

MIT 1102

Statistics and Probability

Lesson 10

$$0 < P < 1 \quad 0\% < P < 100\%$$

Probability → a decimal / percent (fraction)

that describes how probable / likely that an event will occur / happen, especially an event based on chance. << le hasard >>

Definition / terminology (p 217) (chance)

a2 - 2ahr

Random Experiment: R.E.

↳ a process / game for which the outcome cannot be predicted with certainty.

example: R.E.: rolling the dice.

• Universe / Sample space Ω (of R.E.)

↳ all possible outcomes

$$U = S = \Omega = \{1, 2, 3, 4, 5, 6\}$$

{ } listing elements.

• Event → when specific outcomes of a R.E. are specified.

Event A: rolling an even #.

$$A = \{2, 4, 6\}$$

$$P(A) = \frac{3}{6} = 0.5 = 50\%$$

Event B: rolling a 1

$$B = \{1\}$$

$$P(B) = \frac{1}{6}$$

Event C: rolling an odd #

$$C = \{1, 3, 5\}$$


$$P(C) = \frac{3}{6} = 0.5 = 50\%$$

∴ Event A and C are equiprobable!


Definitions : Describing an Event

Impossible event:

Event with probability equal zero ($P = 0$)

ex. drawing 2 Jacks of  without replacement.

Click to add text
 ex: **Obtaining a sum higher than 12 after rolling two dices**



Certain event:

Event with 100% probability ($P = 1$)


ex: **Obtaining a sum between 2 and 12 after rolling two dices**



Probable event:

Event with "some" probability ($0 < P < 1$)

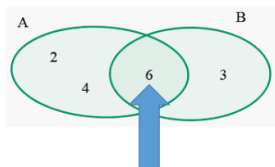
Click to add text
 ex: **Obtaining a sum of 7 after rolling two dices**



Definitions Describing Events together

Compatible events: Events that *share at least one of* their outcomes.

Event A has three winning numbers
{2, 4, 6}



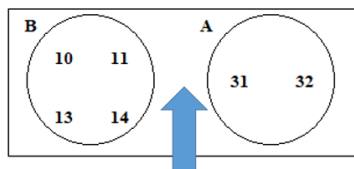
6 is a common outcome for both events

Event B has two winning numbers
(3, 6)

compatible } $A = \{2, 4, 6\}$ mutually exclusive
 $B = \{3, 6\}$ incompatible
 $C = \{1, 3, 5\}$

Incompatible events: Events that *do not share any of* their outcomes.

Event B has four winning numbers
(10, 11, 13, 14)



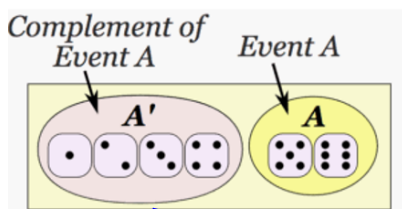
There is not any common outcome for both events

Event A has two winning numbers
(31, 32)

R.E. drawing 2 cards
 Event A: drawing a heart $P(A) = 25\%$
 Event B: drawing a red card
 $P(B) = \frac{1}{2} = 50\%$
 Event C: drawing a black card.

Definitions - Describing 2 Events.

Complementary events: Incompatible events that together cover the entire sample space of outcomes (their probabilities add up to 1).



$$P_{A'} + P_A = \frac{4}{6} + \frac{2}{6} = \frac{6}{6} = 1$$

R.E. drawing 2 cards
 Event A: drawing a heart $P(A) = 25\%$
 Event B: drawing a red card
 $P(B) = \frac{1}{2} = 50\%$
 Event C: drawing a black card. $P(C) = 50\%$

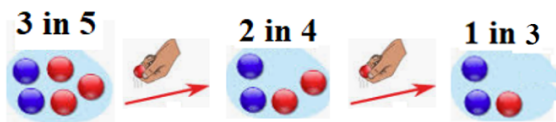
• B + C
 50% 50%
 incompatible
 Complementary

• A + C
 25% 50%
 incompatible
 not complementary

Definitions - Describing events together

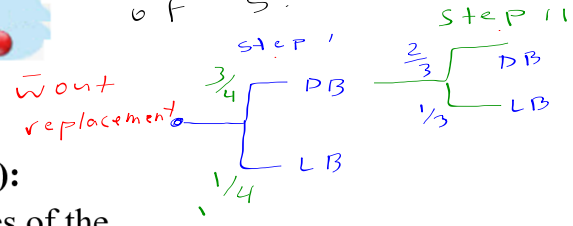
Dependent events (draws **without** replacement):

Two events are *dependent* when the outcomes of the first *influence* the outcomes of the second.



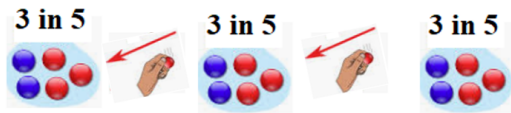
Definitions

2-step R.F.
R.F.: drawing 2 marbles from a bag of 5.



Independent events (draws **with** replacement):

Two events are *independent* when the outcomes of the first *do not influence* the outcomes of the second.

