4 Probability

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4.2 Conditional Probability of Events

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Conditional Probability of Events

Many of the probabilities that we see or hear being used on a daily basis are the result of conditions existing at the time. In this section, we will learn about *conditional probabilities*.

Conditional probability an event will occur A conditional probability is the relative frequency with which an event can be expected to occur under the condition that additional, preexisting information is known about some other event.

$P(A \mid B)$ is used to symbolize the probability of event A occurring under the condition that event B is known to already exist.

Conditional Probability of Events

Some ways to say or express the conditional probability, $P(\text{A} \mid \text{B})$, are:

1st: The "*probability of* A, *given* B"

2nd: The "*probability of* A, *knowing* B"

3rd: The "*probability of* A *happening, knowing* B *has already occurred*"

Conditional Probability of Events

The concept of conditional probability is actually very familiar and occurs very frequently without our even being aware of it.

The news media often report many conditional probability values. However, they don’t make the point that it is a conditional probability and it simply passes for everyday arithmetic.

Example 10 – *Finding Probabilities from a Table of Count Data*

From a nationwide exit poll of 1000 voters in 25 precincts across the country during the 2008 presidential election, we have the following:

Education	Number for Obama	Number for McCain	Number for Others	Number of Voters
No high school	19	20	1	40
HS graduate	114	103	3	220
Some college	172	147	1	320
College grad	135	119	6	260
Postgraduate	70	88	2	160
	510	477	13	1000

Example 10 – *Finding Probabilities from a Table of Count Data*

cont'd

One person is to be selected at random from the above sample of 1000 voters. Using the table, find the answers to the following probability questions.

1. What is the probability that the person selected voted for McCain, knowing that the voter is a high school graduate?

   Answer: 103/220 = 0.46818 = 0.47.

   Expressed in equation form:
   P(McCain | HS graduate) =103/220 = 0.46818 = <u>0.47</u>

Example 10 – *Finding Probabilities from a Table of Count Data*

cont'd

2. What is the probability that the person selected voted for Obama, given that the voter has some college education?

Answer: 172/320 = 0.5375 = 0.54.

Expressed in equation form:

P(Obama | some college) = 172/320 = 0.5375 = <u>0.54</u>

Example 10 – *Finding Probabilities from a Table of Count Data*

cont'd

3. Knowing the selected person voted for McCain, what is the probability that the voter has a postgraduate education?

Answer: 88/477 = 0.1844 = 0.18.

Expressed in equation form:

$P(\text{postgraduate} \mid \text{McCain}) = 88/477 = 0.1844 = \underline{0.18}$

Example 10 – *Finding Probabilities from a Table of Count Data*

cont'd

4. Given that the selected person voted for Obama, what is the probability that the voter does not have a high school education?

Answer: 19/510 = 0.0372 = 0.04.

Expressed in equation form:

P(no high school | Obama) = 19/510 = 0.0372 = <u>0.04</u>

Conditional Probability of Events

Notes

1. The conditional probability notation is very informative and useful. When you express a conditional probability in equation form, it is to your advantage to use the most complete notation—that way, when you read the information back, all the information is there.

2. When finding a conditional probability, some of the possibilities will be eliminated as soon as the condition is known.

Conditional Probability of Events

Consider question 4 in Example 4.10. As soon as the conditional “given that the selected person voted for Obama” is stated, the 477 who voted for McCain and the 13 voting for Others are eliminated, leaving the 510 possible outcomes.