

Binomial Probabilities

- Experiment has repeatable trials
- Each trial can be categorized as either a "success" or a "failure".
- Probabilities must total 1

$$P(A) = {}^n C_r \cdot p^r \cdot q^{n-r}$$

an event \uparrow ${}^n C_r$ \uparrow p^r \uparrow q^{n-r}
 combination of n trials with r successes \uparrow probability of success \uparrow probability of failure
 # of successes \uparrow # of failures

Example # 1 Kyler has a free throw percentage of 78%. Find the probability that he makes exactly 8 out of 9 free throws.

$$\begin{aligned}
 P(8 \text{ of } 9) &= {}^n C_r \cdot p^r \cdot q^{n-r} \\
 &= {}^9 C_8 \cdot (0.78)^8 \cdot (0.22)^1 \\
 &= 9 \cdot (0.78)^8 \cdot (0.22) \\
 &= 0.2713 \approx 27\%
 \end{aligned}$$

$$\begin{aligned}
 P(\text{at least } 8) &= P(8) \text{ or } P(9) \\
 &= 0.27 + {}^9 C_9 \cdot (0.78)^9 \cdot (0.22)^0 \\
 &= 0.27 + 1 \cdot (0.78)^9 \cdot 1 \\
 &= 0.27 + 0.11 = 0.38 \approx 38\%
 \end{aligned}$$

Example # 2 Contessa buys 10 drinks. Under each cap there is a 1 in 4 chance to win a prize. What is the probability that she will get at least 2 prizes?

Binomial Probabilities

Direct Way : $P(2) + P(3) + \dots + P(10)$

This would not be fun!

Use the complement!

$$\begin{aligned}
 P(0 \text{ or } 1) &= P(0) + P(1) \\
 &= {}_{10}C_0 (0.25)^0 (0.75)^{10} + {}_{10}C_1 (0.25)^1 (0.75)^9 \\
 &= 1 \cdot 1 \cdot (0.75)^{10} + 10 \cdot (0.25) \cdot (0.75)^9 \\
 &= 0.0563 + 0.1877 \\
 &= 0.244
 \end{aligned}$$

$1 - 0.244 =$ 0.756

Assignment : 2 Worksheets