STAT | Examples on Conditional Probability

Wednesday, October 14, 2020 10:10 AM

Conditional probability $\Rightarrow P(A \mid B)$

$P(A \text{ and } B)$

bayes theorem

$$P(A \mid B) = \frac{P(B \mid A) * P(A)}{P(B)}$$

Example 01

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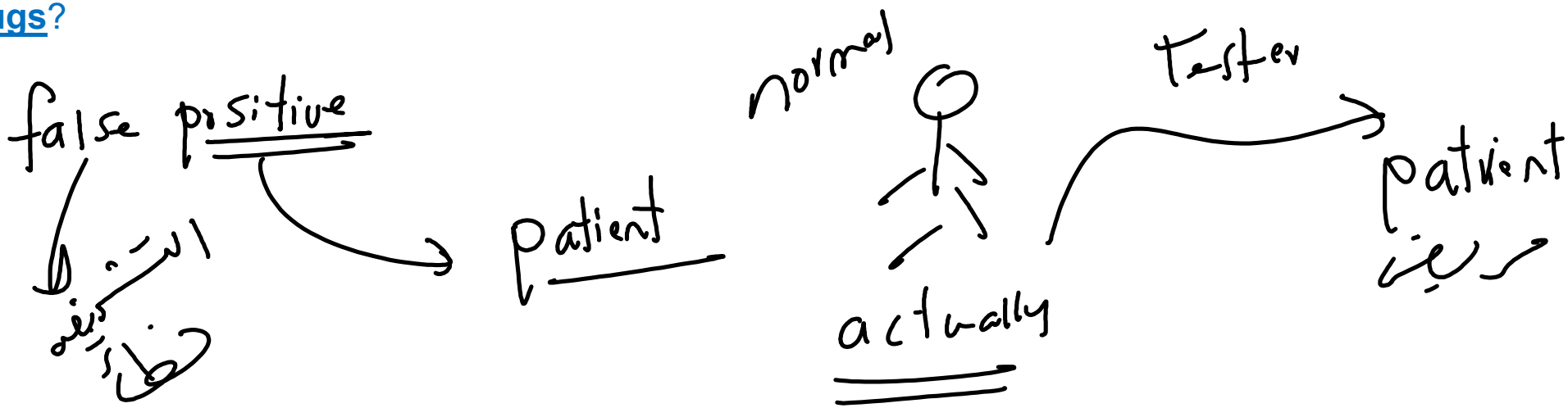
A company screens job applicants for illegal drug use at a certain stage in their hiring process. The specific test they use has a **false positive rate of 2%** and a **false negative rate of 1%**. Suppose that **5% of all their applicants are actually using illegal drugs**, and we randomly select one applicant

Given the **applicant tests positive**, **what is the probability that they are actually on drugs**?



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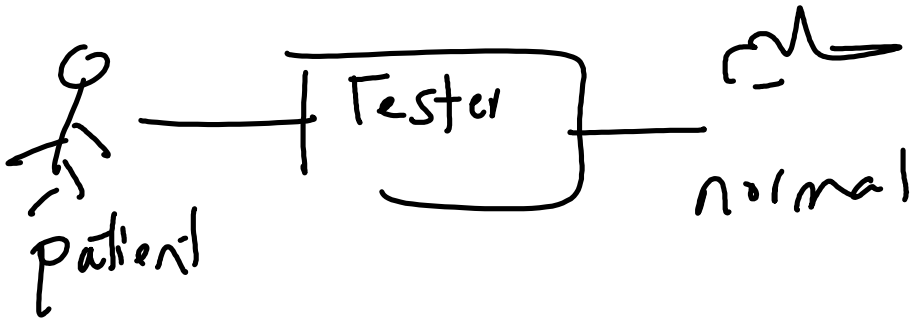
A company screens job applicants for illegal drug use at a certain stage in their hiring process. The specific test they use has a **false positive rate of 2%** and a **false negative rate of 1%**. Suppose that **5% of all their applicants are actually using illegal drugs**, and we randomly select one applicant

Given the **applicant tests positive**, **what is the probability that they are actually on drugs**?

