Connexions module: m16844

Probability Topics: Teacher's Guide*

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Abstract

This module serves as the complementary teacher's guide for the Probability Topics chapter of the Elementary Statistics textbook/collection.

The best way to introduce the terms is through examples. You can introduce the terms experiment, outcome, sample space, event, probability, equally likely, conditional, mutually exclusive events, and independent events AND you can introduce the addition rule, the multiplication rule with the following example: In a box (you cannot see into it), there are are 4 red cards numbered 1, 2, 3, 4 and 9 green cards numbered 1, 2, 3, 4, 5, 6, 7, 8, 9. You randomly draw one card (experiment). Let R be the event the card is red. Let R be the event the card is green. Let R be the event number on it.

Example 1

Event Card Example

- 1. List all possible outcomes (the sample space). Have students list the sample space in the form $\{R1,\ R2,\ R3,\ R4,\ G1,\ G2,\ G3,\ G4,\ G5,\ G6,\ G7,\ G8,\ G9\}$. Each outcome is equally likely. Plane outcome $=\frac{1}{13}$.
- 2. Find P(R).
- 3. Find P(G) . G is the complement of R. P(G) + P(R) =_____.
- 4. P (red card given a that the card has an even number on it) $= P(R \mid E)$. This is a conditional. Pick the red card out of the even cards. There are 6 even cards.
- 5. Find P(R AND E). (Multiplication Rule: $P(R \text{ and } E) = P(E \mid R)(P(R))$
- 6. P(R OR E). (Addition Rule: P(R OR E) = P(E) + P(R) P(E AND R))
- 7. Are the events R and G mutually exclusive? Why or why not?
- 8. Are the events G and E independent? Why or why not?

Example 2

(Optional Topic) A Venn diagram is a tool that helps to simplify probability problems. Introduce a Venn diagram using an example. Example: Suppose 40% of the students at ABC College belong to a club and 50% of the student body work part time. Five percent of the student body works part time and belongs to a club.

Have the students work in groups to draw an appropriate Venn diagram after you have shown them what a Venn diagram basically looks like. The diagram should consist of a rectangle with two overlapping circles. One rectangle represents the students who belong to a club (40%) and the

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other circle represents those students who work part time (50%). The overlapping part are those students who belong to a club and who work part time (5%).

Find the following:

- 1. P(student works part time but does not belong to a club)
- 2. P(student belongs to a club given that the student works part time)
- 3. P(student does not belong to a club)
- 4. P(works part time given that the student belongs to a club)
- 5. P(student belongs to a club or the student works part time)

Solution

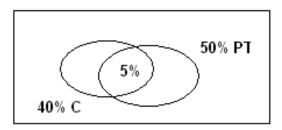


Figure 1

 ${\bf C}$ - student belongs to a club

PT - student works part time

Example 3

Find the following:

- 1. P(a child is 9 11 years old)
- 2. P(a child prefers regular soccer camp)
- 3. P(a child is 9 11 years old and prefers regular soccer camp)
- 4. P(a child is 9 11 years old or prefers regular soccer camp)
- 5. P(a child is over 14 given that the child prefers micro soccer camp)
- 6. P(a child prefers micro soccer camp given that the child is over 14)

Tree Diagrams (Optional Topic)

A **tree** is another probability tool. Many probability problems are simplified by a tree diagram. To exemplify this, suppose you want to draw two cards, one at a time, **without replacement** from the box of 4 red cards and 9 green cards.

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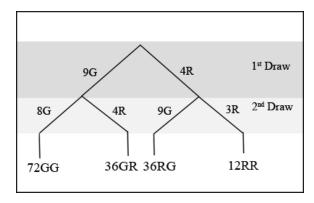


Figure 2: There are (13)(12) = 156 Possible Outcomes. (ex. R1R1, R1R2, R1G3, G3G4, etc.)

Example 4

Find the following:

- 1. P(RR)
- 2. P(RG or GR)
- 3. P(at most one G in two draws)
- 4. P(G on the 2nd draw|R on the 1st draw). The size of the sample space has been reduced to 12 + 36 = 481.
- 5. P(no R on the 1st draw)

Introduce **contingency tables** as another tool to calculate probabilities. Let's suppose an owner of a soccer camp for children keeps information concerning the type of soccer camp the children prefer and their ages. The data is for 572 children.

| Type of Soccer Camp Preference | Under 6 | 6-8 | 9-11 | 12-14 | Over 14 | Row Total |
|--------------------------------|---------|-----|------|-------|---------|-----------|
| Micro | 42 | 76 | 46 | 25 | 10 | 199 |
| Regular | 8 | 68 | 92 | 105 | 100 | 373 |
| Column Total | 50 | 144 | 138 | 130 | 110 | 572 |

Table 1

Assign Practice

Assign Practice 1^1 and Practice 2^2 in class. Have students work in groups.

Assign Lab

The Probability Lab is an excellent way to cement many of the ideas of probability. The lab is a group effort (3 - 4 students per group).

Assign Homework

Assign Homework³. Suggested problems: 1 - 15 odds, 19, 20, 21, 23, 27, 28 - 30.

 $[\]hbox{1"Probability Topics: Practice"$} < \\ \hbox{$http://cnx.org/content/m16839/latest/}>$

 $^{^2}$ "Probability Topics: Practice II" < http://cnx.org/content/m16840/latest/> 3 "Probability Topics: Homework" < http://cnx.org/content/m16836/latest/>