1. A hundred squash balls are tested by dropping from a height of 100 inches and measuring the height of the bounce. A ball is "fast" if it rises above 32 inches. The average height of bounce was 30 inches and the standard deviation was ¾ inches. What is the chance of getting a "fast" standard ball?

Solution.

Using the Central Limit Theorem we can conclude that if $S_n = \sum_{i=1}^{n} X_i$, then $\frac{S_{n-\mu n}}{\sigma\sqrt{n}} \sim N(0,1)$, where X_i – random variable means the height of the bounce with $E[X_i] = 30$ and $\sigma[X_i] = 0.75$. This is equivalent to $X \sim N(\mu, \sigma^2)$, because $S_n = \sum_{i=1}^{n} X_i \sim N(\mu n, \sigma^2 n)$. So $P(X > 32) = P(X^*\sigma[X] - E[X] > 32)$, where $X^* = \frac{X-E[X]}{\sigma[X]} \sim N(0,1)$.
$P(X > 32) = P(X^* * 0.75 - 30 > 32) = P(X^* > 2.6) = 1 - P(X^* < 2.66) = 1 - \Phi(2.66) = 1 - 0{,}9961 = 0{,}0039$ where $\Phi(a)$ – function of standard normal distribution.

Answer: 0.0039