$P(\text{+ve} \mid \text{normal}) = 2\%$

$P(\text{-ve} \mid \text{patient}) = 1\%$

false negative



$P(\text{patient}) = 5\%$

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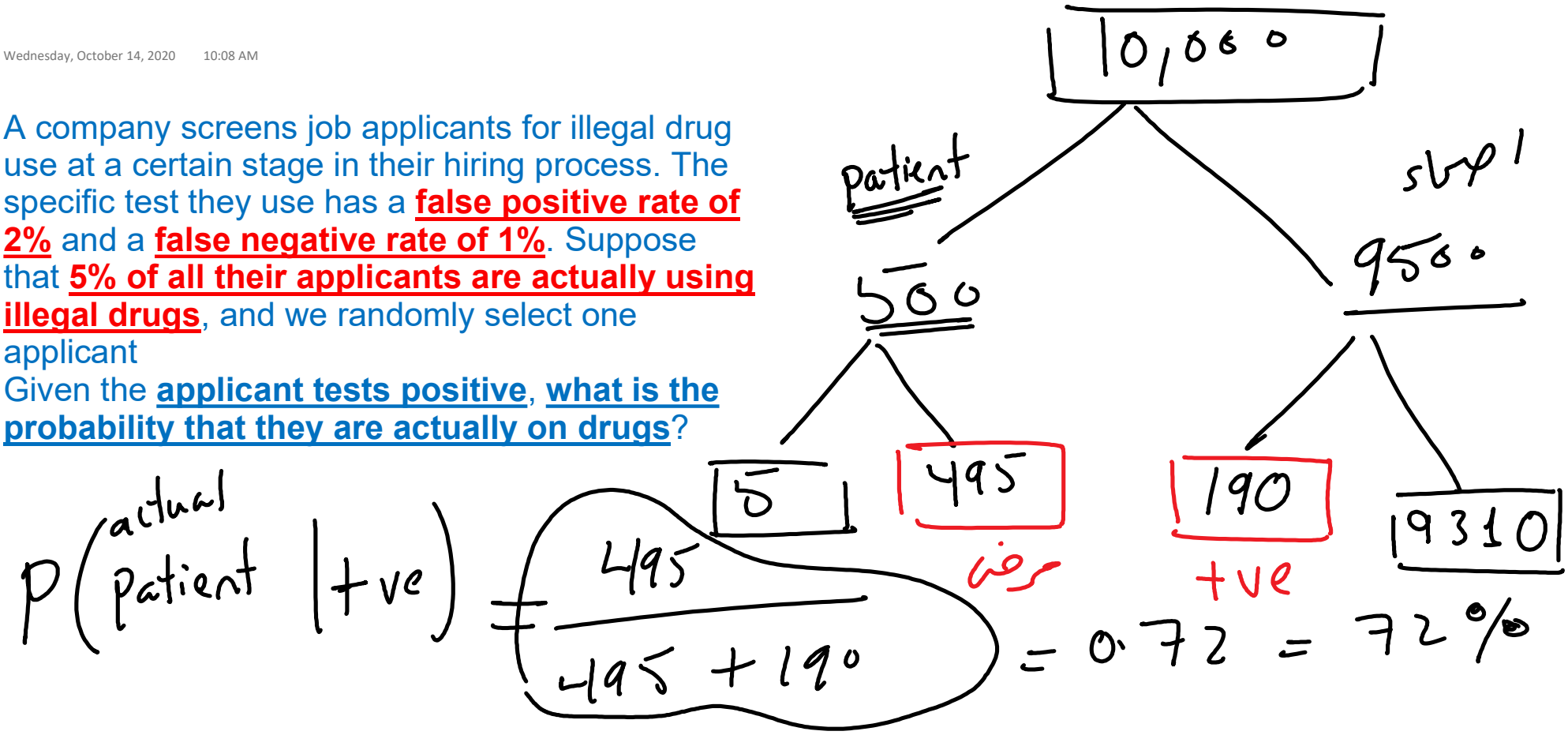

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$$P(\text{actual patient} \mid \text{tve}) = \frac{P(\text{positive} \mid \text{actual patient}) * P(\text{actual patient})}{P(\text{positive})}$$

