

Σ SUM
Capital sigma

σ lowercase sigma

MATH 1342 – STATISTICS

SECTION 7.2: THE CENTRAL LIMIT THEOREM FOR SUMS

- The **central limit theorem (CLT)** for sample sums says that if you keep drawing larger and larger samples and taking their sums, the sample sums form their own normal distribution (the sampling distribution).
- Thus, if you draw random samples of size n , then as n increases, the random variable ΣX consisting of sums, tends to be normally distributed and $\Sigma X \sim N((n)(\mu_X), (\sqrt{n})(\sigma_X))$. $X \sim N(\mu, \sigma)$
- The normal distribution has mean equal to the original mean μ_X multiplied by the sample size $\Rightarrow n\mu_X$
Has standard deviation equal to the original standard deviation σ_X multiplied by the square root of the sample size $\Rightarrow \sqrt{n}\sigma_X$
- The random variable ΣX has a the following z-score associated with it: $z = \frac{\Sigma x - (n)(\mu_X)}{\sqrt{n}\sigma_X}$ $Z = \frac{X - \mu}{\sigma}$

For sums, $\Sigma X \sim N((n)(\mu_X), (\sqrt{n})(\sigma_X))$

To Find a Probability (Page 402)

(1.) Go to [2nd] [DISTR]

(2.) 2:normalcdf

(3.) normalcdf (lower value, upper value, (n)(mean), ($\sqrt{n}$)(std dev))

To Find a Percentile (Page 393)

(1.) Go to [2nd] [DISTR]

(2.) 3:invNorm

(3.) invNorm (area to left, (n)(mean), ($\sqrt{n}$)(std dev))

Ex. 1: An unknown distribution has a mean of 45 and a standard deviation of eight. A sample size of 50 is drawn randomly from the population. Find the probability that the sum of the 50 values is more than 2,400.

$\mu = 45$
 $\sigma = 8$
 $n = 50$

$\Sigma X \sim N(50(45), (\sqrt{50})(8))$

$P(\Sigma X > 2400) = \text{normalcdf}(2400, 1E99, 2250, \sqrt{50}(8)) = .004005$

1.4005% chance sum > 2400

Ex. 2: In a study reported Oct. 29, 2012 on the Flurry Blog, the mean age of tablet users is 35 years. Suppose the standard deviation is ten years. The sample size is 39.

(a) What are the mean and standard deviation for the sum of the ages of tablet users? What is the distribution?

$\mu_{\Sigma X} = 39(35) = 1365$
 $\sigma_{\Sigma X} = (\sqrt{39})(10) \approx 62.44997958$

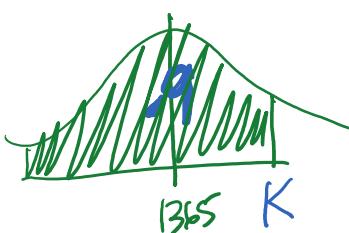
$\Sigma X \sim N(39(35), \sqrt{39}(10))$

(b) Find the probability that the sum of the ages is between 1,400 and 1,500 years.

$P(1400 < \Sigma X < 1500) = \text{normalcdf}(1400, 1500, 1365, 10\sqrt{39})$

$\approx .2723$ is prob the sum of ages is b/w 1400 & 1500

(c) Find the 90th percentile for the sum of the 39 ages.



$K = \text{invNorm}(0.9, 39(35), 10\sqrt{39})$

≈ 1445.0 (to one decimal place)

$\mu_{\Sigma X} = 1365$