For the centrosymmetric and orthorhombic space group $Pbnm$ ($D_{2h}^{16}$) one finds eight different one-dimensional representations for a magnetic structure associated with the wave vector $k = 0$.

Assume four spins $S_j$ ($j = 1 - 4$) at the four equivalent centres of symmetry (0 0 0), (0 0 1/2), (1/2 1/2 1/2) and (1/2 1/2 0). The $3 \cdot 4 = 12$ dimensional vector space can be decomposed using the irreducible representations $\Gamma_j$ ($j = 1 - 4$):

$$\Gamma^{12D} = 3\Gamma_1 + 3\Gamma_2 + 3\Gamma_3 + 3\Gamma_4.$$

Applying a projection operation along the $x$ direction one obtains the following basis functions:

$$A_x = S_{1x} - S_{2x} - S_{3x} + S_{4x}$$
$$F_x = S_{1x} + S_{2x} + S_{3x} + S_{4x}$$
$$C_x = S_{1x} + S_{2x} - S_{3x} - S_{4x}$$
$$G_x = S_{1x} - S_{2x} + S_{3x} - S_{4x}$$

Find for each basis function the corresponding irreducible representation. Proceed as shown in the example during the lecture.