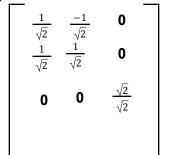
## CSE 330: Spring 2024 Assignment-6 [CO4]

**Total Marks: 20** 

1. (5 marks) Verify that the matrix below for a linear system consists of **orthonormal vectors**.



- 2. 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.
- 3. 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.
- 4. 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.