

# Two Problems on Binomial Distributions

Stat 3011, Summer 2006

Wednesday, July 19

1. 2003 year's NCAA Division I men's basketball championship game was Syracuse vs. Kansas. In this game, Kansas made only a small proportion of its free throws (12 out of 30). However, during the regular season, Kansas had a team free throw percentage of 65.6%.

For the following questions, suppose Kansas's 30 free throws in the championship were made independently, and the probability of making each free throw was .656.

(a) Find the probability that Kansas would make exactly 12 out of the 30 free throws.  
{Hint:  $X =$  number of successes of free throws, then  $X \sim \text{Bin}(30, .656)$ }

(b) (It is arguable that, since Kansas lost by only three points, if they had made more free throws – say, if they had made 16 or more of the 30 tries – they could have won the championship.)

Find the probability that Kansas would make 16 or more of the 30 free throws.  
{Hint:  $30 * .656 = 19.68 > 10$  and  $30 * (1 - .656) = 10.32 > 10$ . Then calculate  $P(X \geq 16)$  where  $X \sim N(19.68, 2.601907)$  approximately. }

2. Suppose that 10% of all University students are Mac users.

(a) If a random sample of 10 University students is taken, what is the probability that 3 of them are Mac users?  
{Hint:  $X \sim \text{Bin}(10, 0.1)$ . Calculate  $P(X=3)$ . }

(b) Again, given a random sample of 10 University students, what is the probability that at least one of them is a Mac user?  
{Hint: Calculate  $1 - P(X = 0)$ }

(c) Suppose instead we take a larger random sample of 150 University students. What is the probability that more than 20 of them are Mac users?  
{Hint: Calculate  $P(X \geq 20)$  where  $X \sim N(150 \cdot 0.1, \sqrt{(150)(0.1)(1 - 0.1)})$ . }