The elements of S_4 (which is the same as $\mathrm{Sym}(\{1,2,3,4\})$)

The number of permutations is $|S_4| = 4! = 24$.

List elements by **cycle type**.

type	#	permutations
$1,1,1,1$	1	id
$2,1,1$	6	$(1,2),\ (1,3),\ (1,4),$ $(2,3),\ (2,4),\ (3,4)$
$3,1$	8	$(1,2,3),\ (1,2,4),\ (1,3,4),\ (2,3,4)$ $(1,3,2),\ (1,4,2),\ (1,4,3),\ (2,4,3)$
4	6	$(1,2,3,4),\ (1,3,4,2),\ (1,4,2,3)$ $(4,3,2,1),\ (2,4,3,1),\ (3,2,4,1)$
$2,2$	3	$(1,2)(3,4),\ (1,3)(2,4),\ (1,4)(2,3)$

This must be right because they are all different permutations and $1+6+8+6+3=24$.

Where is $(2,4,1,3)$? Or $(3,4,1) = (3,4,1)(2)$?