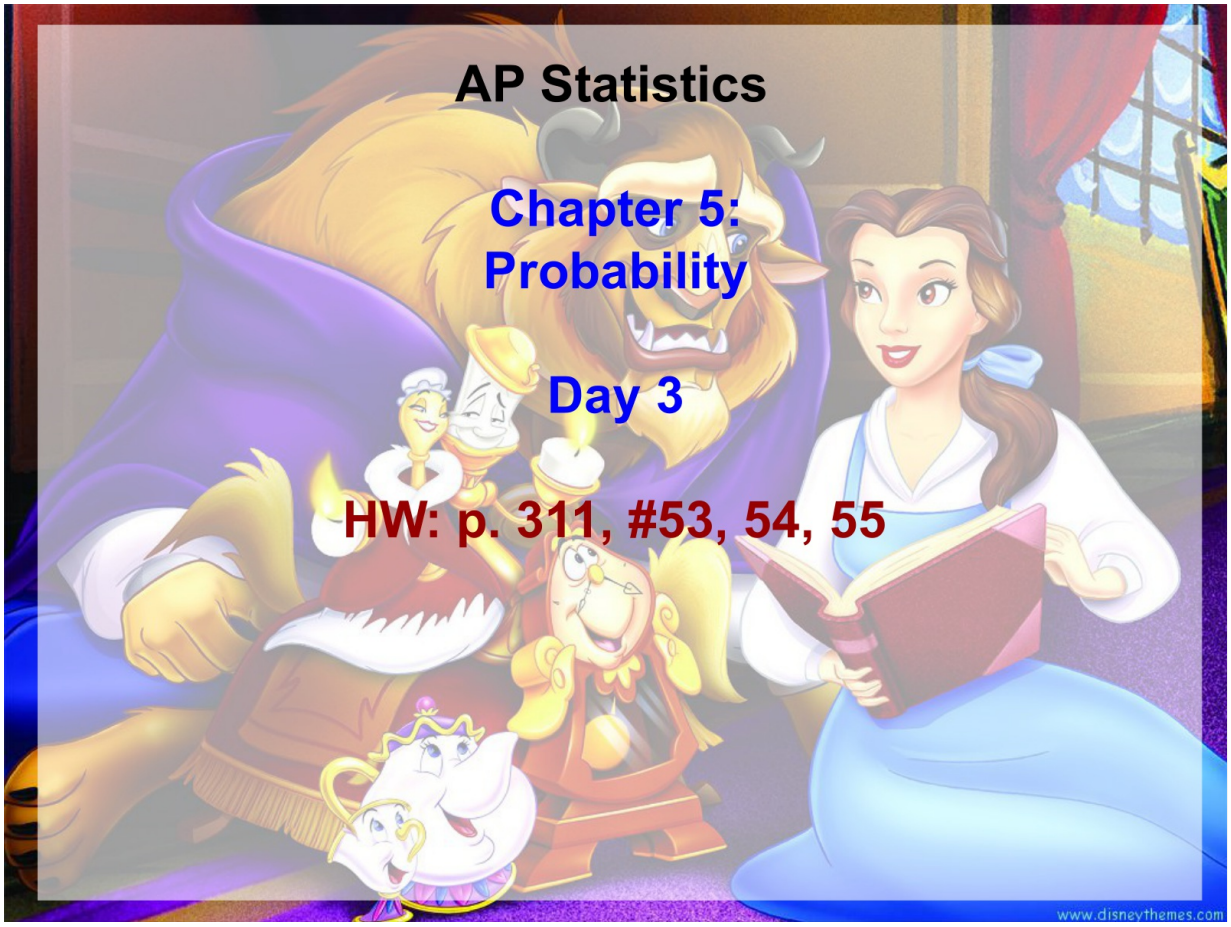

Exercises, page 309:

5.39 (a) The table below illustrates the possible pair combinations in the sample space. (b) Each of the 16 outcomes has probability $\frac{1}{16}$.

