Tutorial 1 #5

Problem: Write the following set of equations using index notation

$$a_{111} + a_{122} + a_{133} + b_1 = r_1$$
$$a_{211} + a_{222} + a_{233} + b_2 = r_2$$
$$a_{311} + a_{322} + a_{333} + b_3 = r_3$$

Solution:

Recall that a **Free index** is one which appears *just once* in each term of the equation and a **Dummy index** is an index that appears twice in a term.

Also, according to the **Summation Convention**: Dummy indices are summed from 1 to 3, Name of dummy index is not important, and dummy index may not be in all terms.

With above in mind, We first try to identify free and dummy indices in each of the equations. The first equation can be written as

$$a_{1ii} + b_1 = r_1$$

where i is a dummy index. The other two equations can be written similarly:

$a_{2ii} + b_2 = r_2$ and $a_{3ii} + b_3 = r_3$

Identifying the remaining index as free, the three equations can be written as:

$$a_{jii} + b_j = r_j$$