Project Euler: Problem 1

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Problem (Multiples of 3 and 5)**.** If we list all the natural numbers below 10 that are mutliples of 3 or 5, we get 3, 5, 6, and 9. The sum of these multiples is 23. Find the sum of all multiples of 3 or 5 below 1000.

Solution. In this problem specifically we want to find the sum below 1000, but this can be generalized to some cap N. There are two ways that this problem can be approached. First a list can be made of all the natural numbers below N that follow the requirements where the sum of all the elements corresponds to the solution. The second approach is to find the values of k_1 and k_2 such that:

$$3k_1 = N$$
$$5k_2 = N$$

where the k's correspond to how high the multiples of 3 and 5 can go before they go above the cap N. Their integer solutions are modeled by:

$$k_1 = \left\lfloor \frac{N}{3} \right\rfloor$$
$$k_2 = \left\lfloor \frac{N}{5} \right\rfloor$$

So now instead of taking every natural number starting from 1 and onwards checking whether it fits the requirements, the numbers can be generated into the following list:

$$v = \left\{3, 6, 9, \ldots, 3k_1, 5, 10, 15, \ldots, 5k_2\right\}$$

where the generated list should not contain any repetitions of numbers that are divisible by both 3 and 5. So now the solution corresponds to:

$$V = \sum_i v_i$$