Time Frame: 50 minutes

Subject Matter: The Multiplication Rules of Probability **TELL ME**

Anticipatory Set:

* If two cards are selected from a deck of cards with replacement, find these probabilities.
1. Both are spades.
2. Both are same suit.
3. Both are kings.

Objective: TSWBAT find the probability of compound events using the multiplication rule # 2.

Standards: DA – 1.1, 1.2, & 1.5

Materials: Textbook, O.H.P. & Transparencies

**SHOW ME**

Presentation of Information:

Definition of Term:

When the outcome or occurrence of the first event affects the outcome or occurrence of the second event in such a way that the probability is changed, the events are said to be ***dependent events***.

Examples of dependent events

1. Drawing a card from a deck, not replacing it, and then drawing a second card.
2. Selecting a ball from an urn, not replacing it, and then selecting a second ball.
3. Being a lifeguard and getting a suntan.
4. Having high grades and getting a scholarship.
5. Parking in a no-parking zone and getting a ticket.

**Example 1:**

 If two cards are drawn from a deck without replacement, find the probability of getting an ace and a queen.

 Solution:

* ***P(ace*** and ***queen) = P(ace)*** $×$ ***P(queen)*** $= \frac{4}{52}×\frac{4}{51}= \frac{16}{2652}= \frac{4}{663}$
* **Multiplication Rule # 2**

When two events A and B are dependent, the probability of both occurring is

***P(A*** and ***B) = P(A)*** $×$ ***P(B*|*A)***

* The notation ***P(B*|*A)*** is called conditional probability.
* It doesn’t mean that ***B*** is divided by ***A***; rather it means that event ***B*** occurs given that event ***A*** has already occurred.

**Example 2:**

 A person owns a collection of 30 CD’s, of which 5 are country music. If 2 CD’s are selected at random, find the probability that both are country music.

 Solution:

1. Rule: ***P(A*** and ***B) = P(A)*** $×$ ***P(B*|*A)***
2. ***P(C1*** and ***C2) = P(C1)*** $×$ ***P(C2)*** $= \frac{5}{30}×\frac{4}{29}= \frac{20}{870}= \frac{2}{87}$

**Example 3:**

 The World Wide Insurance Company found that 53% of the residents of a city had homeowner’s insurance with the company. Of these clients, 27% had automobile insurance with the company. If a resident is selected at random, find the probability that the resident has both homeowner’s and automobile insurance with the World Wide Insurance Company.

 Solution:

1. Rule: ***P(H*** and ***A) = P(H)*** $×$ ***P(A*|*H)***
2. ***P(H*** and ***A)*** $= 0.53×0.27= 0.1431$

**Example 3:**

 Three cards are drawn from an ordinary deck of cards and not replaced. Find the probability of these.

1. Getting three jacks.
2. Getting an ace, king, and a queen in order.
3. Getting a club, a spade, and a heart in order.
4. Getting three clubs.

 Solution:

* ***P(3 jacks)*** $= \frac{4}{52}×\frac{3}{51}× \frac{2}{50}= \frac{24}{132,600}= \frac{1}{5525}$
* ***P(ace*** and ***king*** and ***queen)*** $= \frac{4}{52}×\frac{4}{51}× \frac{4}{50}= \frac{64}{132,600}= \frac{8}{16,575}$
* ***P(club*** and ***spade*** and ***heart)*** $= \frac{13}{52}×\frac{13}{51}× \frac{13}{50}= \frac{2197}{132,600}= \frac{169}{10,200}$
* ***P(3 clubs)***$ = \frac{13}{52}×\frac{12}{51}× \frac{11}{50}= \frac{1716}{132,600}= \frac{11}{850}$

**Example 4:**

Box 1 contains 2 red balls and 1 blue ball. Box 2 contains 3 blue balls and 1 red ball. A coin is tossed. If it falls heads up, box 1 is selected and a ball is drawn. If it falls tails up, box 2 is selected and a ball is drawn. Find the probability of selecting a red ball

$$= \frac{1}{2}×\frac{2}{3}= \frac{2}{6}$$

 Solution:

$$\frac{2}{3}$$

***Red Ball***

$$= \frac{1}{2}×\frac{1}{3}= \frac{1}{6}$$

$$\frac{1}{2}$$

***Box1***

$$\frac{1}{3}$$

***Blue Ball***

***P(B1)***

$$= \frac{1}{2}×\frac{1}{4}= \frac{1}{8}$$

$$\frac{1}{4}$$

***Red Ball***

$$= \frac{1}{2}×\frac{3}{4}= \frac{3}{8}$$

$$\frac{1}{2}$$

***Box2***

***P(B2)***

$$\frac{3}{4}$$

***Blue Ball***

Finally**, use the addition rule,** since a red ball can be obtained from ***Box1*** **or *Box2*.**

***P(red balls)***$ = \frac{2}{6}+\frac{1}{8}= \frac{2}{6}\*\frac{4}{4}+\frac{1}{8}\*\frac{3}{3}=\frac{8}{24}+\frac{3}{24}=\frac{11}{24}$

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**LET ME TRY**

1. Three cards are drawn from a deck *without* replacement. Find these probabilities.
	1. All are queens.
	2. All are hearts.
	3. All are red cards.
2. In a scientific study there are 8 guinea pigs, 5 of which are pregnant. If three are selected at random without replacement, what is the probability that all are pregnant?
3. In problem # 2, find the probability that none are pregnant.
4. In a class containing 12 men and 18 women, 2 students are selected at random to give an impromptu speech. Find the probability that both are women.
5. In problem # 4, find the probability that both speeches are given by men.

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**HOMEWORK**

1. If two cards are selected from a deck of cards without replacement, find these probabilities.
2. Both are spades.
3. Both are same suit.
4. Both are kings.
5. An automobile manufacturer has three factories, **A, B,** and **C**. They produce 50%, 30%, and 20%, respectively, of a specific model of a car. Thirty percent of the cars produced in factory A are white, 40% of those produced in factory B are white, and 25% produced in factory C are white. If an automobile produced by the company is selected at random, find the probability that it is white.