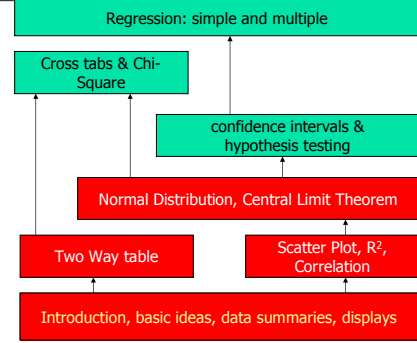


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Normal Distribution, Central Limit Theorem

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Course Road Map



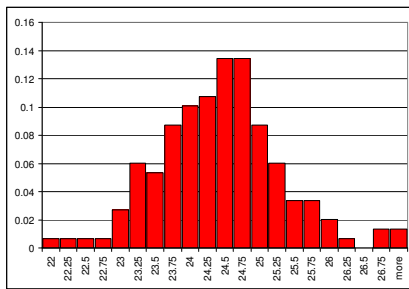
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Review

Example: Biological clocks



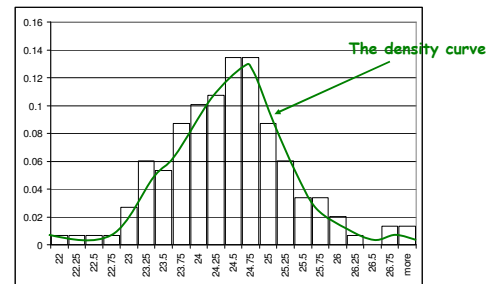
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Review

Example: Biological clocks



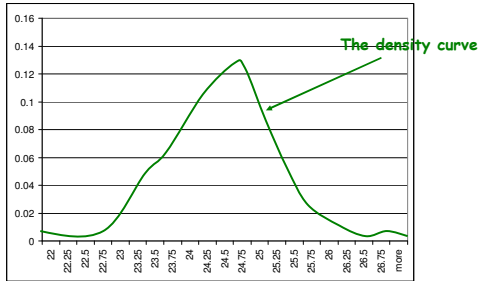
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Review

Example: Biological clocks



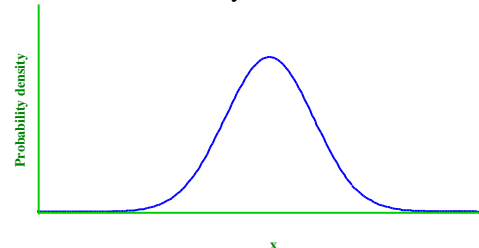
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Review

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



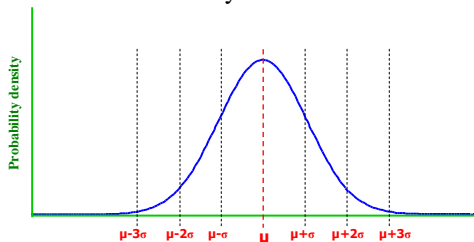
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Review

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



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Review

- Density curve
 - 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 $\mu=0$, $\sigma=1$. $N(0, 1)$
 - 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: $Z=(X-\mu)/\sigma$

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Review

Normal Distribution σ

$$z = \frac{x - \mu}{\sigma}$$

Standard Normal Distribution $\sigma = 1$

One table!

```

    graph TD
      A[Clarify the normal distribution characteristics] --> B[Find the equivalent z-distribution (standard normal dis)]
      B --> C[Analyze z-distribution]
      C --> D[Make inferences for the normal distribution]
      D -.-> A
  
```

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Review

- Example:
- Scores on SAT tests are approximately normally distributed with mean of 500 and standard deviation of 100. What is the proportion of scores between 550 and 650?

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The Main Procedure

- Samples (means).
- **The central limit theorem:** when n is large, the sampling distribution of the sample mean is approximately normal with mean of μ and $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
- Basically when n is very very very large, we get exactly μ !!

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The Main Procedure

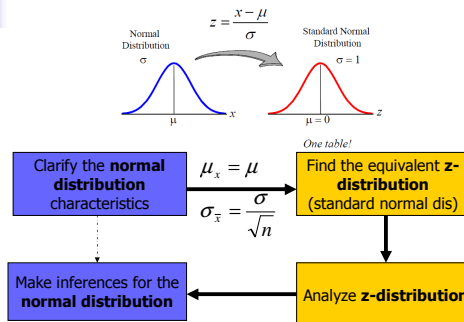
- Samples (means).
- **The central limit theorem:** when n is large, the sampling distribution of the sample mean is approximately normal with mean of μ and $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
- Example: You take a sample of 36 from a population with the mean of 100, and standard deviation of 10. Find the mean and standard deviation of the sampling dis. of your sample mean.

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The Main Procedure

- samples (mean)
 - Example D: Scores on SAT tests are approximately normally distributed with mean of 500 and standard deviation of 100. We take a sample of 100 people. What is the probability that the mean sample becomes less than 480 about this?

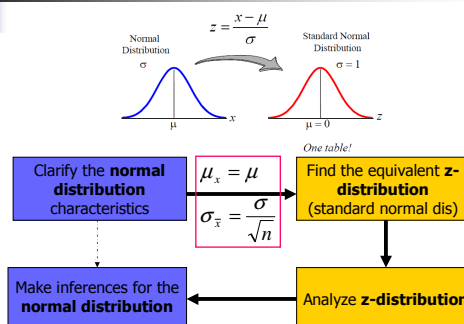
The Main Procedure



The Main Procedure

- samples (mean)
 - Example D: Scores on SAT tests are approximately normally distributed with mean of 500 and standard deviation of 100. We take a sample of 10,000 people. What is the probability that the mean sample becomes less than 480?

The Main Procedure



The Main Procedure

- samples (mean)
 - Example D: Scores on SAT tests are approximately normally distributed with the mean of 500 and the standard deviation of 100. We take a sample of 10,000 people. What is the probability that the mean sample becomes less than 480?
 - Let's discuss.. What if I get a sample of 16 people?
 - What is the proper sample size?

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The Main Procedure

- samples (mean)
 - Example E: Scores on SAT tests are approximately normally distributed with mean of 500 and standard deviation of 100. We take a sample of 100 people. What is the probability that we get more than 4% error?

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The Main Procedure

- Applications of standard normal distribution to the study of
 - 1) population (mean)
 - 2) samples (mean)
 - 3) samples (proportion)
 - Next class

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