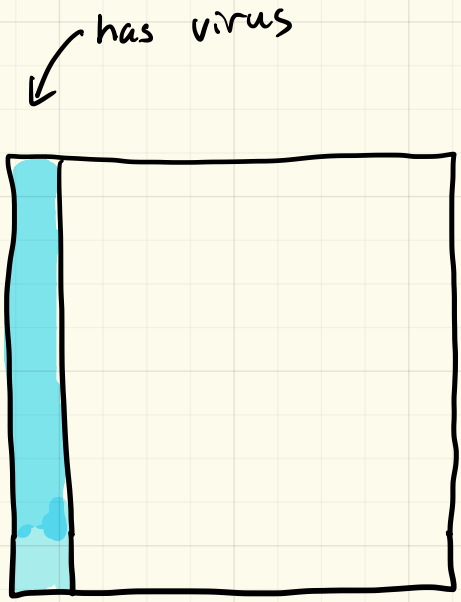
Bayes

100 people
We believe 10% of pop. has virus.

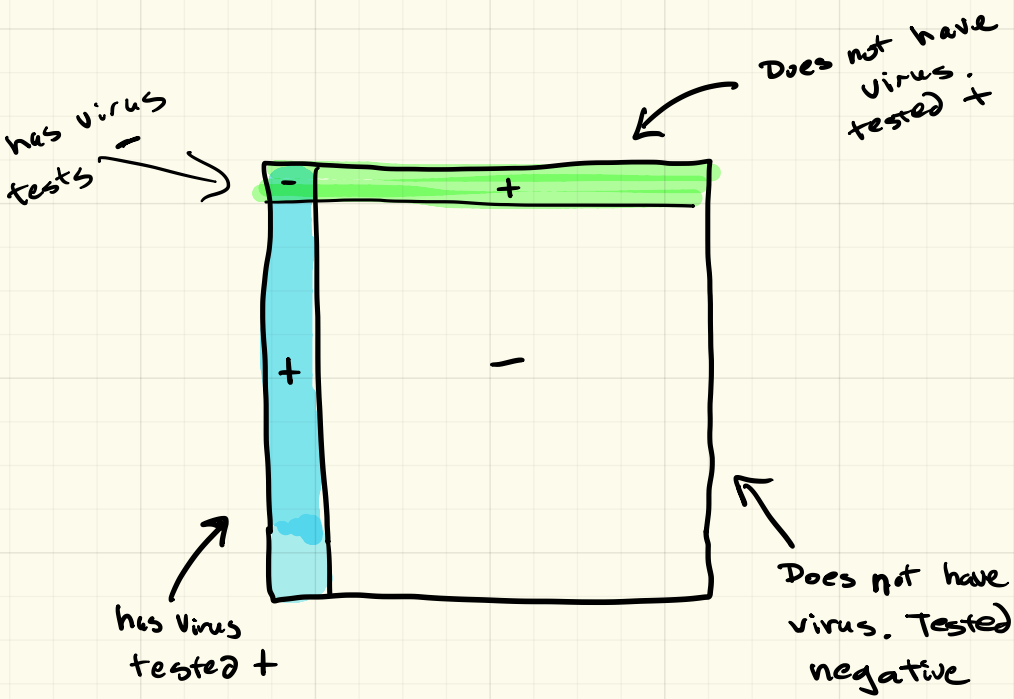


We test <u>all</u> with a test that is 90% accurate.

What is the chance that a person testing + actually has the virus?

We test everyone. 90% of results are correct.

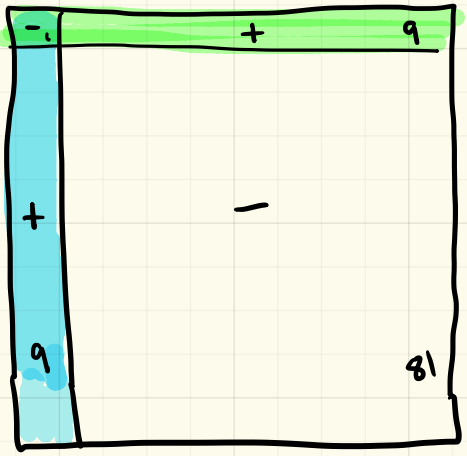
10% results incorrect.



