



## Rule of Sum, Rule of Product, and Permutations

1) Assume a new brand of mobile devices is hitting the market. The company is releasing a number of options: 4 different models, 6 screen sizes, 3 colours, and 2 different storage capacity options. (a) How many distinct mobile devices will be available? (b) If Ali wants the largest screen size, how many options are there to choose from?

- a)  $4 \times 6 \times 3 \times 2 = 144$   
b)  $4 \times 1 \times 3 \times 2 = 24$

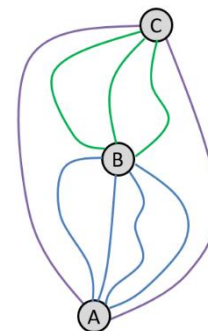
2) While walking down the street Ali and Sam see bank robbers escape in a getaway vehicle. License plates in the province are all 2 letters followed by 4 numbers. When questioned by the police, Ali is sure the first letter on the license plate was an O, C, or G. Sam is sure the second last digit was a 3 or an 8, and the last digit was a 4. How many different license plates will the police need to track?

$$3 \times 26 \times 10 \times 10 \times 2 \times 1 = 15,600$$

3) Assume the Nibbles and Bytes café in ELW offers 5 different kinds of pastry, and 3 different muffins each day. There are also small, medium, large containers of the following drinks: coffee (black, with cream, with sugar, with both), tea (plain, with cream, with sugar, with both, with lemon, with lemon and sugar), hot chocolate, or juice (orange or apple). (a) How many ways can Ali order a bakery item with a medium-sized beverage? (b) How many ways can Ali order a bakery item and coffee for them self, and a muffin and juice for Sam?

- a)  $(5+3) \times 13 = 8 \times 13 = 104$   
b)  $(5+3) \times (3 \times 4) = 8 \times 12 = 96$   
 $3 \times (3 \times 2) = 3 \times 6 = 18$   
 $96 \times 18 = 1728$

4) The “map” on the right shows three towns interconnected by paths (colour-coded by the towns they connect). (a) How many ways can Ali travel from A to C? (b) How many ways can Ali travel from A to C and then back to A? (c) How many round trips are there from part (b) where a different route is taken on the way back to A?



- a) 14 different routes  
b)  $14 \times 14 = 196$   
c)  $14 \times 13 = 182$

5) Consider the word DATABASE. (a) In how many ways can the letters in DATABASE be arranged? (b) How many arrangements are there with all three A's together? (c) How many arrangements are there with all of the vowels together?

- a)  $\frac{8!}{3!} = 6720$   
b)  $6! = 720$   
c)  $4 \times 5! = 480$

5) How many positive integers can we form using the digits 3, 3, 4, 5, 5, 6, 7 if we want the number to be greater than 5,000,000?

$$\frac{6!}{2!} + \frac{6!}{2!2!} + \frac{6!}{2!2!} = 720 \text{ ways}$$