Symetric Matrix ===================

(% i1) A:matrix([1,1,-1],[1,1,1],[-1,1,1]);

$$\begin{pmatrix} 1 & 1 & -1 \\ 1 & 1 & 1 \\ -1 & 1 & 1 \end{pmatrix} \tag{\% o1}$$

characteristic polynomial

(% i2) charpoly(A,x);

$$2x + \left((1-x)^2 - 1\right)(1-x) - 4 \tag{\% o2}$$

(% i3) expand(2*x+((1-x)^2-1)*(1-x)-4);

$$-x^3 + 3x^2 - 4 \tag{\% o3}$$

(% i4) factor(-x^3+3*x^2-4);

$$-(x-2)^2\,(x+1) \tag{\% o4}$$

(% i5) eigenvalues(A);

$$[[-1\,,2]\,,[1\,,2]] \tag{\% o5}$$

(% i6) eigenvectors(A);

$$[[[-1\,,2]\,,[1\,,2]]\,,[[[1\,,-1\,,1]]\,,[[1\,,0\,,-1]\,,[0\,,1\,,1]]]] \tag{\% o6}$$

orthogonal between the line $[1,-1,1]$ and the plane spanded by $[1,0,-1]$ and $[0,1,1]$

(% i7) [1,-1,1].[1,0,-1];

$$0 \tag{\% o7}$$

(% i8) [1,-1,1].[0,1,1];

$$0 \tag{\% o8}$$

(% i9) c_1 = 1; c_2 = 2;

$$c_1 = 1, c_2 = 2 \tag{\% o9}$$

(% i10) 1*[1,0,-1]+2*[0,1,1];

$$[1, 2, 1] \tag{\% o10}$$

(% i11) [1,-1,1].[1,2,1];

$$0 \tag{\% o11}$$

(% i12) P:matrix([1,1,1],[-1,0,2],[1,-1,1]);

$$\begin{pmatrix} 1 & 1 & 1 \\ -1 & 0 & 2 \\ 1 & -1 & 1 \end{pmatrix} \tag{\% o12}$$

normalization of P to PN

(% i13) PN:matrix([1/sqrt(3),1/sqrt(2),1/sqrt(6)],[-1/sqrt(3),0,2/sqrt(6)],[1/sqrt(3),-1/sqrt(2),1/sqrt(6)]);

$$\begin{pmatrix} \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{6}} \\ -\frac{1}{\sqrt{3}} & 0 & \frac{2}{\sqrt{6}} \\ \frac{1}{\sqrt{3}} & -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{6}} \end{pmatrix} \tag{\% o13}$$

(% i14) transpose(PN).A.PN;

$$\begin{pmatrix} -1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{pmatrix} \tag{\% o14}$$