

## Section 5

### Binomial Problem

$X =$  # successes in repeated trials

$n =$  # of trials

$p =$  probability of success on 1 trial

$q =$  " failure "

$$q = 1 - p$$

$$P(x \text{ successes}) = \binom{n}{x} p^x q^{n-x}$$

Ex 2. A drilling company is successful on 82% of drilling attempts. Find the probability of at least seven successes in the next eight attempts.

**BINOMIAL** (repeated trials)

$X =$  # successes = # successful drilling attempts

$$n = 8$$

$$p = 0.82$$

$$q = 1 - p = 0.18$$

$P(\text{at least 7 successes})$

$$= P(X \geq 7)$$

$$= P(X=7) + P(X=8)$$

$$(n(x) p^x q^{n-x})$$

$$= \binom{8}{7} (0.82)^7 (0.18)^1 + \binom{8}{8} (0.82)^8 (0.18)^0$$

$$\approx 0.56$$

How the formula works :

$$P(x \text{ successes}) = \binom{n}{x} p^x q^{n-x}$$

choose which trials are successful

probability of  $x$  successes in a row

probability of  $n-x$  failures in a row

Ex 3. A dart-thrower hits the target 36% of the time. He does not improve with practice. He throws ten darts. Find the probability that he hits the target two or three times.

BINOMIAL (repeated trials)

$X = \# \text{ successes} = \# \text{ times he hits target}$

$$n = 10$$

$$p = 0.36$$

$$q = 1 - p = 0.64$$

$P(2 \text{ or } 3 \text{ hits})$

$$= P(X=2 \text{ or } 3)$$

$$= P(X=2) + P(X=3)$$

$$(n(x)) p^x q^{n-x}$$

$$= \frac{\cancel{1002}}{45} (0.36)^2 (0.64)^8 + \frac{\cancel{1003}}{120} (0.36)^3 (0.64)^7$$

$$\approx 0.41$$

Ex 4. A multiple-choice test has three questions, each of which has four possible answers. A student guesses randomly on each question.

- Find the probability distribution for the number of questions the student gets correct
- Draw a histogram

a) Probability distribution

X	P(X)
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$$X = \# \text{correct} \quad P(x) = \binom{n}{x} p^x q^{n-x}$$

0

1

2

3

$$n=3 \quad p = \frac{1}{4} = 0.25 \quad q = 0.75$$

probability of getting 1 question correct

$X$	$P(x) = \binom{n}{x} p^x q^{n-x}$
0	$3C0 (0.25)^0 (0.75)^3 \approx 0.42$
1	$3C1 (0.25)^1 (0.75)^2 \approx 0.42$
2	$3C2 (0.25)^2 (0.75)^1 \approx 0.14$
3	$3C3 (0.25)^3 (0.75)^0 \approx 0.02$

b) Histogram:

