(27) $(3a+b)^{20}$ — 1st three terms

$$(3a)^{20} + \binom{20}{1}(3a)^{19}b^{1} + \binom{20}{2}(3a)^{18}(b)^{2} + \cdots$$

$\binom{20}{2} = \frac{20\cdot 19}{2} = 190$

20

$$= 3^{20}a^{20} + \left(20\cdot 3^{19}\right)a^{19}b + \left(190\cdot 3^{18}\right)a^{18}b^{2} + \cdots$$

(33) $(7+5y)^{14}$ — eigth term

$$\binom{14}{8}7^{8}(5y)^{6}$$

$\binom{14}{6}$

6.3 Probability

coin flipping: (fair) coin: $P(H) = \frac{1}{2}$ heads

outcomes $\{H, T\}$

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

flip 2 coins: outcomes $\{\underset{1/4}{HH}, \underset{1/4}{HT}, \underset{1/4}{TH}, \underset{1/4}{TT}\}$

independent events: $P(HH) = P(H) \cdot P(H)$

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

$$= \frac{1}{4}$$

$P(HT) = \frac{1}{4}$

HT, TH

good options

$P(\text{exactly one head from 2 flips}) = \frac{2}{4}$

total # outcomes

10 coin flips: $P(\text{all } H) = \underbrace{\frac{1}{2} \cdot \frac{1}{2} \cdot \ldots \cdot \frac{1}{2}}_{10}$

10 independent events

$$= \left(\frac{1}{2}\right)^{10}$$

$$= \frac{1}{1024}$$

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

$\frac{\text{1 good outcome}}{2^{10} \text{ total possible outcomes}}$

playing cards: 4 suits: spades, hearts, diamonds, clubs

13 cards/suit: A, 2–10, J, Q, K

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

roll 2 dice and 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

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

$$P(>9) = \frac{6}{36} = \frac{1}{6}$$

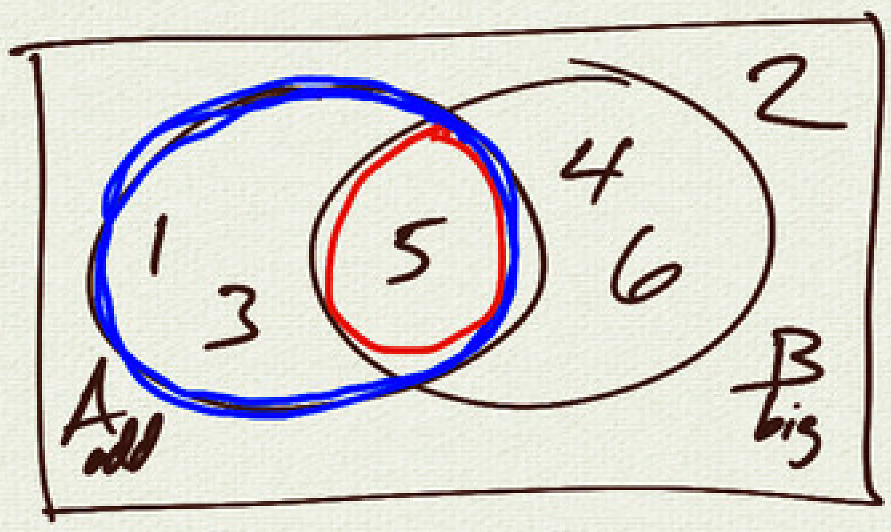
$$P(\text{double}) = \frac{1}{6}$$

---

event = subset of outcomes

$A = \{1,3,5\}$ odd $\qquad P(A) = \frac{1}{2}$

$B = \{4,5,6\}$ $\qquad P(B) = \frac{1}{2}$



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

odd and big

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

odd or big

A, B are <u>independant</u> if $P(A \cap B) = P(A) \cdot P(B)$

$$P(A \cap B) = \frac{1}{6} \stackrel{?}{=} \underbrace{P(A)}_{1/2}\,\underbrace{P(B)}_{1/2}$$

$$\frac{1}{6} \neq \frac{1}{4}$$

A, B are not independant

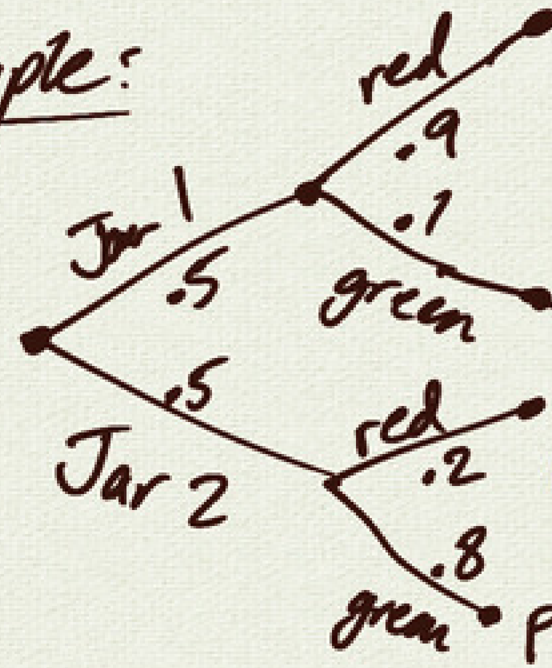
conditional probability:

know A is true: 1, 3, 5 $\Longrightarrow \underbrace{P(B|A)}_{\text{probability of B, given A}} \stackrel{\text{should be}}{=} \frac{1}{3}$

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

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

Example:



$\boxed{P(1\cap R)=.45}$

$P(1\cap G)=.05$

$\boxed{P(2\cap R)=.1}$

$P(2\cap G)=.4$

what is $P(1|R)$?

$$P(R)=P(1\cap R)+P(2\cap R)$$
$$=.55 \quad \left(=\frac{11}{20}\right)$$

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