

A professional soccer player succeeds in scoring a goal on 84% of his penalty kicks. Assume that the success of each kick is independent.

- (a) In a series of games, what is the probability that the first time he fails to score a goal is on his fifth penalty kick?

$p = .84$  makes  
 $1-p = .16$  miss

Geometric  $P(\text{1st fail occurs on 5th kick}) = (.84)^4 (.16)^1 \approx .0797$   
4 makes  
1 miss

- (b) What is the probability that he scores on 5 or fewer of his next 10 penalty kicks?

Binomial Setting

$X = \#$  goals scored  $p = .84$   $1-p = .16$

$P(X \leq 5) = \text{binomcdf}(10, .84, 5) \approx .013 \approx 1.3\%$   
where  $n=10$ ,  $p=.84$ ,  $x=5$

B ✓

I ✓

N ✓  $n=10$

S ✓

- (c) Suppose that our soccer player is out of action with an injury for several weeks. When he returns, he only scores on 5 of his next 10 penalty kicks. Is this evidence that his success rate is now less than 84%? Explain.

$X = \#$  goals scored

$P(X \leq 5) \approx .013$  (from part B)

From part B above, the prob that a player scores 5 or less goals is about 1.3% (when prob of making a goal is 84%) Since this is so low, we should be suspicious about whether he can still hit 84% of his shots.  $\therefore$  we have convincing evidence that his penalty kick success rate has fallen below 84%.