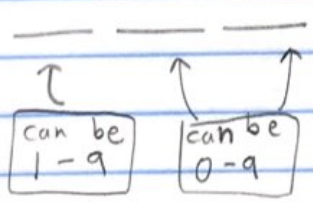
Ch. 9 cont.

Ex: How many whole numbers are there with exactly 3 digits?

* Same question as: How many PIN numbers are there with 3 digits, if the first digit cannot be zero?

Answer

Three decisions: fill in these blanks



; examples: ✓ 752
✓ 377
✓ 401
✗ 047

$\Rightarrow$ total $= 9 \cdot 10 \cdot 10 = \boxed{900}$

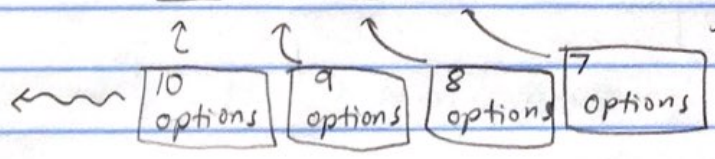
Another way: Total number of numbers with up to 3 digits minus number of numbers with 2 or less:

$= 1000 - 100 = \boxed{900}$

* These both count 0 as a whole number.

Ex: How many PIN numbers are there with 4 digits, this time the first can be zero, but no repeated digits are allowed?

Ans: $10 \cdot 9 \cdot 8 \cdot 7 = \boxed{5040}$



; examples ✓ 0521
✓ 5073
✗ 7717

Outline : - Multiplication principle
- pizza, ice cream
- $|A \times B|$
- Permutations

- Addition and subtraction principle
- $|A \cup B|$ with-and-without intersection
- Cases : no intersection.
- $|U| - |B|$
- $|A \cup B \cup C \cup D|$

- Division principle
- $\frac{|U|}{|B|}$
- Combinations
- Cyclic orders
- Binomial theorem.

Permutation : How many 5 digit PIN's with no repeated numbers? (0 is ok)

$\underline{10}\ \underline{9}\ \underline{8}\ \underline{7}\ \underline{6}$ $= 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6$

$= \boxed{30,240}$

This kind of problem shows up a lot, so we have short hand:

$${}_{10}P_5 = \underbrace{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6}_{\text{5 decreasing numbers, ending at } 10-5+1} = 30,240$$

"10 Permute 5"

Ex: ${}_{17}P_8 = 17 \cdot 16 \cdot 15 \cdot 14 \cdot 13 \cdot 12 \cdot 11 \cdot 10 = 980,179,200$