

## §5.2 THE BINOMIAL PROBABILITY DISTRIBUTION

Def: A BINOMIAL EXPERIMENT IS ONE THAT SATISFIES THE FOLLOWING.

- (1)  $n$  IDENTICAL TRIALS
- (2) EACH TRIAL RESULTS IN ONE OF TWO POSSIBLE OUTCOMES.  
CONVENTION: SUCCESS (S) AND FAILURE (F).
- (3) TRIALS ARE INDEPENDENT.
- (4)  $P(S) = p$  .  $P(F) = q = 1 - p$ .
- (5) RANDOM VARIABLE OF INTEREST:  $X = \#$  SUCCESSSES IN  $n$  TRIALS.  
 $X = 0, 1, 2, \dots, n$ .

DISCUSS. FLIPPING COINS. DRAWING MARBLES - FROM HOW MANY?

### RULE OF THUMB

LET  $N =$  POPULATION SIZE

$n =$  SAMPLE SIZE

IF  $\frac{n}{N} \geq .05$  THEN EXPERIMENT IS NOT BINOMIAL.

IF  $\frac{n}{N} < .05$  THEN IT IS.

## BINOMIAL PROBABILITY DISTRIBUTION

PROBABILITY OF  $k$  SUCCESSES IN  $n$  TRIALS:

$$P(X=k) = C_k^n p^k q^{n-k} = \frac{n!}{k!(n-k)!} p^k q^{n-k}$$

$p(k)$

$$\mu = np \quad \sigma^2 = npq \quad \sigma = \sqrt{npq}$$

ex. BASKETBALL PLAYER MAKES 85% OF FREE THROWS.  
IF HE SHOOTS 4 FREE THROWS, WHAT IS  
 $P(X=1), \dots, P(X=4)$ ?

## CUMULATIVE BINOMIAL PROBABILITIES

$n = 10$

$k$	.01	.05	.10	.20	.30	.40	.50	...
0								
1								
2			$P(X \leq 2)$					
3								
4								
5								
6								
7								
...								