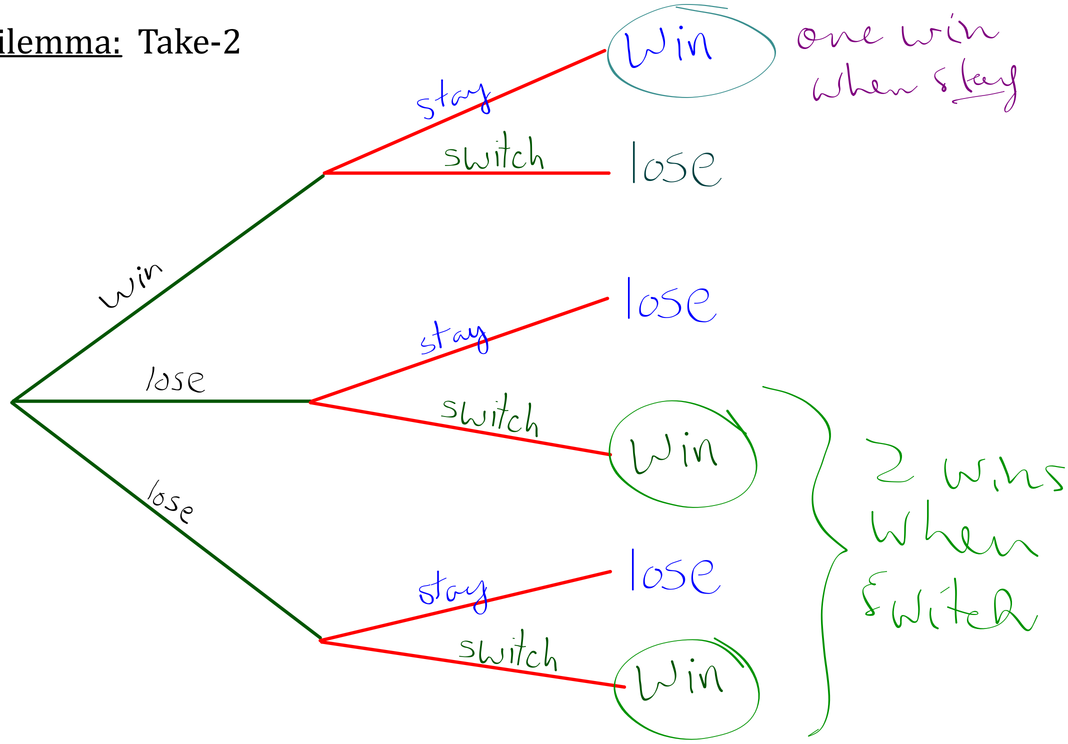
Monty Hall dilemma: Take-2



Answers: A) independent; B) Dependent; C) P(A) = 0,7 P(B) = 0.444; D) 0.311
E) P(C) = 11/19 P(D) = 10/18 F) 0.322 G) NOT the same!!! In this case, the dependent one is higher, maybe because there are more red marbles to begin with? Repeat with the blue marbles. What do you notice?

H. Two events are independent if the probability of one event has no bearing on the probability of the other event. Otherwise, the events are dependent.

I. Drawing both marbles at the same time shouldn't change the probability of drawing two red, as it's the same as drawing two marbles one at a time, without replacement. In both cases, when determining probability, you have to consider the probability for the "first" marble, and then the probability for the "second" marble. However, it doesn't matter which marble you consider as being "first," as the numerator and denominator of the resulting product will be the same.

J. Since events A and B are independent, event A has no bearing on the probability of event B, so $P(B) = P(B \mid A)$. You could use this formula

5.6 Indendent Events

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EXAMPLE 1 Determining probabilities of independent events

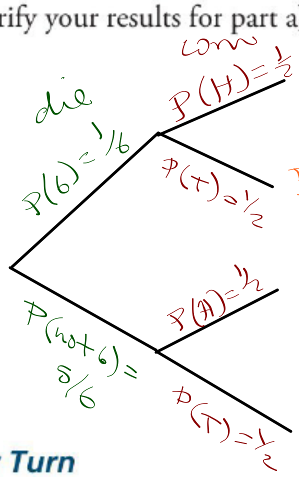
Mokhtar and Chantelle are playing a die and coin game. Each turn consists of rolling a regular die and tossing a coin. Points are awarded for rolling a 6 on the die and/or tossing heads with the coin:

- 1 point for either outcome
- 3 points for both outcomes
- 0 points for neither outcome

Players alternate turns. The first player who gets 10 points wins.

a) Determine the probability that Mokhtar will get 1, 3, or 0 points on his first turn.

b) Verify your results for part a). Explain what you did.



$P(6 \cap H) = \frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$ $P(3 \text{ points})$

$P(6 \cap T) = \frac{1}{12}$

$P(\text{not } 6 \cap H) = \frac{5}{6} \cdot \frac{1}{2} = \frac{5}{12}$

$P(1 \text{ point}) = \frac{1}{12} + \frac{5}{12} = \frac{6}{12} = \frac{1}{2}$

$P(\text{not } 6 \cap T) = \frac{5}{6} \cdot \frac{1}{2} = \frac{5}{12}$ $P(\text{no points})$

$\text{total} = \frac{12}{12}$

Your Turn

a) Are you more likely to get points or not get points on each turn? Explain.

b) Would the probabilities determined for Mokhtar's first turn change for his next turn? Explain.

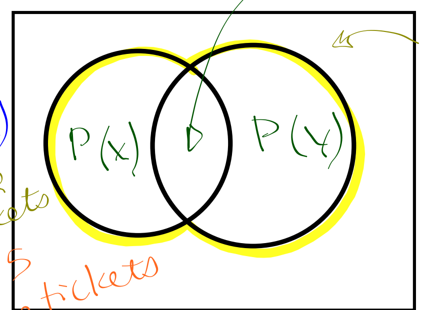
a) more likely $P(\text{points}) = \frac{6}{12} + \frac{1}{12} = \frac{7}{12}$

b) no consecutive turns are independent

EXAMPLE 2 Solving a problem that involves independent events using a graphic organizer

All 1000 tickets for a charity raffle have been sold and placed in a drum. There will be two draws. The first draw will be for the grand prize, and the second draw will be for the consolation prize. After each draw, the winning ticket will be returned to the drum so that it might be drawn again. Max has bought five tickets. Determine the probability, to a tenth of a percent, that he will win at least one prize.

$P(X \cap Y)$



P(lose)

no prize

$P\left(\begin{matrix}\text{at least}\\ \text{one prize}\end{matrix}\right) = 1 - P(\text{no prize})$

I have 5 tickets

$\therefore$ 995 losing tickets

$P(\text{no prize}) = \frac{995}{1000} \cdot \frac{995}{1000}$

$= \frac{199}{200} \cdot \frac{199}{200}$

100%

$P(\text{at least 1 win}) = 1 - \left(\frac{199}{200}\right)^2$

$= 1 - 0.990025$

$= 0.009975$

$\approx 1\%$

OR directly

$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$

Your Turn

Suppose that the rules for the raffle are changed, so the first ticket drawn is not returned to the drum before the second draw.

a) Are the events winning the grand prize and winning the consolation prize dependent or independent?

b) Do you think Max's probability of winning at least one prize will be greater or less than before? Justify your answer.

→ since there are fewer losing tickets left after the 1st draw

Practice: pg. 360 # 5, 7, 8, 10, 11, 13, 14, 16