

Probability Basics

COURSE TEACHING ASSISTANTS

Kamal Ezzo

kamal.ezzo@must.edu.eg

Maryam Gebrael

maryam.gebraeil@must.edu.eg

Tasneem Abdelraouf

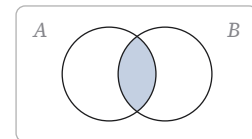
tasneem.abdelraouf@must.edu.eg

Rules

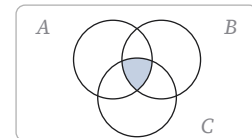
1 Intersection (And)



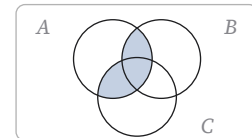
$$P(A \cap B) = P(A) + P(B) - P(A \cup B)$$



$$\begin{aligned} P(A \cap B \cap C) &= P(A) + P(B) + P(C) \\ &\quad - P(A \cup B) - P(B \cup C) - P(A \cup C) \\ &\quad + P(A \cup B \cup C) \end{aligned}$$



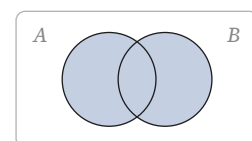
$$P(A \cap (B \cup C)) = P(A \cap B) + P(A \cap C) - P(A \cap B \cap C)$$


Keywords: *and, both, together*

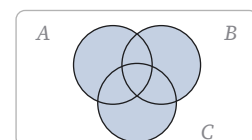
2 Union (Or)



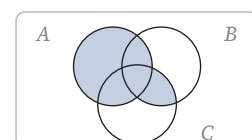
$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$



$$\begin{aligned} P(A \cup B \cup C) &= P(A) + P(B) + P(C) \\ &\quad - P(A \cap B) - P(B \cap C) - P(A \cap C) \\ &\quad + P(A \cap B \cap C) \end{aligned}$$

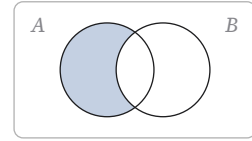


$$P(A \cup (B \cap C)) = P(A) + P(B \cap C) - P(A \cap B \cap C)$$

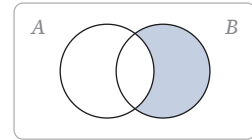

Keywords: *or, either A or B, at least one*

3 Difference (Only) —

$$P(A - B) = P(A) - P(A \cap B)$$



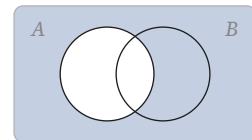
$$P(B - A) = P(B) - P(A \cap B)$$



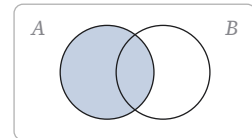
Keywords: *only, but not*

4 Complement (Not) $\bar{A}$ or A' or A^c

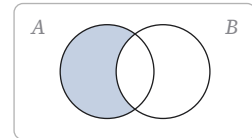
$$P(\bar{A}) = 1 - P(A)$$



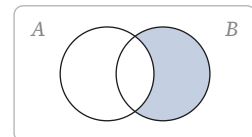
$$P(A) = 1 - P(\bar{A})$$



$$P(A \cap \bar{B}) = P(A - B)$$



$$P(\bar{A} \cap B) = P(B - A)$$



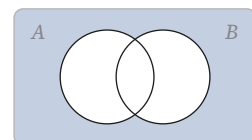
Neither A nor B

opposite of Either A or B $P(A \cup B)$

$$P(\overline{A \cup B}) = 1 - P(A \cup B)$$

same

$$P(\bar{A} \cap \bar{B})$$



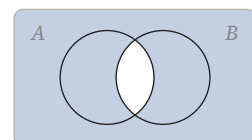
Not both

opposite of Both A and B $P(A \cap B)$

$$P(\overline{A \cap B}) = 1 - P(A \cap B)$$

same

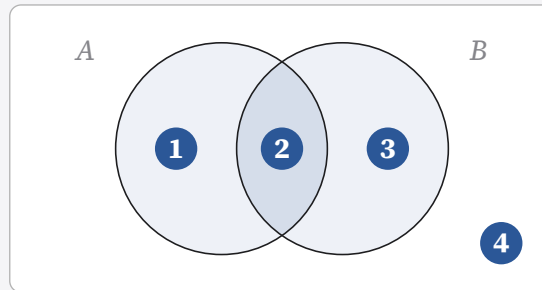
$$P(\bar{A} \cup \bar{B})$$



Keywords: *not, non-occurrence, neither*

Warm-up

Which regions does each phrase mean? Write the regions, then the rule.



$$1 + 2 + 3 + 4 = 1$$

Regions	Rule
	both · and · together
	A only · A but not B
	B only · B but not A
	neither A nor B
	A or B · either · at least one
	not both · not together
	exactly one
	not A

Q1

Let A and B be two events of a sample space, with $P(A) = 0.5$, $P(B) = 0.7$ and $P(A \cup B) = 0.9$. Find:

1. The occurrence of both A and B
2. The occurrence of A only
3. The occurrence of B only
4. The non-occurrence of A or B ($\bar{A} \cup \bar{B}$)
5. The non-occurrence of A and B together ($\overline{A \cap B}$)
6. Neither A nor B
7. Either A or B



Q2

Let A and B be two events of a sample space S , with $P(A) = 0.4$, $P(B) = 0.5$ and $P(A \cup B) = 0.7$. Find the probability of B but not A .











1. A sum of 9
2. A sum of 7 or 11
3. Doubles
4. A sum less than or equal to 9
5. A sum greater than 10
6. The first die greater than the second
7. An even sum
8. Both dice odd



1. All boys
2. All girls or all boys
3. Exactly two boys or exactly two girls
4. At least one child of each gender



1. What is the probability that he or she is a Management major?
2. Which approach to probability did you use?



1. The occurrence of A
2. The non-occurrence of B
3. The occurrence of A or B
4. The non-occurrence of A or B ($\bar{A} \cup \bar{B}$)
5. The occurrence of A only
6. The non-occurrence of A and B together ($\overline{A \cap B}$)



Q11

If $P(A \cap \bar{B}) = 1/12$, $P(B - A) = 5/12$ and $P(\bar{A} \cap \bar{B}) = 1/4$, find:

1. $P(A)$
2. $P(B)$
3. $P(A \cap B)$



1. $P(A \cup B)$
2. $P(A \cup (B \cap C))$
3. $P(A \cap (B \cup C))$
4. $P(A \cup B \cup C)$



Q13

If $P(A) = 0.6$, $P(B) = 0.1$ and $P(A \cap B) = 0.02$, find the probability of:

1. A or B
2. B but not A