

Permutations - Part I



Preliminaries and Objectives

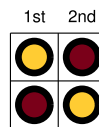
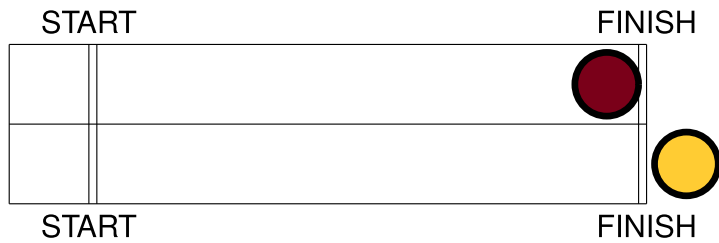
Preliminaries

- Multiplication
- General Counting Principle
- Recursion

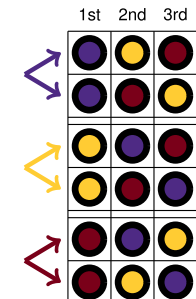
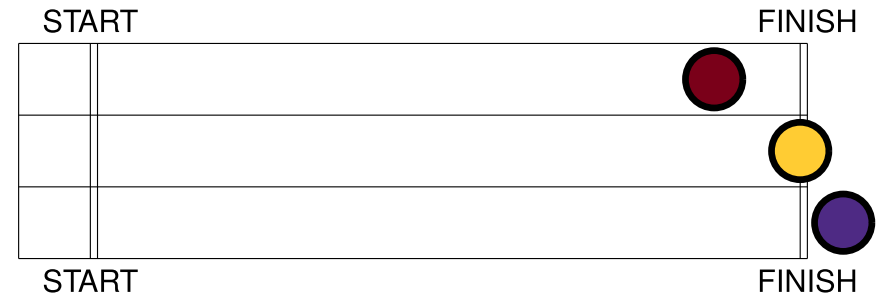
Objectives

- 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

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

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

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

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 $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$