2.6 – Binomial Probability (Experiments)

– **binomial probability (experiments)** → used to find probabilities where there are 2 possible outcomes where key words to look for to know when to use this technique are EXACTLY, AT MOST, or AT LEAST

Ex: What is the probability of getting exactly 4 questions correct on a 5-question multiple-choice (A – D possible answer choices) quiz if you guess at every question? →

$P(4\text{correct}, 1\text{wrong}) = {}_5C_4 \cdot (1/4)^4 \cdot (3/4)^1 = \frac{15}{1024} \rightarrow 1.5\%$

* Exponents should add up to the # of TRIALS!

Binomial Exp "Formula" → $_{\text{total trials}}C_{\text{successes}} \cdot (\text{successes prob})^{\text{success power}} \cdot (\text{failure prob})^{\text{failures power}}$ (Fraction) (Fraction)

Examples: Find each probability using the Binomial Experiment "Formula".

1.) If a family has 4 children, what is the probability that they have exactly 3 boys?

$P(3\text{boys}, 1\text{girl})$

${}_4C_3 \cdot (1/2)^3 \cdot (1/2)^1 =$ 25%

2.) Suppose that a coin is tossed 5 times, what is the probability of getting exactly 2 heads?

$P(2\text{heads}, 3\text{tails})$

${}_5C_2 \cdot (1/2)^2 \cdot (1/2)^3 =$ 31.3%

3.) A die is rolled 3 times, what is the probability of getting exactly three 5's?

$P(\text{exactly } 3\ 5\text{'s})$

${}_3C_3 \cdot (1/6)^3 \cdot (5/6)^0 =$ 0.5%

4.) Tarin and Sam are playing a certain board game, the probability of Tarin winning a game is 75% (3/4). If they play 5 games, then what is the probability that Sam will win exactly 3 games?

25% → 1/4

$P(\text{Sam } 3, \text{Tarin } 2)$

${}_5C_3 \cdot (1/4)^3 \cdot (3/4)^2 =$ 8.8%

5.) Suppose that when hockey star Jamarie Jones takes a shot, he has a $\frac{1}{7}$ probability of scoring a goal. He takes 6 shots in a game one night. * P(not scoring) = 6/7

a.) What is the probability that he will score exactly 1 goal?

$P(1\text{goal}, 5\text{no goals})$

${}_6C_1 \cdot (1/7)^1 \cdot (6/7)^5$

39.7%

b.) What is the probability that he will score at most 2 goals?

0, 1, 2

$P(0) + P(1) + P(2)$

${}_6C_0 \cdot (1/7)^0 \cdot (6/7)^6 = .3966$

${}_6C_1 \cdot (1/7)^1 \cdot (6/7)^5 = +.3966$

${}_6C_2 \cdot (1/7)^2 \cdot (6/7)^4 = +.1652$

95.8%

c.) What is the probability that he will score at least 4 goals?

4, 5, 6

$P(4) + P(5) + P(6)$

${}_6C_4 \cdot (1/7)^4 \cdot (6/7)^2 = .0046$

${}_6C_5 \cdot (1/7)^5 \cdot (6/7)^1 = +.0003$

${}_6C_6 \cdot (1/7)^6 \cdot (6/7)^0 = +.000008$

0.5%