Assignment # 9 (Optional)

Consider a set of four data points: $f(-4) = -3$, $f(-2) = -2$, $f(2) = 2$ and $f(4) = 3$. In the following, these data points are to be used to find the best fit polynomial of degree 2 by using Least-Squares method and also by QR-decomposition method.

Problem # 1: Find the best fit polynomial, $p_2(x)$ of the above data points by least=-squares method by answering the following:

1. [2 marks] Write down the matrices: A and b from the given data above.
2. [4 marks] Compute the normal matrix A^TA and A^Tb.
3. [4 marks] Use the results in the previous part to compute the column matrix $x = (a_0\ a_1\ a_2)^T$, where a_0, a_1 and a_2 are the coefficients of the polynomials p_2, and then write the expression of the polynomial p_2.

Problem # 2: We now find the solution by QR-decomposition method using the same four data points given at the top by answering the following:

1. I[1.5 marks] dentify the matrix A and b (Just copy from the previous problem). Now identify the linearly independent column vectors u_1, u_2 and $u_3$from the matrix A.
2. [4.5 marks] Using Gram-Schmidt process construct the orthonormal column matrices (or

vectors) q_1, q_2 and q_3 from the linearly independent column vectors obtained in the previous part, and then write down the Q matrix.

3. [2 marks] Now calculate the matrix elements of R, and write down the matrix R.
4. [1 mark] Compute Rx and $Q^T b$, where $x = (a_0\ a_1\ a_2)$ which are the coefficients of the polynomial p_2.
5. [1 mark] Using the above result, find the values of (a_0, a_1 and a_2), and write the polynomial p_2.

Submission of the Assignment # 8:

- Solve all problems above.
- Prepare a title page including

Your Name, Your ID#, Theory Section #.

- Prepare a single .pdf or .jpg file containing the title page and the solution pages.
- To submit your assignment solution, visit the Submission Link (**Click here**). This will take you to a Google Form link.
- Fill up the Google Form link with correct information and upload the file there. You are done.

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