## The HBO cable network took a survey of 500 subscribers to determine people's favourite show. Male Female TOTAL Game of thrones West World Other TOTAL 500

	Male	Female	TOTAL
Game of thrones	80	120	
West World	100	25	
Other	50	125	
TOTAL			500

	Male	Female	TOTAL
Game of thrones	80	120	200
West World	100	25	125
Other	50	125	175
TOTAL	230	270	500

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Game of thrones	80	120	200
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Other	50	125	175
TOTAL	230	270	500
	Male	Female	TOTAL
Game of thrones	0.16	0.24	0.4
West World	0.2	0.05	0.25
Other	0.1	0.25	0.35
TOTAL	0.46	0.54	1

	Male	Female	TOTAL	
Game of thrones	80	120	200	
West World	100	25	125	Joint
Other	50	125	175	probability
TOTAL	230	270	500	probability
	Male	Female	TOTAL	
Game of thrones	0.16	0.24	0.4	
West World	0.2	0.05	0.25	P(Female and GoT)
Other	0.1	0.25	0.35	=0.24
TOTAL	0.46	0.54	1	

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Game of thrones	80	120	200	
West World	100	25	125	Joint
Other	50	125	175	probability
TOTAL	230	270	500	probability
	Male	Female	TOTAL	
Game of thrones	0.16	0.24	0.4	
West World	0.2	0.05	0.25	P(Female ∩ GoT)
Other	0.1	0.25	0.35	=0.24
TOTAL	0.46	0.54	1	ı

Note: Sum of all joint probability values should be equal to one.

$$0.16 + 0.24 + 0.2 + .05 + .1 + .25 = 1$$

	Male	Female	TOTAL	
Game of thrones	80	120	200	
West World	100	25	125	Marginal
Other	50	125	175	probability
TOTAL	230	270	500	probability
图 计图	Male	Female	TOTAL	
Game of thrones	0.16	0.24	0.4	D/CaT)
West World	0.2	0.05	0.25	P(GoT)
Other	0.1	0.25	0.35	=0.4
TOTAL	0.46	0.54	1	

Marginal Probability is also called as Simple Probability.

	Male	Female	TOTAL	
Game of thrones	80	120	200	
West World	100	25	125	
Other	50	125	175	
TOTAL	230	270	500	Marginal
	Male	Female	TOTAL	probability distribution
Game of thrones	0.16	0.24	0.4	
West World	0.2	0.05	0.25	
Other	0.1	0.25	0.35	Sums to 1
TOTAL	0.46	0.54	1	

	Male	Female	TOTAL	
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West World	0.2	0.05	0.25					
Other	0.1	0.25	0.35					
TOTAL	0.46	0.54	. 1					
	See a second of the second of							
Q: What is the p	robabil	ity of an	HBO subscriber being					
male?								
maic:	male:							
P(Male) = 0.46								
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	Male	Female	TOTAL
Game of thrones	0.16	0.24	0.4
West World	0.2	0.05	0.25
Other	0.1	0.25	0.35
TOTAL	0.46	0.54	. 1

Q: What is the probability of an HBO subscriber being male **AND** preferring West World?

 $P(Male \cap West World) = 0.2$ 

	Male	Female	TOTAL
Game of thrones	0.16	0.24	0.4
West World	0.2	0.05	0.25
Other	0.1	0.25	0.35
TOTAL	0.46	0.54	. 1

Q: What is the probability of an HBO subscriber being male OR preferring West World?

Game of thrones West World Other	Male 0.16 0.2 0.1	Female 0.24 0.05 0.25	TOTAL 0.4 0.25 0.35	$P(A \cup B) = P(A) + P(B)$ $-P(A \cap B)$
TOTAL	0.46	0.54	. 1	

Q: What is the probability of an HBO subscriber being male OR preferring West World?

P(Male ∪ West World) =

	Male	Female	TOTAL	
Game of thrones	0.16	0.24	0.4	
West World	0.2	0.05	0.25	$P(A \cup B) = P(A) + P(B)$
Other	0.1	0.25	0.35	$-P(A \cap B)$
TOTAL	0.46	0.54	. 1	

Q: What is the probability of an HBO subscriber being male OR preferring West World?

West World 0.2 Other 0.1	0.25 0.35	probability
TOTAL 0.46	1	

Q: Noni just got an HBO subscription. What is the chance that her favourite show will be Game of Thrones?

