$$(a+b)^{17} = \binom{17}{0}a^{17}b^{0} + \binom{17}{1}a^{16}b^{1} + \binom{17}{2}a^{15}b^{2}$$

$$\binom{17}{2} = \frac{17\cdot 16}{2} = 17\cdot 8 = 136$$

6.3 Probability

coin flip: 2 possible outcomes: $\{H, T\}$

$\frac{1}{2}$ $\frac{1}{2}$

2 coin flips: outcomes: (2) $\{HH, HT, TH, TT\}$ ← each probability $\frac{1}{4}$

(1)	H	T
H	HH	HT
T	TH	TT

Aa

Aa	A	a
A	AA	Aa
a	aA	aa

probability of HH

$$P(HH) = \frac{1}{2}\cdot\frac{1}{2} = \frac{1}{4}$$

multiply ⟺ independent events

10 coin flips. What is P(all H)?

$$P(\text{all } H) = \frac{1}{2^{10}} = \underbrace{\left(\tfrac{1}{2}\right)\left(\tfrac{1}{2}\right)\cdots\left(\tfrac{1}{2}\right)}_{10}$$

$$= \frac{1}{2^{10}}$$

1 ⟸ # good outcomes (HHH...H single good outcome)

2^{10} ⟸ total # of outcomes

dice (singular: die)

↖ "number cube"

outcomes: $\{1, 2, 3, 4, 5, 6\}$

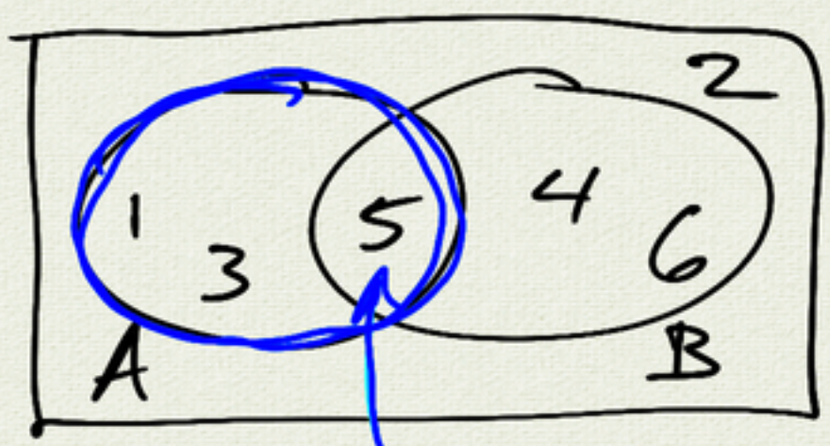
$A = \{1, 3, 5\}$ odd

$P(A) = \frac{3}{6} = \frac{1}{2}$ ← good outcomes; ← total

event = subset of outcomes

$B = \{4, 5, 6\}$ big

$P(B) = \frac{1}{2}$



$A \cup B$ union = or

$= \{1, 3, 4, 5, 6\}$

$A \cap B = \{x \mid x \in A \text{ and } x \in B\}$ intersection

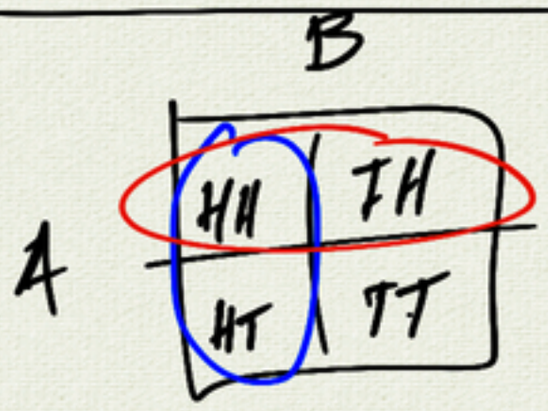
$P(A \cup B) = \frac{5}{6}$ odd or big

$P(A \cap B) = \frac{1}{6} \stackrel{?}{=} P(A) \cdot P(B)$ odd and big; odd; big

