

## 4.5: Two-Way Tables (3 of 5)

### Learning Objectives

- Calculate marginal, joint, and conditional percentages and interpret them as probability estimates.

At this point, we know how to determine *marginal probabilities*, such as the probability that a randomly selected student is female:  $P(\text{female})$ .

And we know how to calculate *conditional probabilities*, such as the probability that a randomly selected female student is in the Health Science program:  $P(\text{Health Science} \mid \text{female})$

But we do not know how to calculate **joint probabilities**, such as the probability that a randomly selected student is both a female *and* in the Health Sciences program.

We write this joint probability as  $P(\text{female and Health Sciences})$ .

The following example illustrates how to calculate a joint probability.

### Example

#### Joint Probability

**Question:** If we select a student at random, what is the probability that the student is both a male **and** in the Info Tech program?

**Answer** This question involves male students who are in the Info Tech program, but it is NOT a conditional probability. We are picking a student at random from the *entire population of 12,000 students*, so there is no condition. Our shorthand notation for this probability is:

$$P(\text{male and Info Tech})$$

Since 564 of the 12,000 students enrolled at the college are both male and in the Info Tech program (see table), the probability  $P(\text{male and Info Tech})$  is:

$$\frac{\text{564}}{\text{12,000}} \approx \text{.05}$$

	Arts-Sci	Bus-Econ	Info Tech	Health Science	Graphics Design	Culinary Arts	Row Totals
Female	4,660	435	494	421	105	83	6,198
Male	4,334	490	<b>564</b>	223	97	94	5,802
Column Totals	8,994	925	1,058	644	202	177	<b>12,000</b>

We call this calculation a **joint probability**. Note that when we calculate a joint probability, we divide the count from an inner cell of the table by the overall total count in the lower right corner.

The following table is used for the next Try It and Did I Get This? activities.

	Arts-Sci	Bus-Econ	Info Tech	Health Science	Graphics Design	Culinary Arts	Row Totals
Female	4,660	435	494	421	105	83	6,198
Male	4,334	490	564	223	97	94	5,802
Column Totals	8,994	925	1,058	644	202	177	12,000

Try It

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