

Swetha D S

Department of Science and Humanities



Unit-4

Orthogonalization, Eigen Values and Eigen Vectors



CLASS-3

THE GRAM-SCHMIDT ORTHOGONALIZATION

PES UNIVERSITY ONLINE

The Gram-Schmidt process:

- It is a process of converting linearly independent vectors into orthonormal vectors.
- Consider any 3 independent vectors a, b, c.
 Then the first orthonormal q₁= a/norm(a).
- If 'b' is perpendicular to the vector 'a' then $q_2=b/norm(b)$ otherwise $B=b-(q_1^Tb)q_1$ and $q_2=B/norm(B)$.

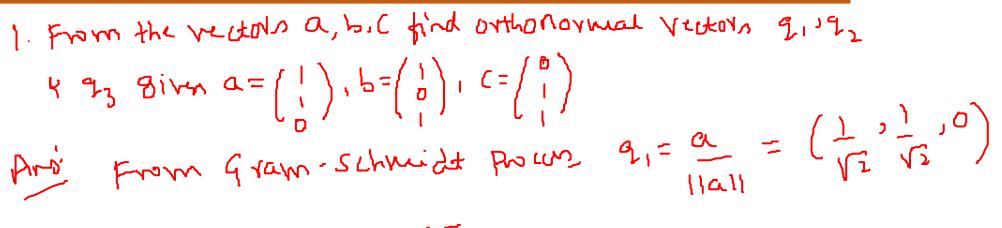
The Gram-Schmidt process (Continued.....)

• If 'c' is perpendicular to the plane spanned by the vectors a and b then $q_3=c/norm(c)$ otherwise $C=c-(q_1^Tc)q_1-(q_2^Tc)q_2$ and $q_3=C/norm(C)$.

This is the one idea of the whole Gram-Schmidt process, to subtract from every new vector its components in the directions that are already settled. That idea is used over and over again. When there is a fourth vector, we subtract away its components in the directions of q_1 , q_2 , q_3 .



Problems:



$$a_{2} = \frac{c_{2}}{|1k_{2}|!}$$
 howhwe $c_{2} = b - (2\sqrt{b})2\sqrt{b}$

$$= \left[\frac{1}{2} - \left[\frac{1}{2} \sqrt{b} \right] \left(\frac{1}{2} \sqrt{b} \right) \right] \left(\frac{1}{2} \sqrt{b} \right)$$

$$= \left(\frac{1}{2} \sqrt{b} \right)$$

$$= \left(\frac{1}{2} \sqrt{b} \right)$$

$$a_{2} = \left(\frac{1}{2} \sqrt{b} \right) - \left(\frac{1}{2} \sqrt{b} \right)$$

$$a_{3} = \left(\frac{1}{2} \sqrt{b} \right) - \left(\frac{1}{2} \sqrt{b} \right) \left(\frac{1}{2} \sqrt{b} \right)$$

$$a_{4} = \left(\frac{1}{2} \sqrt{b} \right) - \left(\frac{1}{2} \sqrt{b} \right) \left(\frac{1}{2} \sqrt{b} \right)$$

$$a_{5} = \left(\frac{1}{2} \sqrt{b} \right) - \left(\frac{1}{2} \sqrt{b} \right) \left(\frac{1}{2} \sqrt{b} \right)$$

$$a_{7} = \left(\frac{1}{2} \sqrt{b} \right) - \left(\frac{1}{2} \sqrt{b} \right) \left(\frac{1}{2} \sqrt{b} \right)$$

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$$a_{7} = \left(\frac{1}{2} \sqrt{b} \right) - \left(\frac{1}{2} \sqrt{b} \right) + \left(\frac{1}{2} \sqrt{b} \right)$$

$$a_{7} = \left(\frac{1}{2} \sqrt{b} \right) - \left(\frac{1}{2} \sqrt{b} \right) + \left(\frac{1}{2} \sqrt{b} \right) + \left(\frac{1}{2} \sqrt{b} \right)$$

$$a_{7} = \left(\frac{1}{2} \sqrt{b} \right) - \left(\frac{1}{2} \sqrt{b} \right) + \left(\frac$$

$$q_{3} = \frac{e_{3}}{|1e_{3}|}, q_{5} = c - (q_{1}^{T} c)q_{1} - (q_{2}^{T} c)q_{2}$$

$$q_{5} = \left(-\frac{2}{3}\right), |1e_{3}|| = \frac{2\sqrt{3}}{3}$$

$$\frac{2}{3}$$

$$\frac{2}{3}$$





THANK YOU

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