# CSE330: Numerical Methods
## Assignment 06
## Total Marks: 25

**1.** Consider a set of four data points: $f(0) = 3, f(4) = -2, f(-1) = 2, f(1) = 1$. In the following, you are asked to find the **best fit polynomial of degree 2** by using the **Discrete square/Least square approximation** method as follows:

a. (2 marks) From the given data, write down the matrices A, b and x.
b. (3 marks) Evaluate $A^{T}A$ and $\det(A^{T}A)$.
c. (2 marks) Compute the best-fit polynomial of degree 2.

**2.** Consider the coordinates: **(x, f(x)) = (0, 1),(0.5, 1.4),(1, 1.7),(1.5, 2)**. In the following, you are asked to construct the **best-fit linear polynomial** by using the **QR-decomposition** method as follows:

a. (2 marks) Construct the matrices A, b and x.
b. (3 marks) Evaluate the orthonormal vectors q1 and q2, and construct the matrix Q.
c. (2 marks) Compute the matrix R.
d. (3 marks) Using Q and R, evaluate the matrix x, and hence compute the best-fit linear polynomial.

**3.** A function is given by $f(x) = e^{0.5x} + \sin x$ which is to be integrated on the interval [0, 2].

a. (2 marks) Evaluate the **exact integral I(f)**.
b. (2 marks) Compute the numerical integral by using the **Newton-Cotes formula with n = 2**.
c. (4 marks) Evaluate the numerical integral $C_{1,4}$ by using the **Composite Newton-Cotes** formula and also find the percentage relative error.