Rough

2) $A = \begin{bmatrix} 1 & 1 \\ -1 & \cdot \\ \vdots & \cdot \\ -1 & \cdot \\ -1 & \cdot \\ \vdots & \vdots \\ 1 & n \end{bmatrix}$ $b = \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix}$

projected vector $p = A(A^TA)^{-1}A^Tb$

$A^TA = \begin{bmatrix} \overbrace{1+1+\cdots 1}^{n \text{ times}} & 1-2+3\cdots-\frac{n}{2}-\frac{n+1}{2}+\cdots+n \\ 1-2-\frac{n}{2}-\frac{n+1}{2}\cdots+n & 1^2+2^2+\cdots n^2 \end{bmatrix}$

$= \begin{bmatrix} n & x \\ x & \frac{n(n+1)(2n+1)}{6} \end{bmatrix}, \quad x =$

3) $\begin{bmatrix} 1 & \frac{1}{\sqrt{6}} & \frac{1}{6} \\ \sqrt{6} & 1 & \frac{1}{\sqrt{6}} \\ 6 & \sqrt{6} & 1 \end{bmatrix}$ $\quad \det(A - \lambda I) = 0$

$$\Rightarrow \det\left(\begin{bmatrix} 1-\lambda & \frac{1}{\sqrt{6}} & \frac{1}{6} \\ \sqrt{6} & 1-\lambda & \frac{1}{\sqrt{6}} \\ 6 & \sqrt{6} & 1-\lambda \end{bmatrix}\right) = 0$$

$$\Rightarrow (1-\lambda)\left(\cancel{\lambda} + \lambda^2 - 2\lambda - 1\right) - \frac{1}{\sqrt{6}}\left(\sqrt{6} - \sqrt{6}\lambda - 1\right) + \frac{1}{6}\left(6 - \cancel{6} + 6\lambda\right) = 0$$

$$\Rightarrow \lambda^2 - \cancel{2\lambda} - \lambda^3 + 2\lambda^2 - 1 + \cancel{\lambda} + \frac{1}{\sqrt{6}} + \cancel{\lambda} = 0$$

$$\Rightarrow \lambda^3 - 3\lambda^2 + 1 - \frac{1}{\sqrt{6}} = 0$$

5) we subtract (-0.16).

So the first row becomes $[0.14-(-0.16) \quad 0 \quad 0 \quad 0.86 \quad 0]$

$= [0.30 \quad 0 \quad 0 \quad 0.86 \quad 0]$

4^{th} row becomes $[0.30 \quad 0 \quad 0 \quad 0.7-(-0.16) \quad 0]$

$= [0.30 \quad 0 \quad 0 \quad 0.86 \quad 0]$

Hence row 1 = row 4 and so determinant = 0.

7) $x^T S x \geq 0 \Rightarrow$ positive def matrix

$\therefore$ cant have -ve eigen values.

$\therefore$ $-3, -2$ CANT be eigen values.

1-

(

F

10) # ways E & F not adjacent = # total − # E & F are adjacent

$= \cancel{8!} \; 8! - (6+1)! \times 2$

$= 8! - 2 \times 7! = 8! - \frac{1}{4} \times 8! = \frac{3}{4} \times 8!$

$= \frac{3}{4} \times 40320 = 30240$