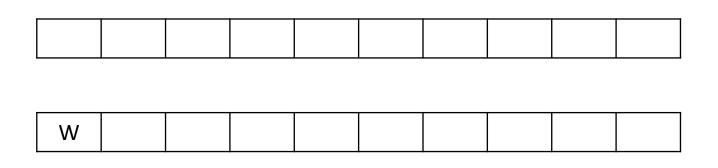


# CSCI262 – Computer Security

Suppose we have a number of letters:

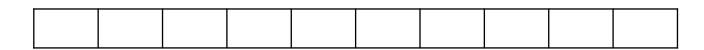
- 1 W,
- 3 Os,
- 2 Ls,
- 2 Ns, and
- 2 Gs.

How many ordered (different ways of) arrangements are there to arrange the letters?



$$\binom{10}{1}$$

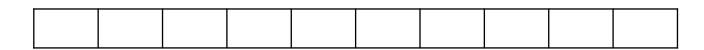
- All together we have 10 letters.
- To start with, we have 10 different possible position to place the letter 'W'.

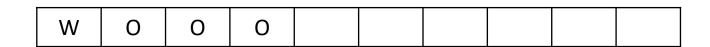




$$\binom{10}{1} \times \binom{9}{3}$$

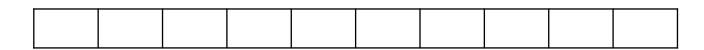
- We have 9 different possible position left to place the remaining 9 letters.
- Let's say we place the 3 letters 'O'.





$$\binom{10}{1} \times \binom{9}{3} \times \binom{6}{2}$$

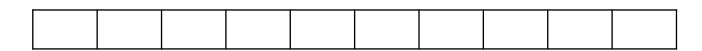
- We have 6 different possible position left to place the remaining 6 letters.
- Let's say we place the 2 letters 'L' next.

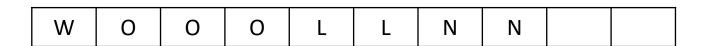




$$\binom{10}{1} \times \binom{9}{3} \times \binom{6}{2}$$

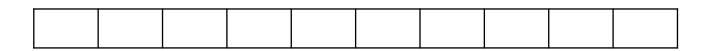
- We have 6 different possible position left to place the remaining 6 letters.
- Let's say we place the 2 letters 'L' next.





$$\binom{10}{1} \times \binom{9}{3} \times \binom{6}{2} \times \binom{4}{2}$$

- We have 4 different possible position left to place the remaining 4 letters.
- Let's say we place the 2 letters 'N' next.



۱۸/	$\cap$	$\cap$			l Ni	N	G	G
VV			_ L	<b>L</b>	1 1	1 1	U	U
					1			1

$$\binom{10}{1} \times \binom{9}{3} \times \binom{6}{2} \times \binom{4}{2} \times \binom{2}{2}$$

- We have 2 different possible position left to place the remaining last 2 letters.
- Let's say we place the remaining 2 letters 'G'.

W	0	0	0	L	L	N	N	G	G
---	---	---	---	---	---	---	---	---	---

 The total number of distinguishable permutation (arrangement) of the letters can be computed as

$$\frac{10!}{1! \times 9!} \times \frac{9!}{3! \times 6!} \times \frac{6!}{2! \times 4!} \times \frac{4!}{2! \times 2!} \times \frac{2!}{2! \times 0!}$$

W	0	0	0	L	L	Ν	Ν	G	G
---	---	---	---	---	---	---	---	---	---

 The total number of distinguishable permutation (arrangement) of the letters can be computed as

$$\frac{10!}{1! \times 9!} \times \frac{9!}{3! \times 6!} \times \frac{6!}{2! \times 4!} \times \frac{4!}{2! \times 2!} \times \frac{2!}{2! \times 0!}$$

W	0	0	0	L	L	N	N	G	G
---	---	---	---	---	---	---	---	---	---

$$\binom{10}{1} \times \binom{9}{3} \times \binom{6}{2} \times \binom{4}{2} \times \binom{2}{2}$$

$$\frac{10!}{1! \times 3! \times 2! \times 2! \times 2! \times 0!}$$

 The total number of distinguishable permutation (arrangement) of the letters can be computed as

$$\frac{10!}{1! \times 3! \times 2! \times 2! \times 2! \times 0!}$$

W	0	0	0	L	L	N	N	G	G	
---	---	---	---	---	---	---	---	---	---	--

$$\binom{10}{1} \times \binom{9}{3} \times \binom{6}{2} \times \binom{4}{2} \times \binom{2}{2}$$

$$\frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{(1) \times (3 \times 2) \times (2 \times 1) \times (2 \times 1) \times (2 \times 1) \times (1)}$$

• The total number of distinguishable permutation (arrangement) of the letters can be computed as  $10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$  $(1) \times (3 \times 2) \times (2 \times 1) \times (2 \times 1) \times (2 \times 1) \times (1)$ 

W	0	0	0	L	L	N	N	G	G	
---	---	---	---	---	---	---	---	---	---	--

$$\frac{\binom{10}{1} \times \binom{9}{3} \times \binom{6}{2} \times \binom{4}{2} \times \binom{2}{2}}{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}$$

$$\frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{(1) \times (6) \times (2) \times (2) \times (2) \times (1)}$$

 The total number of distinguishable permutation (arrangement) of the letters can be computed as

$$\frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{(1) \times (6) \times (2) \times (2) \times (2) \times (1)}$$

W	0	0	0	L	L	N	N	G	G
---	---	---	---	---	---	---	---	---	---

$$\frac{\binom{10}{1} \times \binom{9}{3} \times \binom{6}{2} \times \binom{4}{2} \times \binom{2}{2}}{1} \times \frac{\binom{10}{2} \times \binom{9}{2} \times \binom{10}{2} \binom{10}{2} \times \binom{10}{2} \times \binom{10}{2} \times \binom{10}{2} \times \binom{10}{2} \times \binom{10}{2$$

75,600

 The total number of distinguishable permutation (arrangement) of the letters can be computed as

$$\frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{(1) \times (6) \times (2) \times (2) \times (2) \times (1)}$$

75,600

 One of the possible arrangement (permutation) is WOLLONGONG.