

Permutations and the Enigma Machine

1. In the original Enigma machine, there were three scramblers that could be inserted in any order in the machine, yielding $3! = 6$ possible scrambler configurations. In 1938, German cryptographers added two additional scramblers to their Enigma machines, giving five scramblers for three slots. How many scrambler configurations does this yield?
2. The German Navy Enigma had not five, but eight scramblers. How many scrambler configurations did these machines have? What if these machines had four, not three, slot?
3. Enigma machine operators could use their plugboards to connect pairs of letters prior to scrambling. How many distinct pairs of letters (where order doesn't matter) are there in the English alphabet?
4. Leaving the Enigma machine for a moment, how many distinct triples of letters are there (if order doesn't matter)?
5. How many different groups of 4 can be made out of the 15 students in this class?
6. On page 136, Singh claims there are 100,391,791,500 possible plugboard settings for the Enigma Machine. Verify this number.