Permutations - Part I

Preliminaries and Objectives

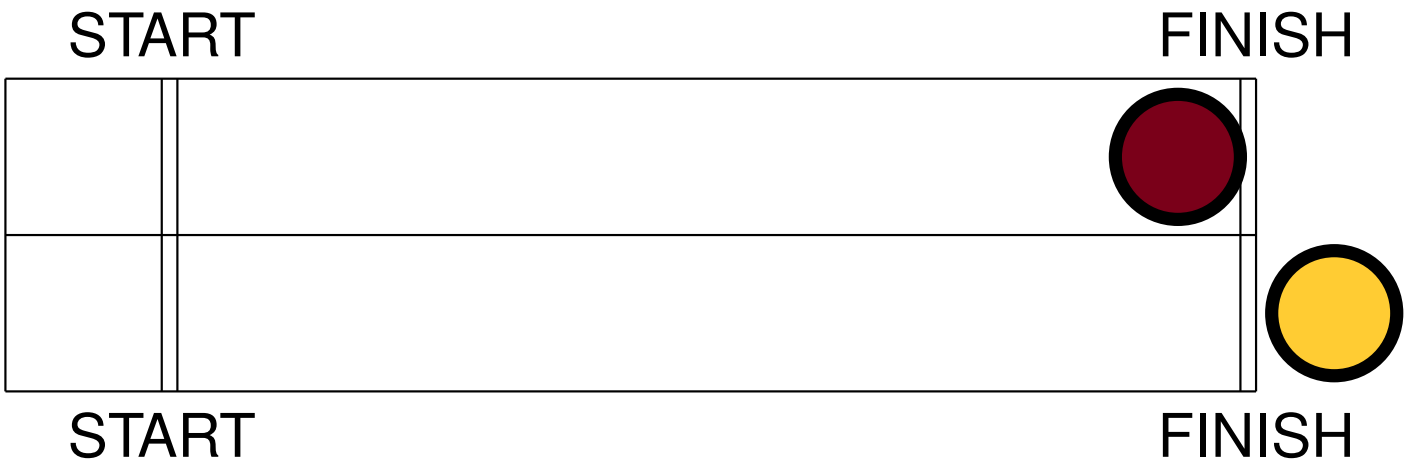
Preliminaries

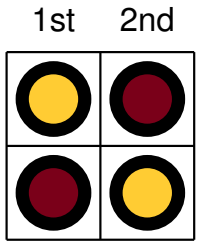
- Multiplication
- General Counting Principle
- Recursion

Objectives

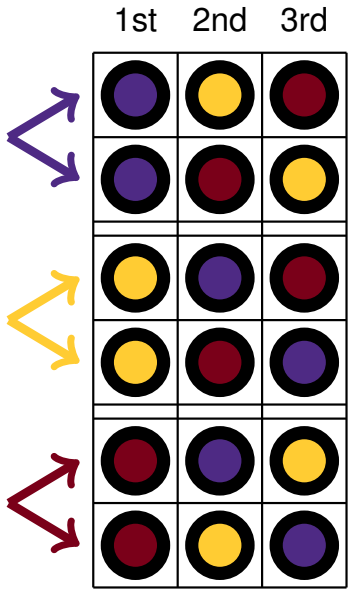
- Count the number of ways to put n objects in order.
- Factorial Notation

Two objects in order





Three objects in order



Seven objects in order

- Pick the winner in one of 7 ways, then arrange the remaining runners.
- Pick the next runner in one of 6 ways, then arrange the remaining runners.
- Pick the next runner in one of 5 ways, then arrange the remaining runners.
- Pick the next runner in one of 4 ways, then arrange the remaining runners.
- Pick the next runner in one of 3 ways, then arrange the remaining runners.
- Pick the next runner in one of 2 ways, then arrange the remaining runners.
- Pick the last runner in the only way possible.

$$7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 5040$$

Factorial Notation

$$7! = 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 5040$$

$$n! = n \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot 3 \cdot 2 \cdot 1$$

$$n! = n \cdot (n-1)!$$

Example

1)	brillig	A)	...
2)	frumious	B)	...
3)	manxome	C)	...
4)	mimsy	D)	...
5)	slithy	E)	...

Solution:

We need to put 5 letters in order, so the total number of ways to do this is $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$