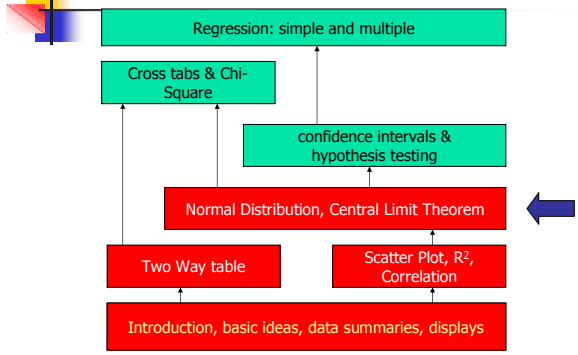
PUB – POS 316
Week 6

Normal Distribution, Central Limit Theorem

Navid Ghaffarzadegan
navidg@gmail.com
Last updated – Jan 1, 10

Course Road Map



Agenda

- Distribution
- Normal Distribution
- Standardized Normal Distribution
- Central Limit Theorem

Population vs. Sample

- We have previously discussed about the difference between sample and population.
- A sample is a part of the population that we "actually" examine to say something about the population.
  - Reasons:
    - It is expensive to study the whole population
    - It is impossible.
    - It is time consuming.
    - It doesn't matter that much!

Sampling Distribution

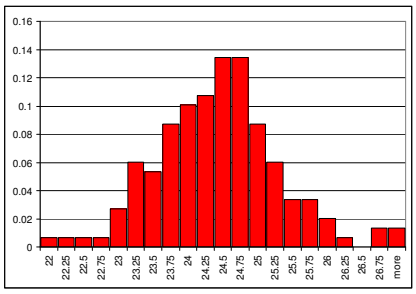
- We want to use sample statistics to make statements about unknown population parameters.
- Problems with sampling

Sampling Distribution

- Example: Biological clocks
- Many plants and animals have biological clocks that coordinate activities with the time of the day. Interestingly it is not always 24 hours. Depends on locations.
- Researchers have gathered data on 149 locations. Let's examine the distribution of the data.

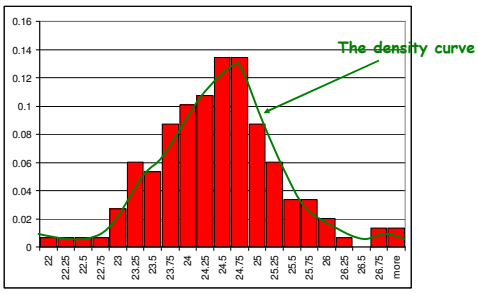
Distribution

- Example: Biological clocks



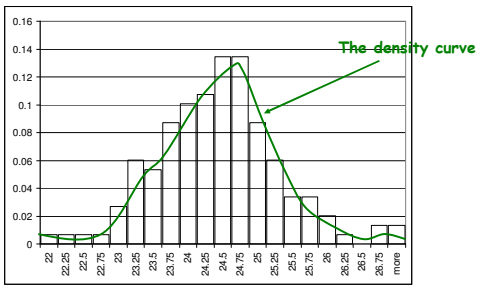
Distribution

- Example: Biological clocks



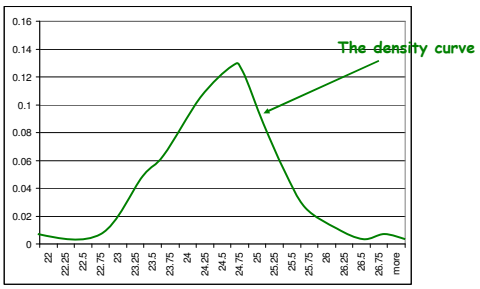
Distribution

- Example: Biological clocks



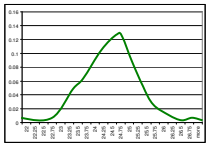
Distribution

- Example: Biological clocks



Distribution

- Example: Biological clocks
- The density curve help us to know about the distribution of the data



  - One pick
  - Bell shaped
  - total area of 1 underneath it.
  - We can approximately see the average, and quartiles

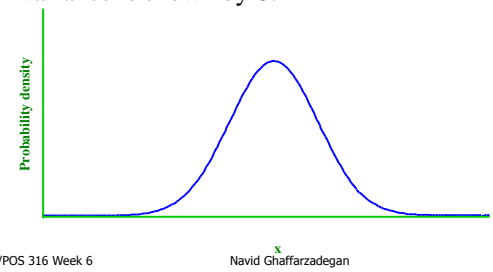
Distribution

- Density curve is usually used to describe a pattern of distribution.
- Q: Draw a density curve for UAlbany students age.
- Q: Draw a density curve for time of entrance to our 316 class?

