Algebra 2H Extra Notes: Binomial Probabilities

A **binomial experiment** consists of *n* independent trials whose outcomes are either successes or failures. The probability of success *p* is the same for each trial and the probability of failure 1 – *p* is the same for each trial.

Some examples of binomial experiments are flipping a fair coin, answering a true/false test, and being left-handed or right-handed.

Binomial Probability
For a binomial experiment with *n* trials, the **binomial probability** that there will be exactly *r* successes is:

$P(r) = {}_nC_r\, p^r (1-p)^{n-r}$, where *p* = probability of success on each trial
and 1 – *p* = probability of failure

Example 1. A scientist claims that 40% of mice used in an experiment will become very aggressive after having been administered a drug. Suppose that 8 mice are randomly selected.

a. What is the probability that exactly 3 of the mice will become aggressive after being given the drug?

$n = 8, r = 3, p = .4, 1-p = .6$

$\frac{8 \cdot 7 \cdot 6}{3 \cdot 2}\ {}_8C_3 (.4)^3 (.6)^5 \approx .28$

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b. What is the probability that at least 6 of the mice will become aggressive after being given the drug?

$P(6) \text{ OR } P(7) \text{ OR } P(8)$

$\frac{8 \cdot 7}{2}\ {}_8C_6 (.4)^6 (.6)^2 + {}_8C_7 (.4)^7 (.6)^1 + {}_8C_8 (.4)^8 \approx .05$

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Example 2. Vince buys 10 juice drinks. The inside of each bottle cap shows either "You Win!" or "Try Again". The chance of winning any prize is 1 in 4. What is the probability that Vince will get at least 2 prizes?

$P(2) + P(3) + \cdots + P(10)$

$1 - P(0 \text{ or } 1 \text{ prizes})$

$1 - \left({}_{10}C_0 (.25)^0 (.75)^{10} + {}_{10}C_1 (.25)^1 (.75)^9\right)$

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$1 - \boxed{\text{ANS}} \approx .76$