Stat 312: Lecture 21
Correlations

Moo K. Chung
mchung@stat.wisc.edu
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Concepts
1. The coefficient of determination $r^2 = \frac{S_{xy}^2}{S_{xx}S_{yy}}$.
2. The sample correlation coefficient $r$ is defined as $r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$. In Lecture 20, we showed that $0 \leq r^2 \leq 1$. Hence $-1 \leq r \leq 1$.
3. $r = 0$ if and only if paired observations $(x_j, y_j)$ pass through the same straight line. From Lecture 20 example 2, if $(x_j, y_j)$ pass through a circle, $r = 0$. So $r$ can be used to measure if the paired observations show linear relationship.
4. Population correlation coefficient
   \[ \rho(X,Y) = \frac{\text{Cov}(X,Y)}{\sqrt{\text{Var}(X)\text{Var}(Y)}}. \]

In-class problems

Example 1. Is there any linear relationship between the mathematical achievement test scores ($x_i$) and calculus grades ($y_i$) for 10 college freshmen?

x=39, 43, 21, 64, 57, 47, 28, 75, 34, 52
y=65, 78, 52, 82, 92, 89, 73, 98, 56, 75

> cor(x,y)
[1] 0.8397859

Example 2. Is there any relationship between the number of times you miss submitting homeworks ($x_i$) and the final grade ($y_i$)?

x=03, 04, 01, 02, 01, 00, 00, 07, 08, 05
y=70, 75, 80, 75, 85, 95, 90, 70, 50, 60

> cor(x,y)
[1] -0.8938321

Self-study problems


Homework 7

Due April 29. 11:00am.