- ** A density curve has total area of 1 underneath it.
- **Normal distribution** is a bell-shaped and symmetric density curve. Average is shown by **μ** and variance is shown by **σ**.
- Many times we assume a normal distribution for a data set.

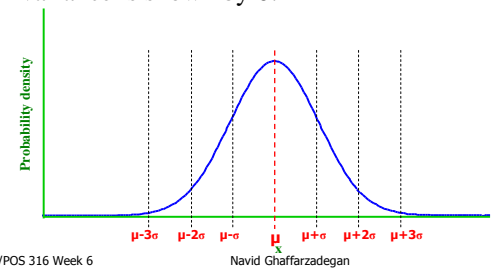
Distribution

- Normal distribution is a bell-shaped, symmetric density curve. Average is shown by μ and variance is shown by σ.



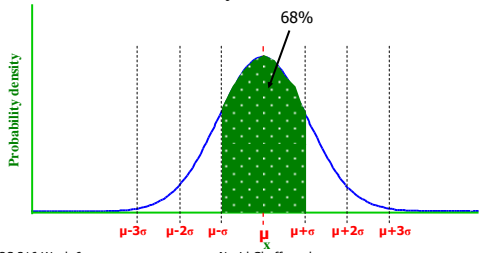
Distribution

- Normal distribution is a bell-shaped, symmetric density curve. Average is shown by μ and variance is shown by σ.



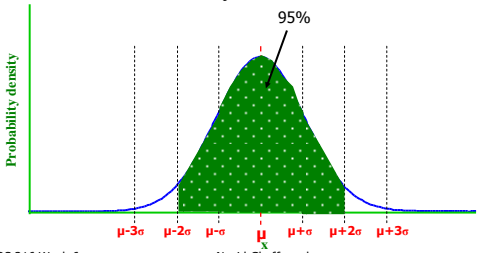
Distribution

- Normal distribution is a bell-shaped, symmetric density curve. Average is shown by μ and variance is shown by σ.



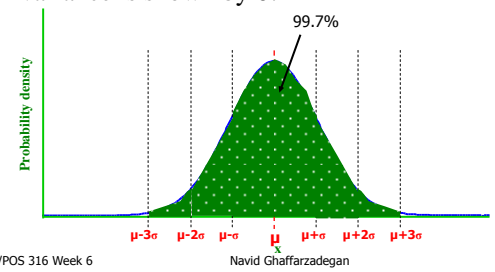
Distribution

- Normal distribution is a bell-shaped, symmetric density curve. Average is shown by μ and variance is shown by σ.



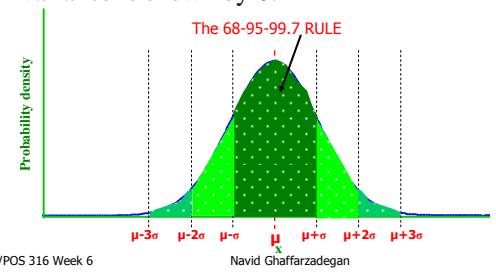
Distribution

- Normal distribution is a bell-shaped, symmetric density curve. Average is shown by μ and variance is shown by σ.



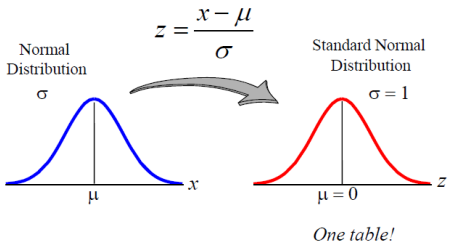
Distribution

- Normal distribution is a bell-shaped, symmetric density curve. Average is shown by μ and variance is shown by σ.