		First Roll			
		1	2	3	4
Second Roll	1	(1,1)	(2,1)	(3,1)	(4,1)
	2	(1,2)	(2,2)	(3,2)	(4,2)
	3	(1,3)	(2,3)	(3,3)	(4,3)
	4	(1,4)	(2,4)	(3,4)	(4,4)

5.41 There are four ways to get a sum of 5 from these two dice: (1,4), (2,3), (3,2), (4,1). Each of these has probability $\frac{1}{16}$ so together the probability of getting a sum of 5 is $4\left(\frac{1}{16}\right)=\frac{1}{4}$.

5.43 (a) Legitimate. (b) Not legitimate: the total is more than 1. (c) Legitimate (even if the deck of cards is not!).

5.45 (a) The given probabilities have sum 0.96, so P(type AB) = 1 − 0.96 = 0.04. The sum of all possible outcomes is 1. (b) The probability that the chosen person does not have AB is the sum of all the other probabilities which is 0.96. (c) P(type O or B) = 0.49 + 0.20 = 0.69.

5.47 (a) The given probabilities have sum 0.72, so this probability must be 0.28. (b) P(at least a high school education) = 1 − P(has not finished HS) = 1 − 0.13 = 0.87.

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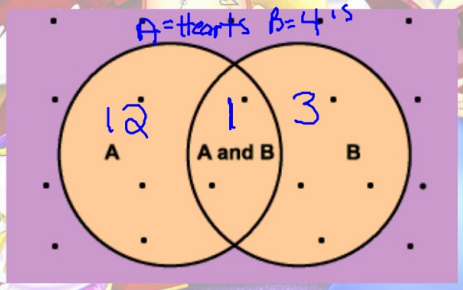
Venn Diagram

A Venn diagram is a graphical representation of sets of outcomes and how they intersect.

The rectangular box represents the sample space.

The circles represent different events.

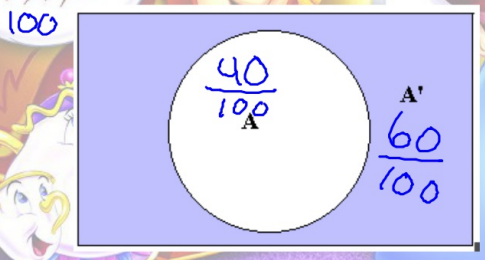


Complement

The complement of an event is the set of all possible outcomes in a sample space that does not lead to an event.

Denoted by A' (or A^C). Its formula is:

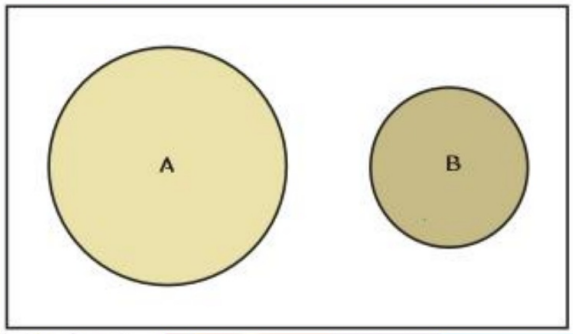
$$P(\text{not } A) = 1 - P(A)$$



Disjoint or Mutually Exclusive Events

Disjoint or **mutually exclusive** events are events that have no outcomes in common.

In other words, they cannot occur together.



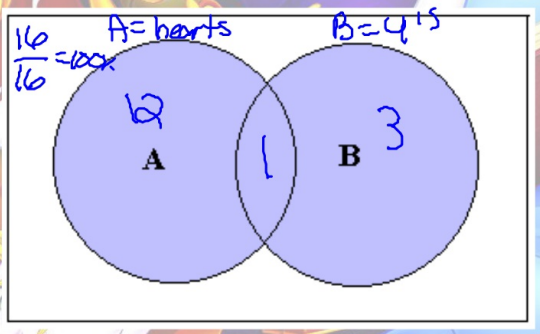
Union

"OR"

The **union** of A and B is the set of all possible outcomes that lead to at least one of two events A and B.

Formula sheet notation

Denoted by (A or B) or $(A \cup B)$.

