Applying Sampling Distribution Models

1. A nationwide study in 2010 indicated that 95% of college students with cell phones send and receive text messages with their phones. Suppose a simple random sample of \( n = 1136 \) of college students with cell phones is obtained.

1a. Let \( \hat{p} \) denote the sample proportion of college students with cell phones who send and receive text messages.
\[
E(\hat{p}) = ? \quad SD(\hat{p}) = ?
\]

1b. What is the sampling distribution model for \( \hat{p} \)? (check the conditions \( np \geq 10 \) and \( n(1 - p) \geq 10 \)).

1c. What is the probability that 1065 or fewer college students in the sample send and receive text messages with their cell phones? (NOTE: 1065 or fewer means the sample proportion \( \hat{p} \) is .9375 or less.)

1d. If you want to reduce the \( SD(\hat{p}) \) by half, how much larger does the sample size \( n \) need to be?

2. In a recent study of the long-term effects of concussions in football players, researchers at Virginia Tech concluded that college football players receive a mean of 50 strong blows to the head that average 40G (40 times the force of gravity). Assume the standard deviation of the number of blows to the head is 16. Suppose you select a simple random sample of \( n = 60 \) college football players and install sensors on their helmets that record \( x \), the number of strong blows to the head. Note that since \( x \) is a count, the distribution of \( x \) cannot be modeled by a normal distribution.

2a. Let \( \bar{x} \) denote the sample mean of the number of strong blows to the head received by 60 football players.
\[
E(\bar{x}) = ? \quad SD(\bar{x}) = ?
\]

2b. What is the sampling distribution model for \( \bar{x} \)? (What important result from Statistics are you using?)

2c. What is the probability that in a sample of 60 football players the mean number of strong blows to the head is 45 or less? Would this be unusual?