

# Probability & Data

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## Exercises Week 2

1. Class has 50 students; 20 male (M), 25 brown-eyed (B). For a randomly chosen student what is the range of possible values for  $P(M \cup B)$ ?

2. Let A, B and C be sets, Use Venn diagrams to show the following:

(a) The 2nd distributive law  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ ,

(b) The 2nd De-Morgan's Law  $\overline{A \cap B} = \bar{A} \cup \bar{B}$ .

Use the lecture notes and Venn Diagrams to prove the above.

3. Explain from the basis of  $C_r^n$ , why  $P_r^n = r! \times C_r^n$ .

4. A committee consisting of 1 President, 2 Vice-Presidents and 1 Treasurer is selected from a society consisting of 10 members.

(a) How many ways can we select the committee?

(b) How many ways can we arrange the committee in a row at the front of the stage, if the 2 Vice-President positions are considered equal?

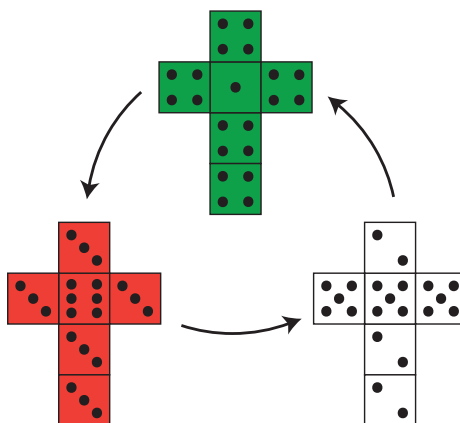
(c) How many ways can we arrange the committee around a round table, if the 2 Vice-President positions are considered equal?

5. Use Venn diagrams and the Probability Axioms to show that

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C).$$

6. Show that if  $A \subset B$ , then  $P(A) \leq P(B)$ .
7. What is the probability of getting 3 tails in 5 tosses of a fair coin?  
Please use a counting method for this question - in a later chapter we will discuss the binomial distribution, where this sort of probability can be calculated by using a formula.
8. A game consists of two players each choosing a die. They roll once and the highest number wins.

Which die would you choose?



- (i) Make probability tables for the red and white dice.
- (ii) Make a probability table for the product sample space of red and white.
- (iii) Compute the probability that red beats white.
- (iv) Pair up with another group. Have one group compare red vs. green and the other compare green vs. red. Based on the three comparisons rank the dice from best to worst.