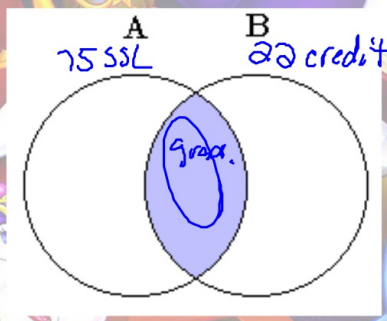


Intersection

* and

The **intersection** of A and B is the set of all possible outcomes that lead to both events A and B.

Denoted by (A and B) or $(A \cap B)$.



Conditional Event

A **conditional event** (A given B) is a set of outcomes for event A that occurs if B has occurred.

Formula sheet ↓

Denoted by $(A|B)$.

Example

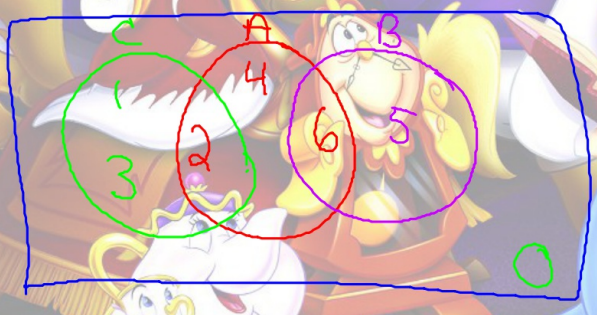
The sample space for throwing a die is S = {1, 2, 3, 4, 5, 6}. Suppose events A, B, and C are defined as follows:

A = Getting an even number = {2, 4, 6}
B = Getting at least 5 = {5, 6}
C = Getting at most 3 = {1, 2, 3}

Example

Create a Venn diagram.

A = Getting an even number = {2, 4, 6}
B = Getting at least 5 = {5, 6}
C = Getting at most 3 = {1, 2, 3}



Example

Find P(A), P(B), and P(C).

$P(A) = 3/6 = 1/2$

$P(B) = 2/6 = 1/3$

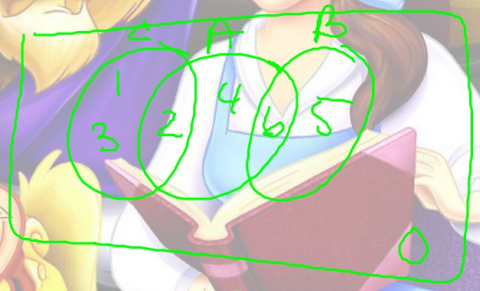
$P(C) = 3/6 = 1/2$

Find A', B', C'.

$A' = 1 - 1/2 = 1/2$

$B' = 1 - 1/3 = 2/3$

$C' = 1 - 1/2 = 1/2$



Example

Find $(A \cup B)$, $(A \cup C)$, $(B \cup C)$.

$(A \cup B) = 4/6 = 2/3$

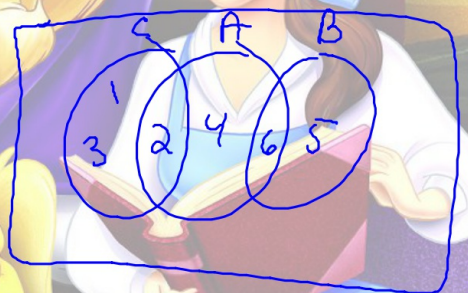
2, 4, 6 , 5 ~~6~~

$(A \cup C) = 5/6$

2, 4, 6 1, ~~2~~, 3

$(B \cup C) = 5/6$

5, 6 1, 2, 3



Example

Find $(A \cap B)$, $(A \cap C)$, $(B \cap C)$.

$(A \cap B) = 1/6$

$(A \cap C) = 1/6$

$(B \cap C) = 0$ ← impossible event

Example

conditional ↓ 1st ↙

Find $(A|B)$, $(A|C)$, $(B|C)$.

$(A|B)$ = Prob of getting an even # given that the # is at least 5. = $1/2$

$(A|C)$ = Prob of getting an even # given that the # is at most 3. = $1/3$

$(B|C)$ = Find the prob of a # at least 5 given that the # is at most 3. = 0