

Step-1

Suppose a matrix is an orthonormal matrix, such that each entry in the matrix is either $\frac{1}{4}$ or $-\frac{1}{4}$. Consider any column of such a matrix. It is going to be $\left(\pm\frac{1}{4}, \pm\frac{1}{4}, \dots, \pm\frac{1}{4}\right)^T$.

Therefore, the length of this vector is $\sqrt{\frac{1}{16} + \frac{1}{16} + \dots + \frac{1}{16}}$.

Since this length has to be 1, it is clear that the vector has 16 components.

Step-2

Therefore, the orthonormal matrix should be of the size: 16×16 .

One such example of an orthonormal matrix is as given below: Let $a_{i,j}$ denote the entry in the i^{th} row and j^{th} column of the matrix.

$$a_{i,j} = \begin{cases} \frac{1}{4} & \text{if } i \neq j \\ -\frac{1}{4} & \text{if } i = j \end{cases}$$

Then,