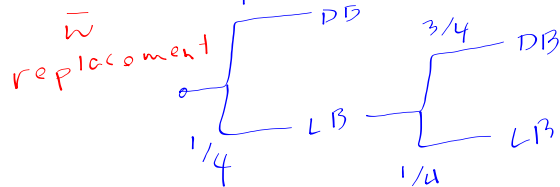


HWK - definition

P 208 # 7.12 / 7.13

P 210 # 7.16 - 7.18

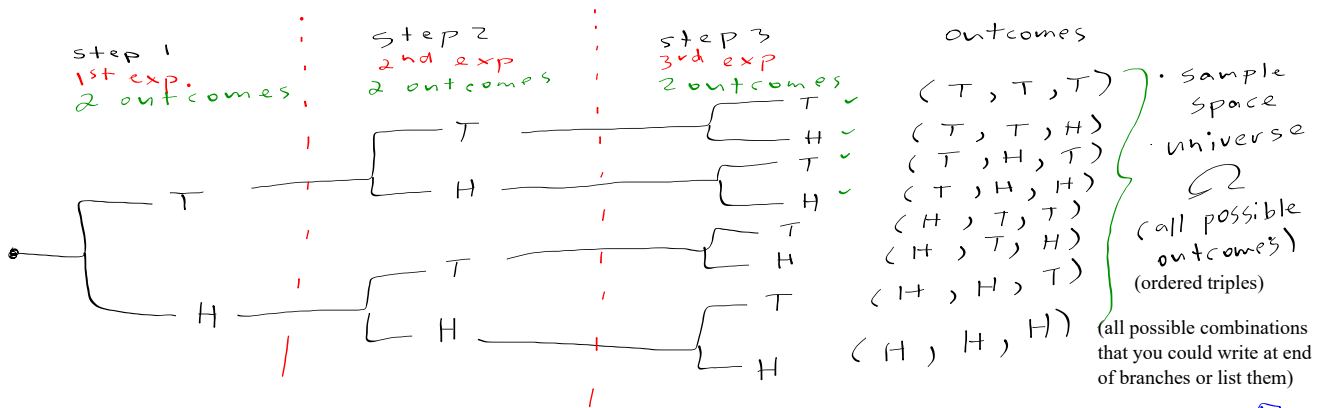
P 213 - 214 # 7.25 - 7.26



Lesson 11 Representing a Random Experiment
 (and all of its outcomes) w a Tree Diagram

(useful for equiprobable events)

P190 R.E.: flipping a coin 3 times. → multi-step R.E.

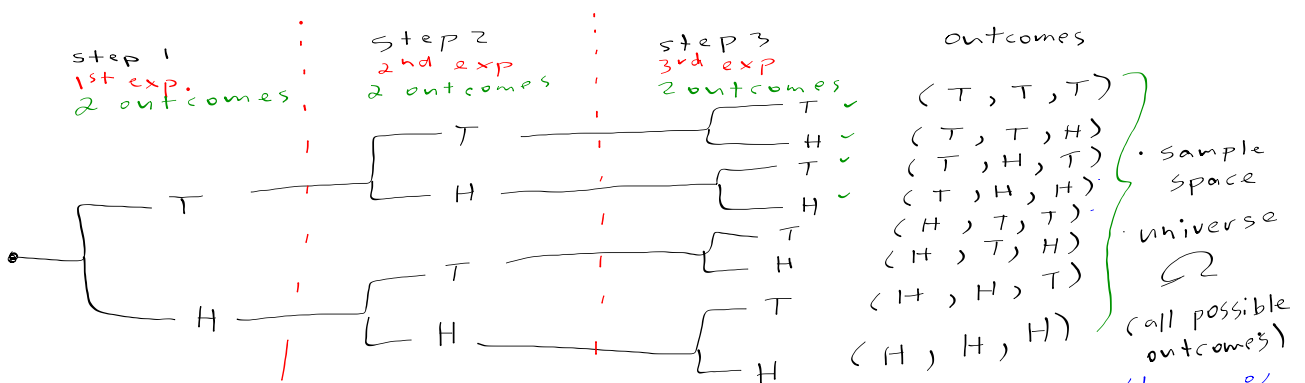


P187: How to calculate the # of possible outcomes:

$$\left(\begin{array}{c} \# \text{ of} \\ \text{outcomes} \\ \text{in step 1} \end{array} \right) \times \left(\begin{array}{c} \# \text{ of} \\ \text{outcomes} \\ \text{in step 2} \end{array} \right) \times \dots$$

ex: $2 \times 2 \times 2 = 8$ p.o.

Listing Events coming from Tree Diagram



Event A: tossing a tails at least twice. $P(A) = \frac{4}{8} = 50\%$

$$A = \{ (T, T, T), (T, T, H), (T, H, T), (H, T, T) \}$$

Event B: tossing the same thing 3 times.

$$B = \{ (H, H, H), (T, T, T) \} \quad P(B) = \frac{2}{8} = 25\%$$

Draw tree and answer question
P 194 # 7.4 a) - d)

HWK:
P 192 - 196
7.2 - 7.6