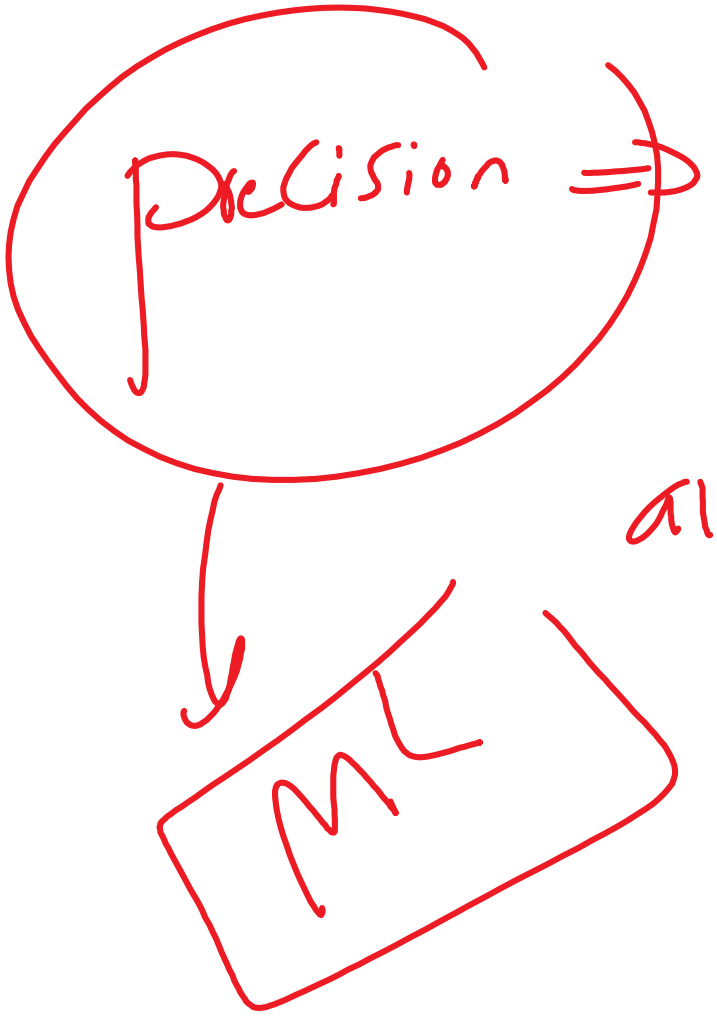
$P(\text{tve} \mid \text{normal}) = 2\%$

$P(-\text{ve} \mid \text{patient}) = 1\%$

$P(\text{patient}) = 5\%$

$$= \frac{0.99 * 0.05}{0.05 * 0.99 + 0.95 * 0.02}$$

$$= 0.72 \rightsquigarrow 72\%$$



How many Samples were actual positive out of all positive predicted Sample

Example 02

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Researchers surveyed 100 students on which superpower they would most like to have. This two-way table displays data for the sample of students who responded to the survey:

Superpower	Male	Female	TOTAL
Fly	26	12	38
Invisibility	12	32	44
Other	10	8	18
TOTAL	48	52	100

A student will be chosen at random.

Find the probability that the student chose to fly as their superpower.

Find the probability that the student was male.

Find the probability that the student was male, given the student chose to fly as their superpower.

$p(\text{fly}) = \frac{38}{100} = 38\%$

$p(\text{male}) = \frac{48}{100}$

$p(\text{male} \mid \text{fly}) = \frac{26}{38} = 68\%$

Example 3

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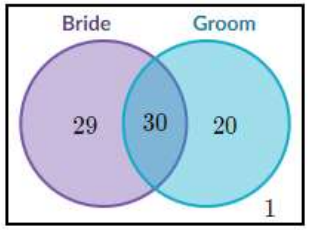
The usher "حاجب" at a wedding asked each of the 80 guests whether they were a friend of the bride "عروس " or of the groom "عريس ". Here are the results:



Given that a randomly selected guest is a friend of the groom, find the probability they are a friend of the bride.

$$P(\text{friend of bride} \mid \text{friend of groom}) = \frac{30}{50} = 60\%$$