How many

virus AND test +	9
virus AND test -	1
no virus AND test +	9
no virus AND test -	81

We test everyone. 90% of results are correct.
10% results incorrect.



- How many ways to test positive?
  Have virus and test + 9
  Not have virus and test + 9
- How many ways to test positive AND have virus?

9

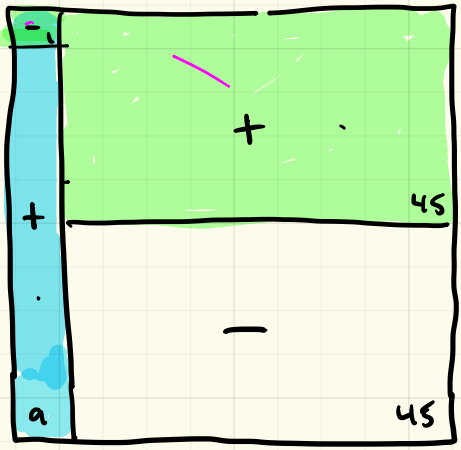
Chance of having virus if you test positive? $\frac{9}{18}$

50%

Now what if test is 90% accurate if different you have virus

And 50% accurate if you don't.

incorrect results



Test positive? With virus 9 w/o virus 45

Test positive and have virus? 9

$$\frac{9}{9+45}$$

$$\frac{9}{54} \cong .17$$

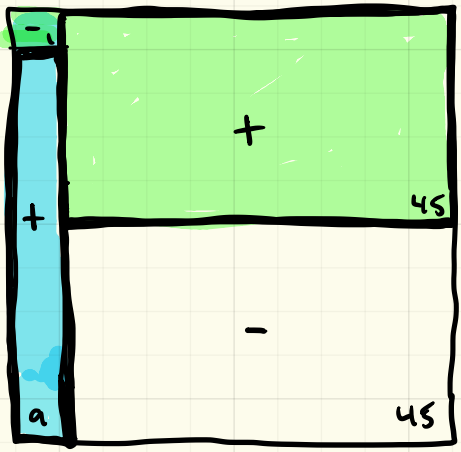
17%

→ H be event a person has the virus
P a random person test positive ➕ ➕

Chance has virus when testing positive.

$$\frac{\text{➕}}{\text{➕} + \text{➕}}$$

$H + \bar{H} = 100$



$P(H) = .1$

$P(\bar{H}) = .9$

Chance person has virus given they test positive.

$$P(H \mid P)$$

Chance person tests positive and has virus

$$P(P \cap H)$$

Chance person tests positive and has NO virus

$$P(P \cap \tilde{H})$$

H be event a person has the virus

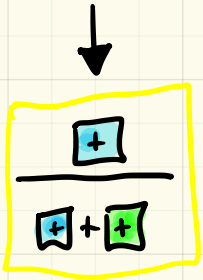
P a random person test positive ⊞ ⊞

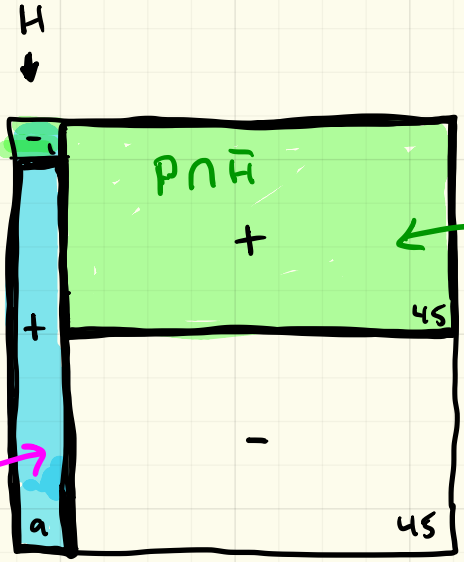
$P(H) = \frac{1}{10}$

w/ virus test 90%

w/o virus test 50%

Chance has virus when testing positive. $P(H|P)$





$P(P \cap H) = P(P|H) \cdot P(H)$

Chance person has virus given they test positive.

