

Tuesday, October 23 2018

$P \times P$ (Punnett Square)

	P	P
P	PP	PP
P	Pp	PP

5 babies and none are Tay-Sachs babies?

or more tay Sachs = [not] {exactly 0 T-s babies}

exactly 0 = not T-S Baby 1 and not T-S baby 2 ... not T-S baby 5

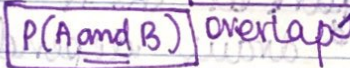
WORKING WITH OR

$P(A \text{ or } B) = P(A) + P(B)$

SPECIAL CASE OF OR

A/B don't overlap (are mutually exclusive)

$P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$

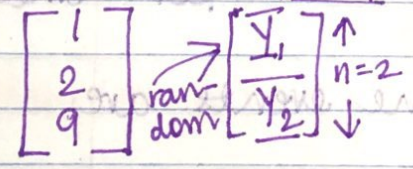


Exactly 0	Exactly 1	Exactly 2	Exactly 3	Exactly 4	Exactly 5
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NOT A

A

WORKING W/ AND



$P(Y_1 = 2 \text{ and } Y_2 = 2) = ?$

CASE 1: at random with replacement (Independent Identically distributed) Making a punnett square.

	1	2	9
1	1,1	1,2	1,9
2	2,1	2,2	2,9
9	9,1	9,2	9,9

ordered pairs

$P(2 \text{ and } 2) = \frac{1}{9}$

$\boxed{Y_1=2}$
 $P(Y_1=2) = \frac{1}{3} = \frac{3}{9}$

$P(Y_2=2) = \frac{1}{3} = \frac{3}{9}$
 (IID)

$\therefore P(Y_1=2 \text{ and } Y_2=2) = P(Y_1=2) \times P(Y_2=2)$
 - works for IID sampling

CASE 2: Simple Random Sampling (SRS) - At Random w/o sampling.

$\begin{bmatrix} 1 \\ 2 \\ 9 \end{bmatrix} \xrightarrow{\text{SRS}} \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix}$ $P(Y_1=2 \text{ and } Y_2=2) = 0$

From previous punnet square
 Q: Does EOM apply to 6 possibilities

First draw:

$P(Y_1=2) = \frac{1}{3} = \frac{2}{6}$

second draw:

$P(Y_2=2) = \frac{1}{3} = \frac{2}{6}$

But $P_{\text{SRS}}(Y_1=2 \text{ and } Y_2=2) = 0$
 But theory doesn't work
 as far as SRS is concerned
 SRS: 2nd draw depends on first draw.

← not possible

CONDITIONAL PROBABILITY
 $P(B \text{ given } A) [P(B|A)]$

$P(B \text{ GIVEN } A) = \frac{P(A \text{ and } B)}{P(A)}$

↑ only if $P(A) \geq 0$

$P(A \text{ and } B) = P(A) \cdot P(B|A) = P(B) \cdot P(B|A)$ ← General

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

Product Rule for and

Special case

IID $P(A \text{ and } B) = P(A) \cdot P(B)$ as the events are independent of each other.

Def. 2 things A and B are independent if information about A does not change chance for B and vice versa.

* If A and B are independent,

$$P(B|A) = P(B)$$

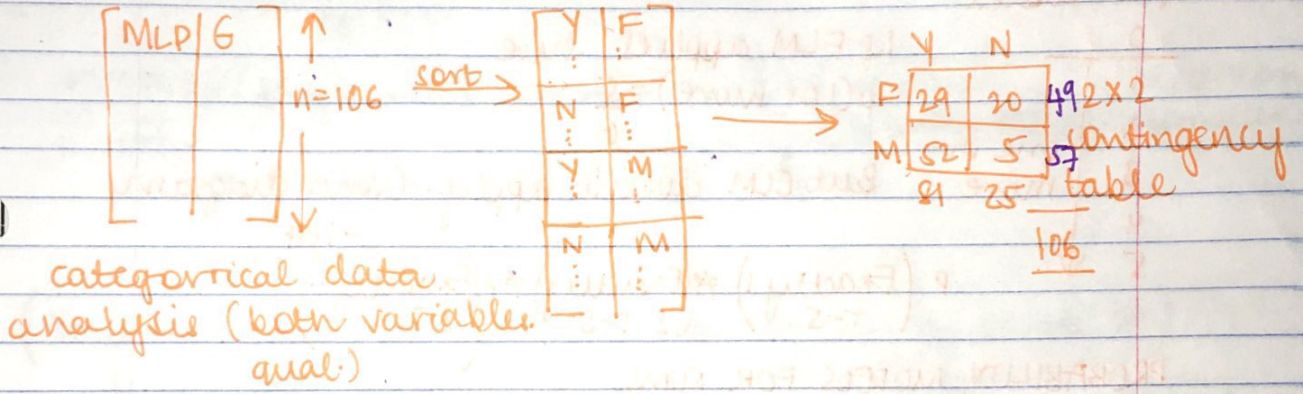
Because A doesn't change B
and $P(A|B) = P(A)$

$$P_{SRS}(Y_1 = 2 \text{ and } Y_2 = 2)$$

$$= P_{SRS}(Y_1 = 2) * P_{SRS}(Y_2 = 2 | Y_1 = 2)$$

$$= \frac{1}{3} * 0 = 0$$

Marijuana legalisation preference studies



Q: Are gender and MLP independent?

A: Imagine choosing a person @ random from 106 people.
 $P(\text{Yes}) = \frac{81}{106}$ } By the equally likely model (as we
 choose total # of people for denominator)

$$P(\text{Yes} | \text{Female}) = \frac{29}{49} = 59\% \text{ conditional probability: specialised data set.}$$

$$P(\text{Yes} | \text{Male}) = \frac{52}{57} \approx 91\%$$

Are in this study gender and MLP are dependent as gender has some change in MLP %.
 Since $91\% \neq 59\% \neq 76\%$
 strongly associated in data set
 G and MLP
 we can say this because the % are so different.