

Outcome: Apply principles of probability to calculate or verify the chances of an event. [CONCLUDE]

TASK: When the probability of one event occurring changes depending on other events occurring then we say that there is a **conditional probability**.

1. Let the following letters stand for the following.

M = Male

F = Female

C = Going to College

N = Not going to college

	Gender		Total
	Male	Female	
Going to College	16	13	29
Not Going to College	14	9	23
Total	30	22	52

If a person was picked at random, find the probability that the person was

(a) a female, $P(F) = 22/52$

(b) going to college, $P(C) = 29/52$

(c) going to college **given** they are female, $P(C/F) = (C \text{ and } F)/F \rightarrow 13/22$

(d) Which is more likely, that a person picked at random will be going to college, given they are a male, $P(C/M)$, or that a person will be male, given they are going to college, $P(M/C)$. Show that calculations for both.

$$\begin{aligned} P(C/M) \\ &= (C \text{ and } M)/M \\ &= 16/30 \\ &= .533 \end{aligned}$$

$$\begin{aligned} P(M/C) \\ &= (M \text{ and } C)/C \\ &= 16/29 \\ &= .5517 \end{aligned}$$

This is more likely!

2. A survey was taken to examine the relationship between hair color and eye color. The chart below shows the proportion of the people surveyed who fell into each category. If a person was picked at random, find each of the following conditional probabilities. Show the calculation you used.

		Hair Color			Total
		Black	Blond	Red	
Eye Color	Blue	0.15	0.20	0.05	0.40
	Brown	0.25	0.10	0.00	0.35
	Green	0.05	0.05	0.15	0.25
Total		0.45	0.35	0.20	1.00

(a) Find the probability the person picked had brown eyes given they had blond hair.

$$P(\text{brown eyes} \mid \text{blond hair}) \qquad \qquad \qquad \mathbf{(\text{Brown Eyes and Blond Hair}) / \text{Blond Hair}}$$

$$\qquad \qquad \qquad \mathbf{.10 / .35 = .2857}$$

(b) Find the probability the person had red hair given they had green eyes.

$$P(\text{red hair} \mid \text{green eyes}) \qquad \qquad \qquad \mathbf{(\text{Red Hair and Green Eyes}) / \text{Green Eyes}}$$

$$\qquad \qquad \qquad \mathbf{.15 / .25 = .6}$$

3. Three different local hospitals in New York surveyed their patients. The survey asked whether the patient's physician communicated efficiently. The results, given as joint relative frequencies, are shown in the two-way table.

		Location		
		Glens Falls	Saratoga	Albany
Response	Yes	0.123	0.288	0.338
	No	0.042	0.077	0.131

a. What is the probability that a randomly selected patient located in Saratoga was satisfied with the communication of the physician? $\mathbf{.288 / .365 = .789}$

b. What is the probability that a randomly selected patient who was not satisfied with the physician's communication is located in Glens Falls? $\mathbf{.042 / .25 = .168}$