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Combinatorics

Question number six has two parts to the answer that are added together to satisfy the restriction of each letter being used twice. The two parts are from two different cases. First would be if one letter is used four times and the others are used twice each. The second case would if two numbers are used three times each and the others are used twice.

First term of the addition is 4! \* (10!/(4!\*2!\*2!\*2!\*)). The first term of the expression is the 4!. This factorial explained the number of ways that you can choose which number: (a, b, c, d) gets used 4 times. This is the first step which is then multiplied by the quotient of (10!/(4!\*2!\*2!\*2!\*)). The top factorial, 10!, is the number of ways to arrange the ten letters without any restriction. Then using arrangements with repetition to avoid double counting. You divide 10! by the factorial of how many times each number is repeated. The 4! on the bottom represents the letter that is used four times, and the 2!'s represent the other three letters being used twice.

The second term of the addition is 6\*(10!/(3!\*3!\*2!\*2!\*)). The 6 represents the number of ways you can select which letter gets repeated twice. Then that term is multiplied by the arrangement with repetition. Similar to the first term the 10! on top is the arrangement of the letters without restriction. Then that is divided by the 3!'s which represent the two letters that are repeated three times, as well as the 2!'s which are the other two letters only repeated twice.

Adding those two terms creates a sum that satisfies two conditions that meet the restrictions standard.