Male Female TOTAL 0.24 Game of thrones 0.16 0.4 0.2 0.25 West World 0.05 0.1 0.25 0.35 **Other** TOTAL 0.46 0.54 1

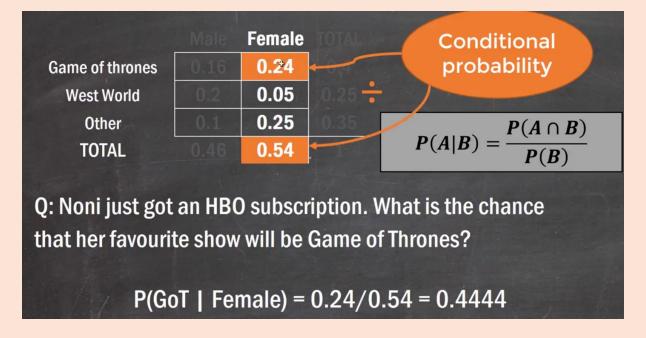
Conditional probability

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

Q: Noni just got an HBO subscription. What is the chance that her favourite show will be Game of Thrones?

		Female	Conditional
Game of thrones	0.16	0.24	probability
West World	0.2	0.05	0.25
Other	0.1	0.25	$P(A \cap B)$
TOTAL		0.54	$P(A B) = \frac{P(A \cap B)}{P(B)}$

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Conditional probability

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

Q: Noni just got an HBO subscription. What is the chance that her favourite show will be Game of Thrones?



Conditional probability distribution

Q: Noni just got an HBO subscription. What is the chance that her favourite show will be Game of Thrones?

	Female	P(Show   Female)	TOTAL	
Game of thrones	0.24	0.444	0.4	Conditional
West World	0.05	0.093	0.25	probability
Other	0.25	0.463	0.35	distribution
TOTAL	0.54	1	1	

Q: Noni just got an HBO subscription. What is the chance that her favourite show will be Game of Thrones?

Male Female TOTAL 0.16 0.24 Game of thrones 0.4 0.2 0.05 0.25 West World **Other** 0.1 0.25 0.35 TOTAL 0.46 0.54

Conditional probability

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

Q: Given that a subscriber's favourite show is West World. What is the probability that they are male?

	Male	Female	TOTAL	Conditional
Game of thrones	0.16	0.24	10,4	probability
West World	0.2	0.05	0.25	
Other	0.1	0.25	0.35	$P(A \cap B)$
TOTAL		0.54	.1	$P(A B) = \frac{P(A \cap B)}{P(B)}$

Q: Given that a subscriber's favourite show is West World. What is the probability that they are male?



Q: Given that a subscriber's favourite show is West World. What is the probability that they are male?

P(Male | West World) = 0.2/0.25 = 0.80

	Male	Female	TOTAL
Game of thrones	0.16	0.24	0.4
West World	0.2	0.05	0.25
Other	0.1	0.25	0.35
TOTAL	0.46	0.54	. 1

	Male	Female	TOTAL	
Game of thrones	0.16	0.24	0.4	If independent then:
West World	0.2	0.05	0.25	I
Other	0.1	0.25	0.35	P(A B) = P(A)
TOTAL	0.46	0.54	. 1	CHARLES LANGE

	Male	Female	TOTAL			
Game of thrones	0.16	0.24	0.4	If independent then:		
West World	0.2	0.05	0.25			
Other	0.1	0.25	0.35	P(A B) = P(A)		
TOTAL	0.46	0.54	1	<b>对对他是是特殊的</b>		
P(West World   Female) = 0.05/0.54 = 0.093 P(West World) = 0.25						
Therefore NOT INDEPENDENT as 0.093 ≠ 0.25						

i.e. The variable gender influences the West World show.

	Male	Female	TOTAL	
Game of thrones	0.16	0.24	0.4	If independent then:
West World	0.2	0.05	0.25	
Other	0.1	0.25	0.35	$P(A \cap B) = P(A) \times P(B)$
TOTAL	0.46	0.54	. 1	THE RESIDENCE

	Male	Female	TOTAL	
Game of thrones	0.16	0.24	0.4	If independent then:
West World	0.2	0.05	0.25	
Other	0.1	0.25	0.35	$P(A \cap B) = P(A) \times P(B)$
TOTAL	0.46	0.54	. 1	Wall of the state

P(West World  $\cap$  Female) = 0.05 P(West World) X P(Female) = 0.54 X 0.25 = 0.14

Therefore NOT INDEPENDENT as  $0.05 \neq 0.14$