Marginal and Conditional Probability Extra Examples:

< Ex > Titanic Data with 1046 passengers: Randomly select a passenger.

	First Class	**Second Class**	**Third Class**	Total
Died	103	146	370	619
Survived	181	115	131	427
Total	284	261	501	1046

(a) Find the probability that the person survived.

P(S) = 427 / 1046 = 0.4082

(b) If the person survived, what is the probability that this person was the first-class passenger?

P(S | F) = ((181/427) / (284/ 1046)) * (284/ 1046) = 0.4239

Marginal and Joint Probabilities

If a probability is based on a single variable, it is a marginal probability. The probability of outcomes for two or more variables is called a joint probability.

> Titanic Data with 1,046 passengers

Contingency Table

Survival Status	Passenger Ticket Class			Total
	First	Second	Third	
Died	103	146	370	619
Survived	181	115	131	427
Total	284	261	501	1046

(a) Find the marginal distribution for Survival Status

Died	Survived	Total
0.592	0.408	1.000

(b) Find the marginal distribution for Passenger Ticket Class.

First	Second	Third	Total
0.271	0.250	0.479	1.000

(c) Find the joint distribution.

Survival Status	Passenger Ticket Class			Total
	First	Second	Third	
Died	0.098	0.140	0.354	0.592
Survived	0.173	0.110	0.125	0.408
Total	0.271	0.250	0.479	1.000

Conditional Probability

The conditional probability of event A given event B is computed as

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

It is useful to think of A as the event/outcome of interest and B as the condition.

< Ex > Titanic Data with 1,046 passengers

Survival Status	Passenger Ticket Class			Total
	First	Second	Third	
Died	103	146	370	619
Survived	181	115	131	427
Total	284	261	501	1046

(a) Find the probability that a randomly selected person is a survived and third class passenger.

P(S & T) = 131 / 1046 = 0.125

(b) If we know that the person was the first-class passenger, what is the probability that this passenger died?

P(F | FD) = ((103 / 1046) / (284/1046))= 0.3627

(c) If we know that the person was the third-class passenger, what is the probability that this passenger died?

P(T | TD) = ((370/ 1046) / (501/1046)) = 0.7385