1. Determine the number of positive integers that divide 10^{30} or 20^{20}?

2. Determine the number of integers between 1 and 1000 that are divisible by 2, 3, or 5.

3. Determine the number of NE paths from T_1 to T_2 which do not go through the walls a, b, c.

4. i is a surplus of the permutation π if $\pi(i) > i$. Determine the number of permutations from S_n with a surplus $n-1$ or $n-2$.

5. Call two permutations of the $2n$-element set $S = \{a_1, \ldots, a_n, b_1, \ldots, b_n\}$ *equivalent* if one can be obtained from the other by interchanges of consecutive elements of the form $a_i b_i$ or $b_i a_i$. How many equivalence classes are there?

6. Let $H_n = \sum_{i=1}^{n} \frac{1}{i}$ be the n-th Harmonic number. Prove that the average number of cycles among permutations in S_n equals H_n.

7. Let $q(n)$ denote the number of partitions of n with ≥ 2 parts. Prove that $q(n) = p(n) - p(n-1)$.