# 12.2 – Conditional Probability

# Conditional Probability

- Conditional Probability contains a condition that may limit the sample space for an event.
- You can write a conditional probability using the notation

$$P(B|A)$$

- This reads "the probability of event B, given event A"

# Conditional Probability

The table shows the results of a class survey.
Find *P*(own a pet | female)

Do you own a pet?

| | yes | no |
|---|---|---|
| female | 8 | 6 |
| male | 5 | 7 |

14 females;
13 males

The condition female limits the sample space to 14 possible outcomes.

Of the 14 females, 8 own a pet.

Therefore, *P*(own a pet | female) equals $\frac{8}{14}$.

# Conditional Probability

The table shows the results of a class survey.
Find *P*(wash the dishes | male)

Did you wash the dishes last night?

| | yes | no |
|---|---|---|
| female | 7 | 6 |
| male | 7 | 8 |

13 females;
15 males

The condition male limits the sample space to 15 possible outcomes.

Of the 15 males, 7 did the dishes.

Therefore, *P*(wash the dishes | male) $\frac{7}{15}$

# Let’s Try One

Using the data in the table, find the probability that a sample of not recycled waste was plastic. *P*(plastic | non-recycled)

The given condition limits the sample space to non-recycled waste.

A favorable outcome is non-recycled plastic.

| Material | Recycled | Not Recycled |
|---|---|---|
| Paper | 34.9 | 48.9 |
| Metal | 6.5 | 10.1 |
| Glass | 2.9 | 9.1 |
| Plastic | 1.1 | 20.4 |
| Other | 15.3 | 67.8 |

$$P(\text{plastic} \mid \text{non-recycled}) = \frac{20.4}{48.9 + 10.1 + 9.1 + 20.4 + 67.8}$$

$$= \frac{20.4}{156.3}$$

$$\approx 0.13$$

The probability that the non-recycled waste was plastic is about 13%.

# Conditional Probability Formula

- For any two events A and B from a sample space with P(A) does not equal zero

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

# Conditional Probability

Researchers asked people who exercise regularly whether they jog or walk. Fifty-eight percent of the respondents were male. Twenty percent of all respondents were males who said they jog. Find the probability that a male respondent jogs.

Relate: $P(\boxed{\text{male}}) = 58\%$

$P(\boxed{\text{male}} \text{ and } \boxed{\text{jogs}}) = 20\%$

Define: Let $\boxed{A}$ = male.

Let $\boxed{B}$ = jogs.

Write: $P(\boxed{A} | \boxed{B}) = \dfrac{P(\boxed{A} \text{ and } \boxed{B})}{P(\boxed{A})}$

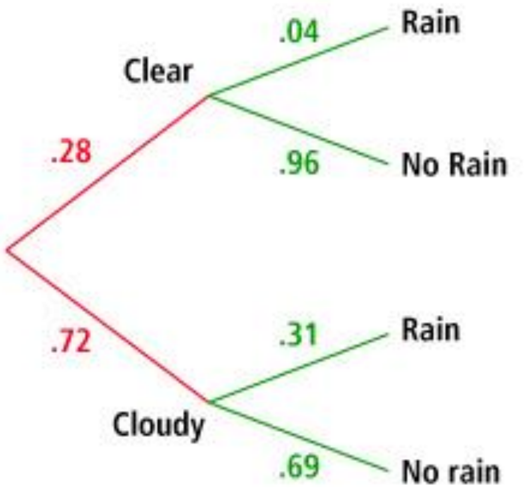
$= \dfrac{0.2}{0.58}$ Substitute 0.2 for $P(A \text{ and } B)$ and 0.58 for $P(A)$.

$\approx 0.344$ Simplify.

The probability that a male respondent jogs is about 34%.

# Using Tree Diagrams

Jim created the tree diagram after examining years of weather observations in his hometown. The diagram shows the probability of whether a day will begin clear or cloudy, and then the probability of rain on days that begin clear and cloudy.




**a.** Find the probability that a day will start out clear, and then will rain.

The path containing clear and rain represents days that start out clear and then will rain.

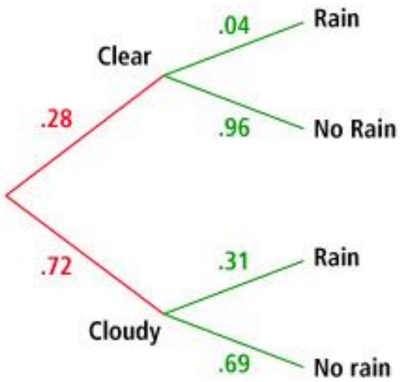
$$\begin{aligned} P(\text{clear and rain}) &= P(\text{rain} \mid \text{clear}) \cdot P(\text{clear}) \\ &= 0.04 \cdot 0.28 \\ &= 0.011 \end{aligned}$$

The probability that a day will start out clear and then rain is about 1%.

# Conditional Probability

**(continued)**

**b.** Find the probability that it will not rain on any given day.




The paths containing clear and no rain and cloudy and no rain both represent a day when it will not rain. Find the probability for both paths and add them.

$P$(clear and no rain) + $P$(cloudy and no rain) =
$P$(clear) • $P$(no rain | clear) + $P$(cloudy) • $P$(no rain | cloudy)
= 0.28(.96) + .72(.69)
= 0.7656

The probability that it will not rain on any given day is about 77%.

# Let's Try One

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- A survey of Pleasanton Teenagers was given.
  - 60% of the responders have 1 sibling; 20% have 2 or more siblings
  - Of the responders with 0 siblings, 90% have their own room
  - Of the respondents with 1 sibling, 20% do not have their own room
  - Of the respondents with 2 siblings, 50% have their own room

Create a tree diagram and determine

A) $P$(own room | 0 siblings)

B) $P$(share room | 1 sibling)

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