

# Unit 1 Probability

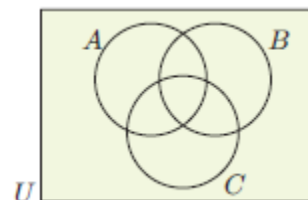
## Some Communication and Thinking Questions

1. What is  $P(A | A')$ ?
2. What is  $P(A \cup A')$ ?
3. What is  $P(A \cap A')$ ?
- 4.

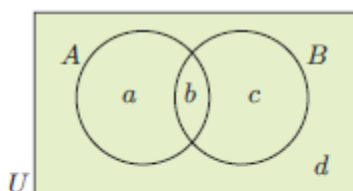
The diagram alongside is the most general case for three events in the same sample space  $U$ .

On separate Venn diagram sketches, shade:

- |                     |                            |                              |
|---------------------|----------------------------|------------------------------|
| <b>a</b> $A$        | <b>b</b> $B'$              | <b>c</b> $B \cap C$          |
| <b>d</b> $A \cup C$ | <b>e</b> $A \cap B \cap C$ | <b>f</b> $(A \cup B) \cap C$ |



5. What is  $P(A | A)$ ?
6. What is  $P(A \cap A)$ ?
7. What is  $P(A | B)$  if  $A$  and  $B$  are mutually exclusive?
8. What is  $P(A | B)$  if  $A$  and  $B$  are independent?
9. What is  $P(A \cup B)$  if  $A$  and  $B$  are independent?
10.  $P(A)$ ,  $P(B)$ ,  $P(C)$  are mutually exclusive. What is the additive principle for them?
11.  $P(A)$ ,  $P(B)$ ,  $P(C)$  are independent of each other. What is the  $P(A \cap B \cap C)$ ? [A not pleasant extension: What is the  $P(A \cup B \cup C)$ ?]
12.  $A$  and  $B$  are dependent events. Will  $P(A | B) = P(B | A)$ ?
13.  $A$  and  $B$  are independent events. Will  $P(A | B) = P(B | A)$ ?
14.  $A$  and  $B$  are mutually exclusive events. Will  $P(A | B) = P(B | A)$ ?
15. If  $P(A)$  is 0.4 and  $P(B)$  is 0.6 and  $P(A \cap B)$  is 0, what do you know about  $P(A)$  and  $P(B)$ ?
16. If  $P(A)$  is 0.4 and  $P(B)$  is 0.6 and  $P(A \cap B)$  is 0.24, what do you know about  $P(A)$  and  $P(B)$ ?
17. If  $P(A)$  is 0.4 and  $P(B)$  is 0.6 and  $P(A \cap B)$  is 0.4, what do you know about  $P(A)$  and  $P(B)$ ?
18. If  $P(A)$  is 0.4 and  $P(B)$  is 0.6 and  $P(A \cap B)$  is 0.1, what do you know about  $P(A)$  and  $P(B)$ ?
19. If  $P(A)$  is 0.4 and  $P(B)$  is 0.6 and  $P(A \cap B)$  is 0.4, what is  $P(B | A)$ ? What about  $P(A | B)$ ? Why?
20. Provide a real world example for  $P(A) = 1 - P(A')$  that shows why it is true.
21. Provide a real world example for the mutually exclusive and ( $P(A \cap B) = P(A) + P(B)$ ) that shows why the equation is true.
22. Using a Venn diagram, show why the additive principle is true.
- 23.



From the Venn diagram, 
$$P(A) = \frac{a + b}{a + b + c + d}.$$

- Use the Venn diagram to find:
  - $P(B)$
  - $P(A \cap B)$
  - $P(A \cup B)$
  - $P(A) + P(B) - P(A \cap B)$
- What is the connection between  $P(A \cup B)$  and  $P(A) + P(B) - P(A \cap B)$ ?

24.

$A$  and  $B$  are independent events. Prove that  $A'$  and  $B'$  are also independent events.