4.4 Conditional Probability pg231
Warm up

1) a) What is the number of cards that are either even numbers or clubs, in a standard deck of cards?

b) What is the probability of picking such a card from a standard deck?

Solution:

a) Use $n(E \cup C) = n(E) + n(C) - n(E \cap C)$

$= n(\text{even}) + n(\text{clubs}) - n(\text{even clubs})$

$= 20 + 13 - 5$

$= 28$

b) Probability?

$P(E \cup C) = 28/52 = 7/13$

4.4 Conditional Probability pg231

Chapter 4 – Dealing with Uncertainty

Learning Goal: Calculate probabilities when one event is affected by another

Definition of Conditional Probability

- The **conditional probability** of event B, given that event A has occurred, written as

  P(B | A) is given by:

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

- Therefore, conditional probability deals with determining the probability of an event given that another event has already happened.

Example 1

- The probability that it snows Saturday and Sunday is 0.2. The probability that it snows Saturday is 0.8. What is the probability that it snows Sunday given that it snowed Saturday?

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{0.2}{0.8} = 0.25$$

Multiplication Law for Conditional Probability

- The probability of events A and B occurring, given that A has occurred, is given by

$$P(A \cap B) = P(B|A) \times P(A)$$

Use to find $P(A \cap B)$ given $P(B|A)$ and $P(A)$.

Example 2

What is the probability of drawing 2 face cards in a row from a deck of 52 playing cards if the first card is not replaced?

$P(B \cap A) = P(B \mid A) \times P(A)$

$P(2^{nd}\ FC \cap 1^{st}\ FC) = P(2^{nd}\ FC \mid 1^{st}\ FC) \times P(1^{st}\ FC)$

$= 11/51 \times 12/52$

$= 132/2652$

$= 11/221 \doteq 0.0498 \doteq 5\%$

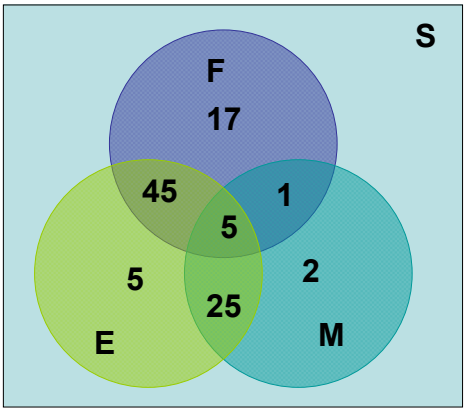
Example 3

- 100 Students surveyed
- **Refer to yesterday's Venn diagram.**
- **What is the probability that a student takes Mathematics given that he or she also takes English?**

Course Taken	No. of students
English	80
Mathematics	33
French	68
English and Mathematics	30
French and Mathematics	6
English and French	50
All three courses	5

Example 3 – Venn Diagram

What is the probability that a student takes Mathematics given that he or she also takes English?



Another Example (continued)

- To answer the question, we need to find P(Math | English).

- We know...

$$\mathbf{P(Math \mid English) = \frac{P(Math \cap English)}{P(English)}}$$

- Therefore…

P(Math | English) = 0.3/0.8=3/8= 0.375=37.5%

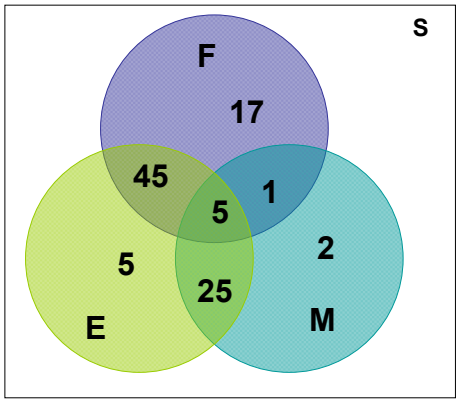
Example 4

a) How many students are enrolled in French given that they are also enrolled in english?

n(F|E) = n(F∩E) = 50

b) What is the P(F|E)?

=n(F|E)/n(E)
=50/80=5/8=0.625=62.5%



4.4 Classwork/Homework Assessment:

- Pg235 #1-5,7,8,10-14.
- RAMN 4.5