UNIT 6 – LESSON 3 INDEPENDENT & DEPENDENT EVENTS

Independent Events = Two events, A and B, are independent if the probability of A does not affect the probability of B

Dependent Events = Two events, A and B, are dependent if the outcome of the first affects the outcome of the second

PROBABILITY FORMULAS:

Independent Events P (A and B) = P (A) * P (B)

Dependent Events P (A and B) = P (A) · P (B|A) (last notation reads "probability of event B given A")

Rule of Addition P (A or B) = P (A) + P (B) – P (A and B)

To determine if two events are independent:

Use the Independent Event Probability formula: P(A and B) = P(A) * P(B)

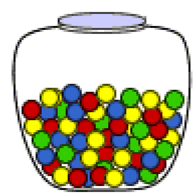
Example 1) P(A) = 0.25, P(B) = 0.40, P(A and B) = 0.65

If we multiply P(A) * P(B) and it equals P(A and B), then the events are independent

0.25 * 0.40 = 0.1 which DOES NOT EQUAL P(A and B) and the events ARE NOT independent

Example 2) Independent Event

Experiment: A jar contains 3 red, 5 green, 2 blue and 6 yellow marbles. A marble is chosen at random from the jar. After replacing it, a second marble is chosen. What is the probability of choosing a green and then a yellow marble?



Probabilities: P(green) $= \frac{5}{16}$

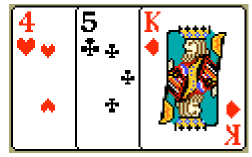
P(yellow) $= \frac{6}{16}$

P(green and yellow) = P(green) * P(yellow)

$\frac{5}{16} * \frac{6}{16} = \frac{30}{256} = \frac{15}{128}$ = 11.7%

Example 3) Dependent Event

Experiment: A card is chosen at random from a standard deck of 52 playing cards. Without replacing it, a second card is chosen. What is the probability that the first card chosen is a queen and the second card chosen is a jack?



Probabilities: P(queen on first pick) $= \frac{4}{52}$

P(jack on 2nd pick given queen on 1st pick) $= \frac{4}{51}$

P(queen and jack) = $\frac{4}{52} * \frac{4}{51} = \frac{16}{2652} = \frac{4}{663}$ = 0.6%

Example 4) Using the Rule of Addition

A local coffee house surveyed 317 customers regarding their preference of chocolate chip or cranberry walnut scones.

- 150 customers prefer the Cranberry Walnut Scones.
- 81 customers who responded were males and prefer the Chocolate Chip Scones.
- 172 female customers responded.

Find the probability that a customer chosen at random will be a male or prefer the Chocolate Chip Scones.

Make a table to display the data. Notice – this is not an example of MUTUALLY EXCLUSIVE events. A customer chosen at random could possibly be a female and prefer Buffalo Chicken pizza.

- 150 customers prefer the Cranberry Walnut Scones; 317 – 150 = **167 customers prefer the chocolate chip scone**
- 172 female customers responded; 317 – 172 = **145 male customers**
- 81 customers who responded were males and prefer the Chocolate Chip Scones; 145 – 81 = **64 male customers who prefer the cranberry-walnut scone**

	Chocolate Chip	**Cranberry-Walnut**	**Total**
Male	81	**64**	**145**
Female	86	86	172
Total	167	150	317

The probability of events that are not mutually exclusive is found using

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

Let A = male and let B = chocolate chip scone

$$\begin{aligned} P(A \text{ or } B) &= P(A) + P(B) - P(A \text{ and } B) \\ &= \frac{145}{317} + \frac{167}{317} - \frac{81}{317} \\ &= \frac{231}{317} \\ &\approx 72.9\% \end{aligned}$$