Precalc13.5

Find the probability of an event, given the occurrence of another event

conditional probability

sample space

subset

$P_{A|B}$

Reduced sample space…two-way table

12. Medicine To test the effectiveness of a new vaccine, researchers gave 100 volunteers the conventional treatment and gave 100 other volunteers the new vaccine. The results are shown in the table below.

a. What is the probability that the disease is prevented in a volunteer chosen at random?

b. What is the probability that the disease is prevented in a volunteer who was given the new vaccine?

c. What is the probability that the disease is prevented in a volunteer who was not given the new vaccine?

Treatment	Disease Prevented	Disease Not Prevented
New Vaccine	68	32
Conventional Treatment	62	38

Is the new vaccine better?

Conditional Probability	The conditional probability of event A, given event B, is defined as $P(A \mid B) = \frac{P(A \text{ and } B)}{P(B)}$ where $P(B) \neq 0$.

Find each probability.

4. Two number cubes are tossed. Find the probability that the numbers showing on the cubes match given that their sum is greater than five.

dice

double

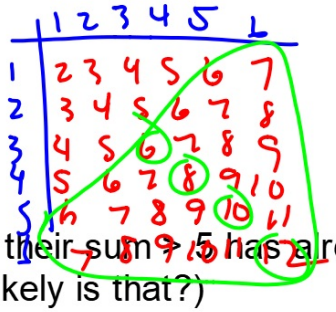
$P_{(\text{doubles}|\text{sum}>5)}$

$\frac{4}{26} = \frac{2}{13}$

$\frac{\frac{4}{36}}{\frac{26}{36}}$

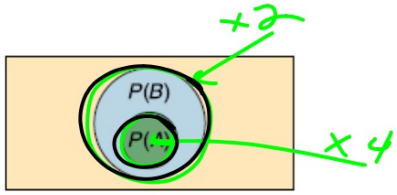
$\frac{26}{36}$

$\frac{4}{26}$



Given: their sum > 5 has already happened...
(How likely is that?)
Use a table...reduced sample space

In some situations, event A is a subset of event B. When this occurs, the probability that both event A and event B, $P(A \text{ and } B)$, occur is the same as the probability of event A occurring. Thus, in these situations $P(A \mid B) = \dfrac{P(A)}{P(B)}$.



Event A is a subset of event B.

$P(\text{mult4} \mid \text{even})$

$\frac{3}{6} = \frac{1}{2}$

4 **A 12-sided dodecahedron has the numerals 1 through 12 on its faces. The die is rolled once, and the number on the top face is recorded. What is the probability that the number is a multiple of 4 if it is known that it is even?**

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

P(mult4&even|even)

A pair of number cubes is thrown. Find each probability given that their sum is greater than or equal to 9.

9. P(numbers match)

10. P(sum is even)

11. P(numbers match or sum is even)

$P(\text{doubles} \mid \geq 9)$

$P(\text{even} \mid \geq 9)$

$P(\text{doubles or even} \mid \geq 9)$

13. Currency A dollar-bill changer in a snack machine was tested with 100 $1-bills. Twenty-five of the bills were counterfeit. The results of the test are shown in the chart at the right.

Bill	Accepted	Rejected
Legal	69	6
Counterfeit	1	24

75
25
100

a. What is the probability that a bill accepted by the changer is legal?

b. What is the probability that a bill is rejected given that it is legal?

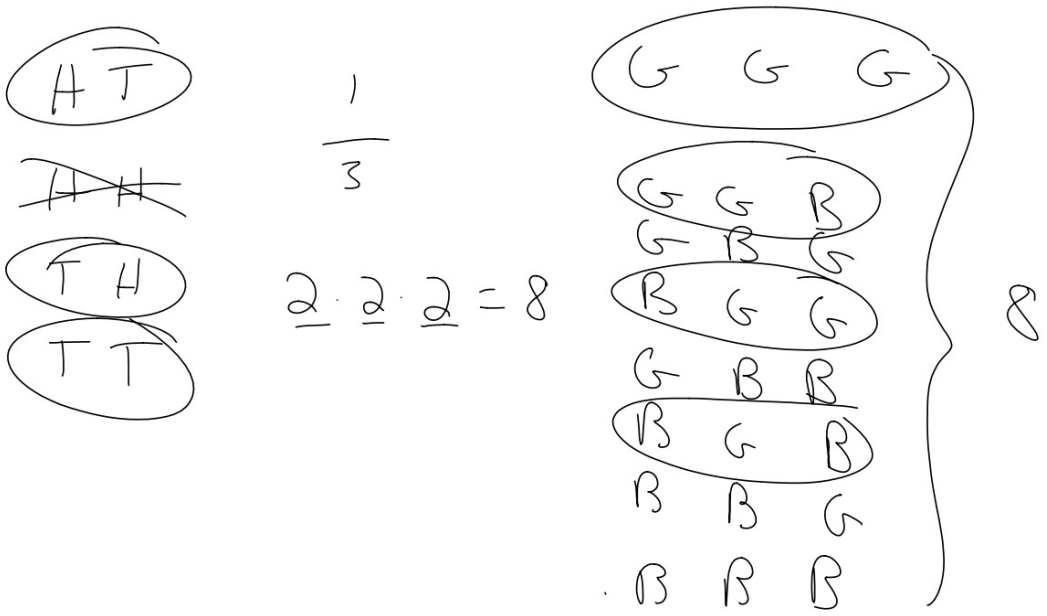
c. What is the probability that a counterfeit bill is not rejected?

L|A
R|L
A|C

$P(L|A) \quad \frac{69}{70} = 99\%$ (accepted)

$P(R|L) \quad \frac{6}{75} \quad 8\%$

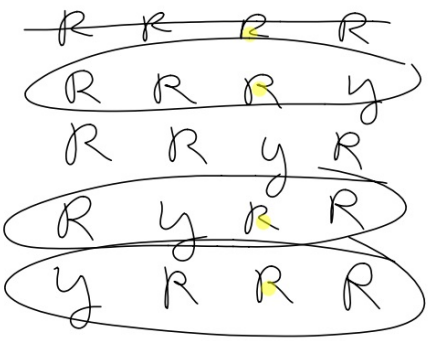
$P(A|C) \quad \frac{1}{25} = 4\%$


H T
H H
T H
T T
1/3
2 · 2 · 2 = 8
G G G
G G B
G B G
B G G
G B B
B G B
B B G
B B B
8
2/4
1/2

$\frac{2}{16}\ \frac{2}{}\ \frac{2}{}\ \frac{2}{}$ $P_{3R/\#3R}$

$\frac{3}{8}$

R y	R y	R y	R y



~~R R R R~~	R R y y	R y y y
R R R y	R y y R	y R y y
R R y R	~~y y R R~~	~~y y R y~~
R y R R	y ~~R R y~~	y y y R
y R R R	~~R y R y~~	y y y y
	y R y R	

WB 13.5