Whoops

d	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7
0	35.2488							
1	35.2533	1.64293						
2	35.2626	1.62429	-3.38356					
3	35.2601	1.62928	-3.38855	-0.912138				
4	35.2455	1.65863	-3.41790	-0.882795	5.38447			
5	35.2420	1.66561	-3.42488	-0.875809	5.37749	-1.28893		
6	35.2383	1.67306	-3.43233	-0.868366	5.37004	-1.28148	1.38079	
7	35.2373	1.67502	-3.43429	-0.866400	5.36808	-1.27952	1.37883	-0.366535
	⇑							

1. There is a problem
2. If we are using orthogonal functions, the amplitudes for each order α_k must be constant
3. That is, the numbers within each column are the same value
4. For example: a_0: there are 8 values for the mean!

Consequences: Product Matrix

$$\text{orthogonal: } \mathbf{A}^*\mathbf{A} = 180 \begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \tag{1.15}$$

$$\text{not orthogonal: } \mathbf{A}^*\mathbf{A} = \begin{bmatrix} 361 & -1 & 1 & -1 & 1 & -1 & 1 & -1 \\ -1 & 181 & -1 & 1 & -1 & 1 & -1 & 1 \\ 1 & -1 & 181 & -1 & 1 & -1 & 1 & -1 \\ -1 & 1 & -1 & 181 & -1 & 1 & -1 & 1 \\ 1 & -1 & 1 & -1 & 181 & -1 & 1 & -1 \\ -1 & 1 & -1 & 1 & -1 & 181 & -1 & 1 \\ 1 & -1 & 1 & -1 & 1 & -1 & 181 & -1 \\ -1 & 1 & -1 & 1 & -1 & 1 & -1 & 181 \end{bmatrix} \tag{1.16}$$

Moral of the Story

$$\mathbf{A}^*\mathbf{A} = \begin{bmatrix} 361 & -1 & 1 & -1 & 1 & -1 & 1 & -1 \\ -1 & 181 & -1 & 1 & -1 & 1 & -1 & 1 \\ 1 & -1 & 181 & -1 & 1 & -1 & 1 & -1 \\ -1 & 1 & -1 & 181 & -1 & 1 & -1 & 1 \\ 1 & -1 & 1 & -1 & 181 & -1 & 1 & -1 \\ -1 & 1 & -1 & 1 & -1 & 181 & -1 & 1 \\ 1 & -1 & 1 & -1 & 1 & -1 & 181 & -1 \\ -1 & 1 & -1 & 1 & -1 & 1 & -1 & 181 \end{bmatrix} \tag{1.16}$$

⚠ You don't invert this matrix by pretending it is diagonal