$$P(H|P)$$

Chance person tests positive given they have virus, times chance of having virus

$$P(P \cap H) = P(P|H) \cdot P(H)$$

Chance person tests positive given don't have virus, times chance of not having virus

$$P(P \cap \bar{H}) = P(P|\bar{H})\,P(\bar{H})$$

$$(.5)(.9)$$

H be event a person has the virus

P a random person test positive [+] [+]

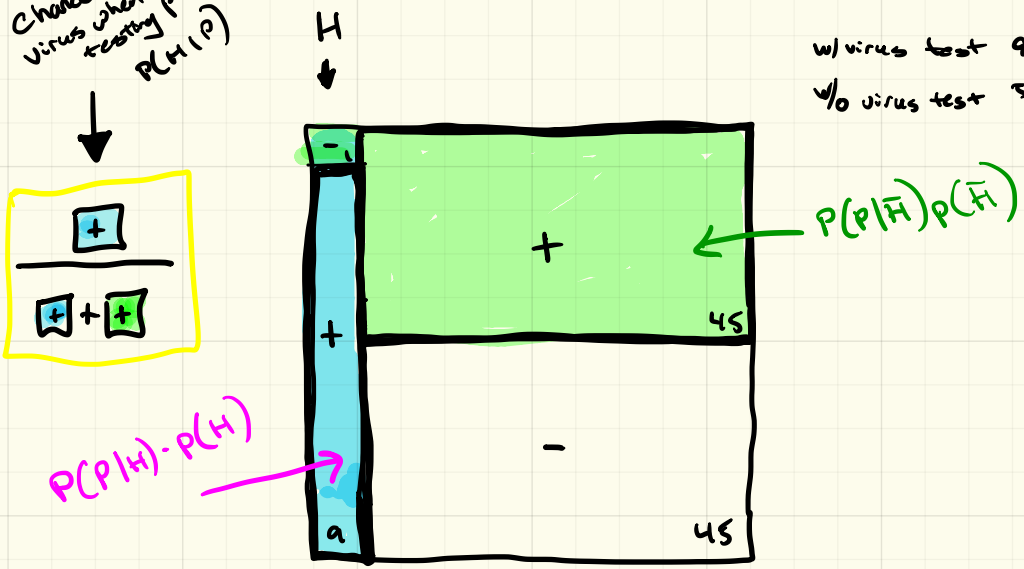
Chance has virus when testing positive.

$P(H|P)$

$P(H) = \frac{1}{10}$

w/ virus test 90%

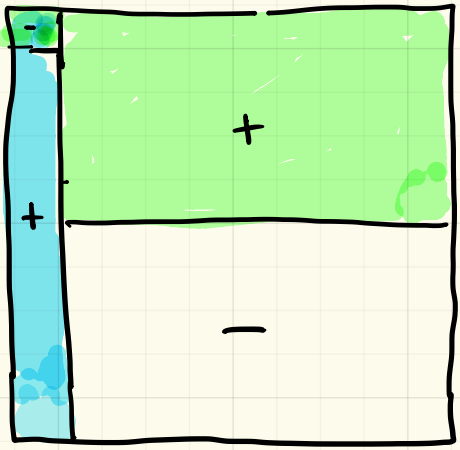
w/o virus test 50%



$$P(H|P) = \frac{[+]}{[+] + [+]}$$

$$P(H|P) = \frac{P(P|H)\,P(H)}{P(P|H)\cdot P(H) + P(P|\bar{H})\cdot P(\bar{H})} \quad 17\%$$

$$= \frac{(.9)(.1)}{(.9)(.1) + (.5)(.9)} = \frac{.09}{.54} \simeq .17$$



$$\frac{+}{+ + +}$$

BAYES FORMULA