# COEN 311 Section W (Computer Organization and Software)
# Assignment 5
Due Monday April 13, 2022

**Submission instructions:**

- You have to demonstrate your work for each question
- Only one **pdf** file is acceptable. Include the statement that you are submitting your original work.
- Submit through Moodle.
- Emails are not accepted. In case you face technical issue with Moodle, you mustsend a screenshot of the issue and email your assignment **before** the deadline.

**Problem 1)** **(20 points)**

Write an x86 assembly subroutine `mult` that implements unsigned multiplication of two 8 bit numbers (`n1`, `n2`) stored in memory and produces a product (`prod`) of 16 bits. The multiplication is implemented by repeated addition and not using the *mul* instruction.

**Problem 2)** **(45 points)**

a) Write an x86 subroutine `mean` to calculate the mean M of a given list of N 16 bit numbers. Parameters are passed using the stack. (15 points)
b) Write an x86 subroutine `variance` to calculate the variance $\sigma^2$ of a given list of N 16 bit numbers. Parameters are passed using the stack. (15 points)
c) Write the main x86 program that calculates the variance of the given array of N 16-bit numbers by calling the subroutines `mean` and `variance`. (10 points)
d) Analyze the stack and its contents in the main program. (5 points)

**Problem 3)** **(10 points)**

At what addresses is the interrupt vector for type 80 stored in the memory?

**Problem 4)** **(25 points)**

Modify the example program given in the lecture to print all 256 ASCII characters using INT 21 interrupt on the screen. Hint: you must find the code for the first ASCII character and increment the code in a loop.