FOM 12

5.6 – Independent Events

If the outcome of event *B* does not depend in any way on the outcome of event *A*, then the events *A* and *B* are **Independent Events**. (Example: two coin tosses and rolling dice)

Two events are independent if (and only if) the product of their individual probabilities is equal to the probability of both events happening. $P(A \text{ and } B) = P(A) \cdot P(B)$

Example 1: What is the probability of rolling an even number on a six-sided die and getting tails on a coin toss?

Independent events ∴

$$P(\text{even} \cap \text{tails}) = P(\text{even}) \times P(\text{tails})$$
$$= \frac{3}{6} \times \frac{1}{2}$$
$$= \frac{3}{12} = \boxed{\frac{1}{4}}$$

Example 2: If a pregnant woman is equally likely to have a girl or a boy.

a) What is the probability that a woman who is planning on having three children will have all girls?

Independent!

$$P(GGG) = P(G) \cdot P(G) \cdot P(G)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \boxed{\frac{1}{8}}$$

b) What is the probability of the woman having at least one girl?

$$P(\text{at least 1 girl}) = P(G) + P(GG) + P(GGG)$$

OR $= 1 - P(\text{No girls})$

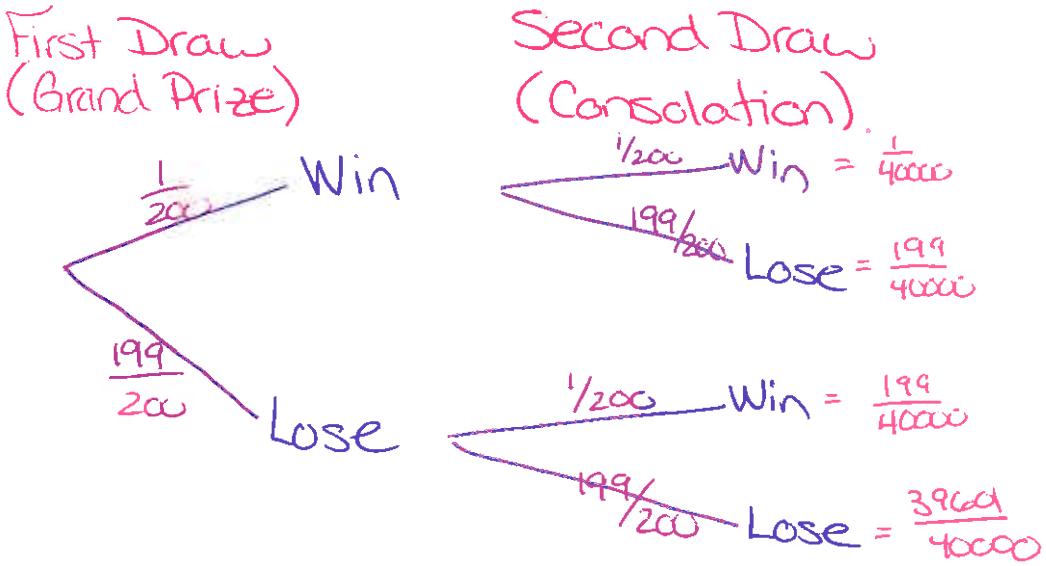
$$= 1 - P(B)P(B)P(B)$$
$$= 1 - \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$$
$$= 1 - \frac{1}{8}$$
$$= \frac{8}{8} - \frac{1}{8} = \boxed{\frac{7}{8}}$$

Example 3: 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.

G = Win Grand Prize

C = Win Consolation Prize

$\frac{5}{1000} = \frac{1}{200}$



$P(\text{win at least 1}) = P(WW) + P(WL) + P(LW)$

$= \frac{1}{40000} + \frac{199}{40000} + \frac{199}{40000}$

$= \frac{399}{40000} = 0.009975$

(x 100 to find %)

$= 0.9975$

$= 1.0\%$

Assignment: Pg. 360 #1 – 9, 12, 13, 15 Extension (#17, 19)