

# Measurement Confidence

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## Measurement Principles

- Measurement target: population of possible infinite size
  - population mean, population stddev
- Measurement sample: a given set of measurement results (finite size)
  - sample mean, sample stddev
- Using sample properties to estimate population properties (typically population mean)
  - confidence interval: with 90% probability, population mean is between  $c_1$  and  $c_2$

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## Confidence Interval of Mean

- Central Limit Theorem:
  - if the sum of independent identically distributed  $N$  random variables has a finite variance, then it will be approximately normally distributed
    - mean as the random variable mean times  $N$
    - stddev is the random variable stddev times square root  $N$
- Given a sample mean and stddev
  - if sample stddev approximates population stddev, we can estimate confidence interval

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## Confidence Interval of Mean (cont.)

- Central Limit Theorem inaccurate with small  $N$
- Now assume the population follows normal distribution
- t-distribution

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## Hypothesis Testing

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- Testing for a zero mean
  - see whether zero is in the confidence interval
- Comparing two alternatives
  - paired
  - unpaired
- p-value
  - the rarity of a measurement result given the population distribution



## Disclaimer

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- Most materials in these slides were developed from the book "The Art of Computer Systems Performance Analysis", R. Jain, 1991, Wiley.