Answer on Question #83760 – Math – Discrete Mathematics

Question

How many 8-bits sequences that start with the same two bits or their fourth and fifth bits are equal or end with the same two bits are there?

Solution

The total number of 8-bit sequences is $2^8 = 256$.

Denote N_1 the number of sequences with the stated property. We have

$$N_1 = 256 - N_2$$

where N_2 is the number of 8-bit sequences with all different pairs: 1st and 2nd different bits, and 4th and 5th different bits, and 7th and 8th different bits.

Calculate N_2 .

There are 2 ways to choose the 1st bit, after that the 2nd bit is defined automatically – it is opposite to the 1st. There are 2 ways to choose the 3rd bit, 2 ways to choose the 4th bit – 5th is defined automatically, 2 ways to choose the 6th bit, 2 ways to choose the 7th bit – 8th is defined automatically.

So totally there are $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$ ways, $N_2 = 32$.

Then $N_1 = 256 - N_2 = 224$.

Answer: 224.