

#### Continuous Probability Distributions

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### Today ...

- Probability distribution for continuous variables
  The expected value (mean) and variance
- The Normal distribution
  Standardized N- distribution
- Practical use
- Normal approximation to binomial distributions
- + Other continuous probability distributions (T,  $\chi^2,\,F)$









- Eg: Height in cm, weight in kg, velocity in km/h
- Synonym: measurement variable, scale variable
- Properties:
- Probability of a particular value is 0
  Probability density is estimated over intervals of single values









































Given  $X \sim N(0,1)$ , Find  $Pr(X \le 1)$ Table 3 column A :  $Pr(X \le 1) = \Phi(1) = 0.8413$ 



# Ex. 5.12

Given  $X \sim N(0,1)$ , Find Pr ( $X \le -1.96$ ) Table 3 column B: Pr ( $X \le -1.96$ ) = Pr (X > 1.96) = 0.025

#### Ex. 5.13

Given  $X \sim N(0,1)$ , Find Pr (-1  $\leq X \leq 1.5$ ) Pr (-1  $\leq X \leq 1.5$ ) = Pr (X  $\leq 1.5$ ) – Pr (X  $\leq -1$ ) = Pr (X  $\leq 1.5$ ) – Pr (X > 1) = 0.9332 – 0.1587 = 0.7745































### Kan man oppnå normalfordeling?

- Transformation: express something using a different scale
- Some usual examples: Length: 1 inch = 2,54 cm Acidity: pH = - log [H<sup>+</sup>] dB = log (loud pressure) Absolute temperature: K = 273,15 + °C
  - Athletics: 1.place = shortest time, 2. place = no. 2 shortest time ......and so on
- Nothing suspicious about this!!

## Other approaches in analysis

- Non-parametric procedures: - Rank tests
- Bootstrapping
  - Many (> 1000) repeated samples with replacement
- Robust standard error
  - Estimate the standard error based on the variability in the data using residualer

  - Sandwich variannce estimate
  - Large sample procedure

#### Other continuous Probability Distributions

- Normal distribution (Gauss distribution)
- Same characteristics are valid for:
  - Standard normalfordeling (the Z distribution )
  - T distribution
  - $\chi^2$  distribution
  - F distribution

# Other continuous Probability Distributions

T - distribution

- Resembles the Zi distribution, but with ticker tails. Defined by degrees of freedom (*df*). Is used, rather than the Z-distr. When the variance is unknown and must be estimated from the data (relatively small samples) •
- χ<sup>2</sup> distribution
  Skewed to the right. Shape is determined by degrees of freedom (*df*)
  Many different procedures. Variance, modelling, tables.

- F distribution (ratio)
  Skewed to the right. Shape is determined by degrees of freedom (*df*) in the nominator and denominator.
  ANOVA, regression, modelling.

