Homework3

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1. Find the projection of the vector **v** onto the subspace S.
   S=span{[0 0 -1 1]^T, [0 1 1 1]^T}
   v=[1 0 1 1]^T

2. Find the least squares solution of the system **Ax**=**b**.
   $\mathbf{A}_{3x2}$=[2 1;1 2;1 1], **b**=[2 0 -3]^T
   $\mathbf{B}_{4x3}$==[1 0 1;1 1 1;0 1 1;1 1 0], **b**=[4 -1 0 1]^T

3. Find the least squares regression line (y=ax+b) for the data points:
   (-1, 1), (1, 0), (3 -3)

4. Find the least squares regression quadratic polynomial (y=ax^2+x+c) for the data points:
   (-2, 0), (-1, 0), (0, 1), (1, 2), (2, 5)

5. Find a unit vector orthogonal to both **u**=[1 -4 1]^T and **v**=[2 3 0]^T.

6. Find the area of a parallelogram that has **u**=[-3 4 1]^T and **v**=[0 -2 6]^T as adjacent sides.

7. Apply the Gram Schmidt process to B={[0 3 4]^T, [1 0 0]^T, [1 1 0]^T} (according to this order).

8. $\mathbf{C}_{3x3}$=**QR** using the Gram Schmidt process.
   C's 1st column is [0 0 1]^T, 2nd column is [0 1 1]^T, 3rd column is [1 1 1]^T.

9. Find the determinant of
   $\mathbf{D}_{5x5}$=[2 0 1 3 -2;-2 1 3 2 -1;1 0 -1 2 3;3 -1 2 4 -3;1 1 3 2 0]

10. Find an equation of the plane passing through (0, 1, 0), (-1, 3, 2), (-2 0 1).

11. Find the determinant of $\mathbf{E}_{nxn}$ (The values on the diagonal are (1-n) and others are 1).

$$\begin{bmatrix} 1-n & 1 & 1 & \dots & 1 \\ 1 & 1-n & 1 & \dots & 1 \\ 1 & 1 & 1-n & \dots & 1 \\ . & . & . & \dots & . \\ . & . & . & \dots & . \\ 1 & 1 & 1 & \dots & 1-n \end{bmatrix}$$

12. Use the Cramer's rule to solve x, y and z.
    2x+3y+ 3z= 3
    6x+6y+12z=13
    12x+9y- z= 2

13. Let Dn be the determinant of the 1, 1, -1 tridiagonal matrix (nxn), that is

$$D_n=\det\begin{bmatrix} 1 & -1 & & & & \\ 1 & 1 & -1 & & & \\ & 1 & 1 & -1 & & \\ & & & \cdots & & \\ & & & 1 & 1 & -1 \\ & & & & 1 & 1 \end{bmatrix}$$

Calculate D^{15}.