# Ritangle Q1

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1 The Question

As the cog rotates, with the center cog always going clockwise, Ada adds together all 792 different 4-digit numbers she sees in the rectangle, starting with 1101 as shown. Her sum is S.

Will, on the other hand, multiplies the three numbers in the rectangle together. The sum of these 792 products is T.

What is the value of $\frac{S}{T}$ (to 4 s.f.)?
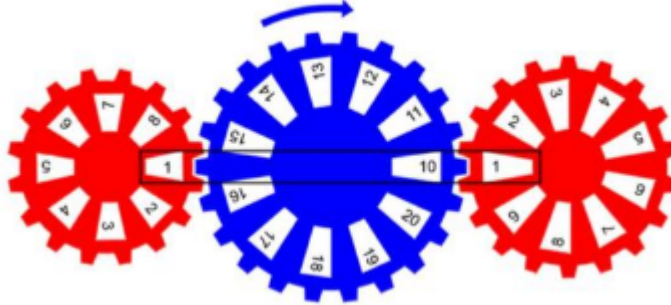
2 Finding S

Firstly, each combination of numbers will appear exactly once, as to get back to the same position the cogs will have to rotate a multiple of all 3 cogs possible positions, in this case it is $8 \times 11 \times 9 = 792$ and as that is the total number of rotations, each number combination will appear exactly once.

After confirming which combinations will appear, we can use the fact that addition is commutative to split up S in to 3 parts, one for each cog.

We know that that first cog will rotate $11 \times 9 = 99$ times and that each number will appear one after each other. We can also see that the value of this number must be multiplied by 1000 to give it the correct place value.

From this we get $(1000 \times (1 + 2 + 3 + 4 + 5 + 6 + 7 + 8)) \times 11 \times 9 = 3564000$

Repeating this for the other 2 cogs we get $(10 \times (10 + 11 + 12 + ... + 20)) \times 8 \times 9 = 118800$ and $(1 + 2 + 3 + ... + 9) \times 8 \times 11 = 3960$

The sum of these 3 numbers is the value of S

So $\therefore$ $S = 3564000 + 118800 + 3690 = 3686760$