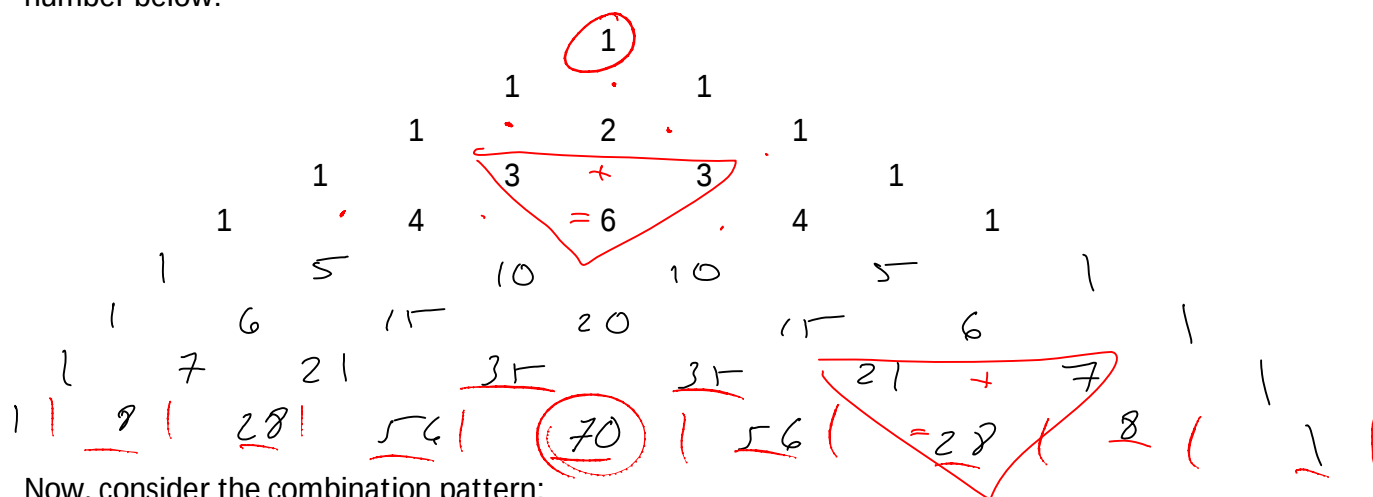


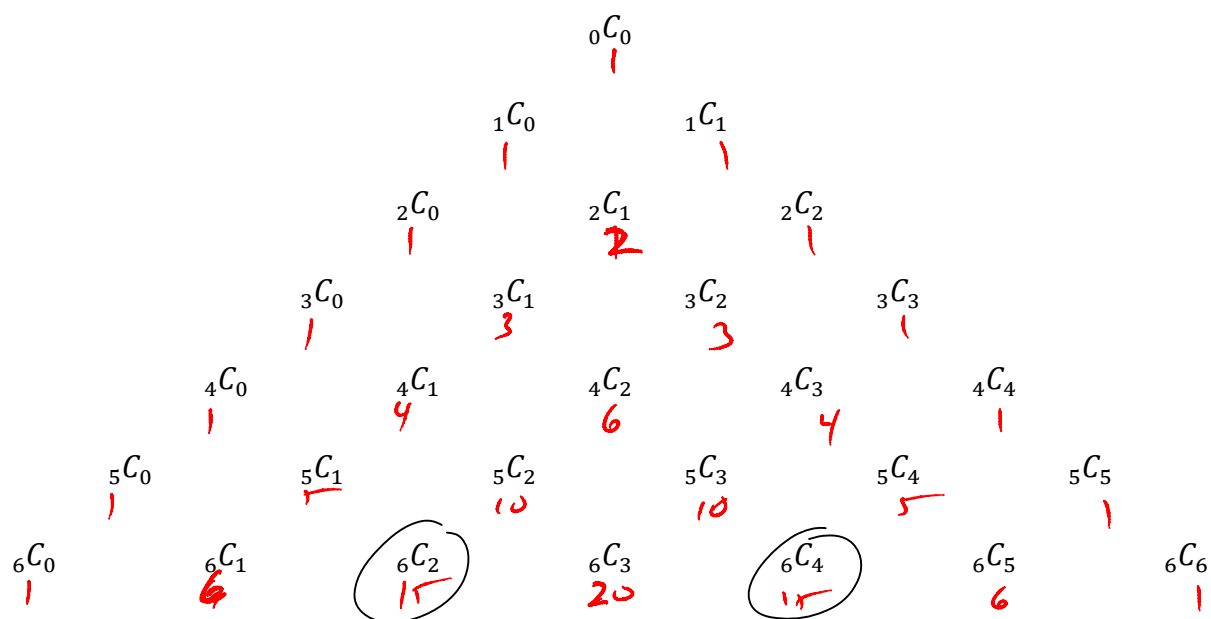
## Unit 11: Combinatorics

### 11.3A Pascal's Triangle & Pathways

Pascal's Triangle – a pattern (sequence) of numbers where you add two numbers above to create the number below:



Now, consider the combination pattern:



Note: there is symmetry in Pascal's triangle, thus there is symmetry to combinations.

$${}_nC_r = {}_nC_{n-r}$$

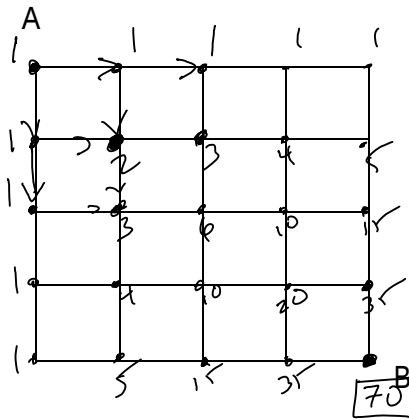
$$n-r$$

ex.  ${}_7C_3 = {}_7C_4$

$${}_{13}C_5 = {}_{13}C_8$$

We use the idea behind Pascal's triangle (adding two connecting values to determine the next number in the sequence) to solve pathway questions.

ex. How many paths from corners A to B, moving only down and right?



8 moves :  $4 \downarrow + 4 \rightarrow$   

$$\frac{8!}{4!4!} = \frac{8 \cdot 7 \cdot 6 \cdot 5 \cdot 4!}{4! \cdot 4!} = \frac{8 \cdot 7 \cdot 6 \cdot 5}{4 \cdot 4} = 70$$

