}_1$, then fill in following Table. (2 marks)

D_6	D_5	D_4	$\boldsymbol{r}_8$	D_3	D_2	D_1	$\boldsymbol{r}_4$	D_0	$\boldsymbol{r}_2$	$\boldsymbol{r}_1$

2. Suppose at the receiving end, there is an error in position 11: D_6 (the opposite binary, e.g., D_6 is “0” in the Table, then the received bit D_6 is “1” in error). Other bits are correct. What is the codeword received at the receiving end? (1 mark)

3. Based on Hamming simulator, write a user manual (maximum 6-step) on how to identify the error in position 11. (May reference to the last file in Readings/week 3/Canvas for writing a user manual). (2 marks)

Question 3 (10 marks)

Video conferencing provides service for capturing audio/video and transferring digital packets over the Internet. Figure 1 shows 5 identical networked PCs, each has 99.9% availability. A_5 is used as a load-balancer to distribute the incoming video conferencing traffic across backend servers A_1 -- A_4 for further processing. Answer the following questions with maximum 600 words.

1. How the quantization error level affects the quality of digital audio/video, e.g., fidelity of transmitted video streams. Provide a step-by-step explanation to compare the quality using 3 bit-depth and 8 bit-depth per sampling. (4 marks)

2. Provide a strategy for improving the availability of the system. What would be the potential consequence of your strategy. Provide a step-by-step explanation and detailed calculation to support your argument. (4 marks)

3. While both Windows and macOS can be used for applications such as video conferencing, list 3-4 points to show how they are different (2 marks)

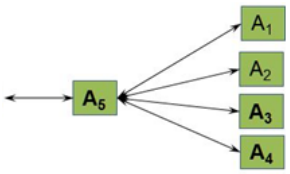

Figure 1 Web server set-up for distributing incoming packets.