$\frac{1}{6} \stackrel{?}{=} (\frac{1}{2})(\frac{1}{2})$

A and B are not independent

definition: A, B are independent if $P(A \cap B) = P(A) \cdot P(B)$



$A \cap B = \{HH\}$

$P(HH) = P(H) \cdot P(H)$

$\frac{1}{2} \cdot \frac{1}{2}$

A = 1st flip heads; B = 2nd flip heads

2 dice + add

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

$$P(2) = \frac{1}{36}$$

$$P(7) = \frac{6}{36} = \frac{1}{6}$$

$$P(\text{odd}) = P(1) + P(3) + P(5) + P(7) + P(9) + P(11)$$

$$= \frac{0 + 2 + 4 + 6 + 4 + 2}{36}$$

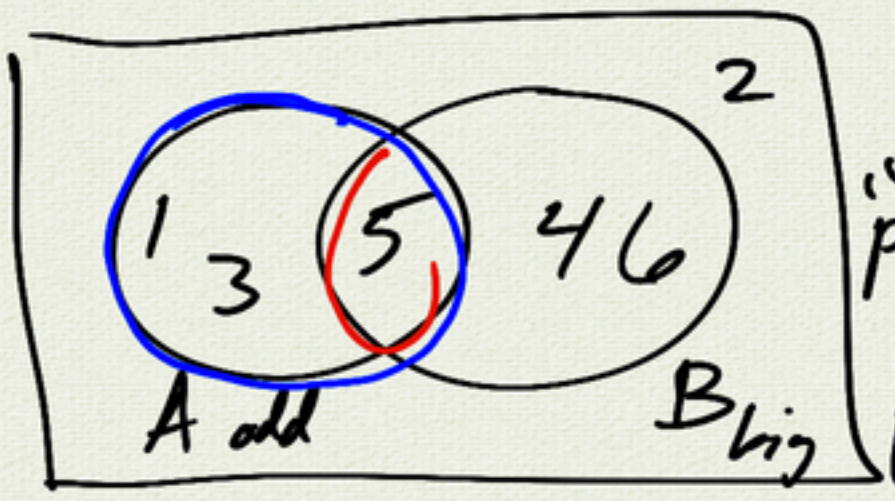
$$= \frac{18}{36}$$

$$= \frac{1}{2}$$

game:

flip coin → jar 1: 90% red, 10% green

→ jar 2: 20% red, 80% green



$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

"probability of B given A"

(I assume A is true)

conditional probability

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{1/6}{1/2} = \frac{1}{3}$$

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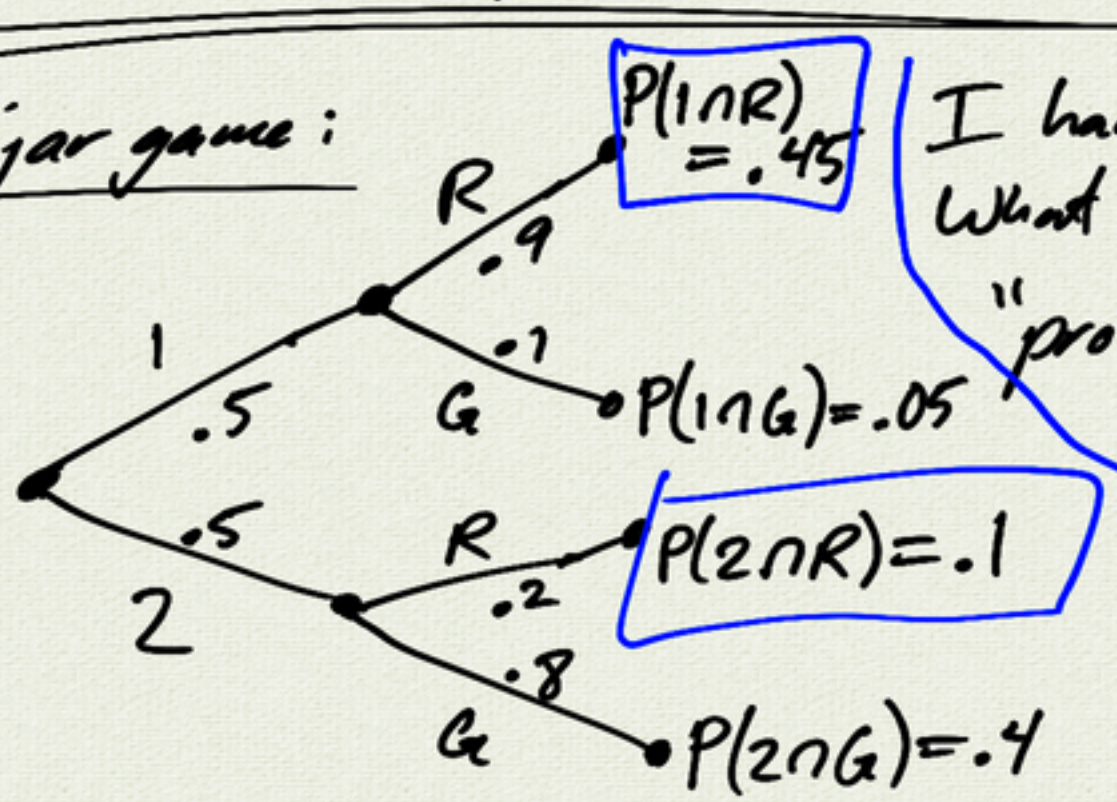
back to jar game:



I have a red. What is $P(1|R)$?

"probability of Jar 1, given Red"

add to 1

$$P(1|R) = \frac{P(1 \cap R)}{P(R)} = \frac{.45}{.45+.1} = \frac{.45}{.55} = \frac{9}{11}$$