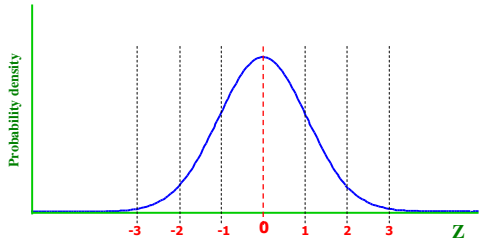
Distribution

- ** A density curve has total area of 1 underneath it.
- Normal distribution is a bell-shaped, symmetric density curve. Average is shown by μ and variance is shown by σ.
- Standard normal distribution is a normal distribution with μ=0, σ=1.
- Many times we want to transform a normal distribution to a standard normal distribution in order to be able to say something about the distribution.
- Use: Z=(X- μ)/ σ



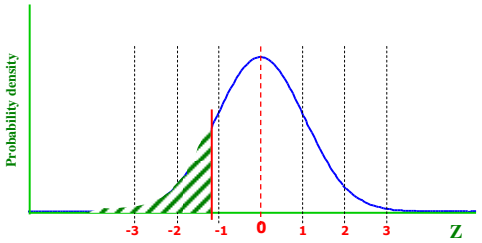
Distribution

- How to use the z-score table: Standard normal probabilities?



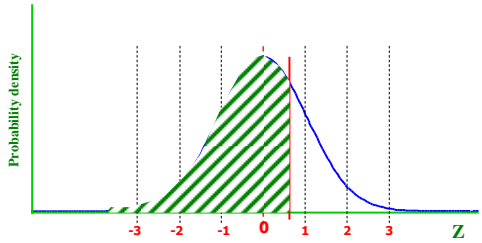
Distribution

- How to use the z-score table: Standard normal probabilities?



Distribution

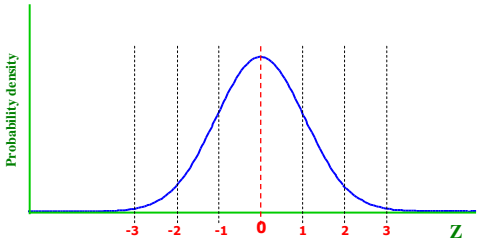
- How to use the z-score table: Standard normal probabilities?



Distribution

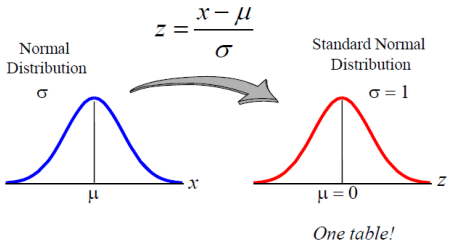
- Example: find the area for

z=-2, -1.5, 0, 1, 1.13, 2.45, 3.42, 4.5



Distribution

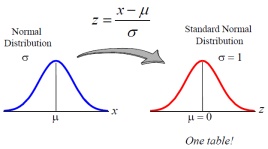
- Average of years of experience for UAlbany Professors is 12 years, with the standard deviation of 4 years. Assuming that the distribution of years of experience is a normal distribution, 1) draw a density curve and 2) find a z-variable which can transform this distribution to a Standard normal distribution.



Distribution

- Average of years of experience for UAlbany Professors is 12 years, with the standard deviation of 4 years. Assuming that the distribution of years of experience is a normal distribution, 1) draw a density curve and 2) find a z-variable which can transform this distribution to a Standard normal distribution.
- 3. What percentage of the professors have less than 8 years of experience?

The Main Procedure



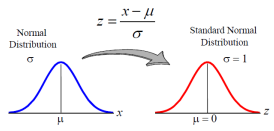
Clarify the **normal distribution** characteristics

Find the equivalent **z-distribution** (standard normal dis)

Analyze **z-distribution**

Make inferences for the **normal distribution**

The Main Procedure



One table!

Clarify the **normal distribution** characteristics → Find the equivalent **z-distribution** (standard normal dis)

Analyze **z-distribution** → Make inferences for the **normal distribution**

The Main Procedure

- Example A:
- Scores on SAT tests are approximately normally distributed with the mean of 500 and standard deviation of 100. What is the proportion of scores below 400?

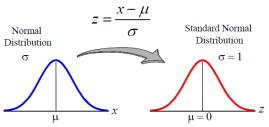
The Main Procedure

- Example B:
- Scores on SAT tests are approximately normally distributed with mean of 500 and standard deviation of 100. What is the proportion of scores above 650?

The Main Procedure

- Example C:
- Scores on SAT tests are approximately normally distributed with mean of 500 and standard deviation of 100. What is the proportion of scores between 400 and 650?

The Main Procedure



One table!

Clarify the **normal distribution** characteristics

Find the equivalent **z-distribution** (standard normal dis)

Analyze **z-distribution**

Make inferences for the **normal distribution**