Level M Regression Models Examples

Hubble

In 1929 Edwin Hubble investigated the relationship between distance and radial velocity of extra-galactic nebulae (celestial objects). It was hoped that some knowledge of this relationship might give clues as to the way the universe was formed and what may happen later. His findings revolutionized astronomy and are the source of much research today. The data which Hubble used for 24 nebulae included Distance (x, in Megaparsecs) from Earth and the recesson velocity (y, in km/sec).

Summary Statistics $\sum_{i=1}^{24} x_i y_i = 12514, \sum_{i=1}^{24} x_i^2 = 29.518, \sum_{i=1}^{24} y_i^2 = 6511425,$
$\sum_{i=1}^{24} x_i = 21.873, \sum_{i=1}^{24} y_i = 8955$

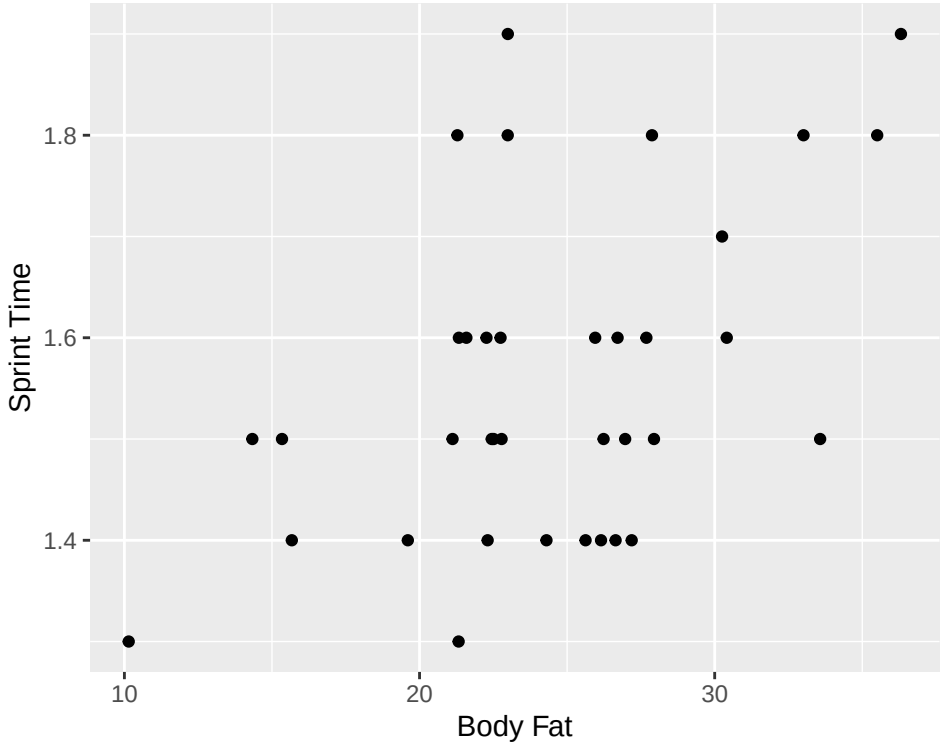
a) Assuming that the relationship is linear, use the summary statistics to calculate the sample correlation coefficient

b) Use Statistical Table 8 to test the null hypothesis that the population correlation coefficient $\rho = 0$ ($H_1 : \rho \neq 0$).

c) Interpret your results.

Footballers

In a study to investigate the fitness of young (sixteen-year old) Scottish professional footballers, 36 such footballers were subjected to a battery of fitness tests. One of the tests was the time taken to sprint 10m and it was of interest to investigate the relationship between this and % body fat.

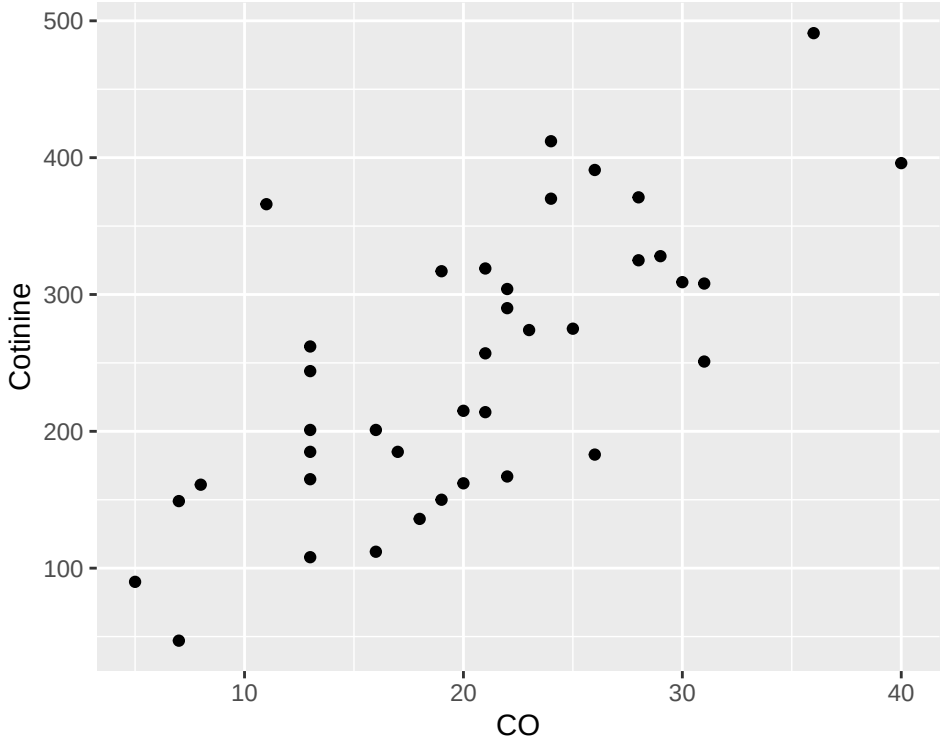


a) Use the plot to comment on the relationship between % body fat and 10m sprint time.

b) The sample correlation coefficient between % body fat and sprint time over 10m is 0.471. Carry out a test of the null hypothesis that the population correlation coefficient $\rho = 0$ (where H_1: $\rho \neq 0$) and interpret your results.

Smokers

At the start of a trial to help smokers in the West of Scotland to quit, a random sample of 40 smokers had their blood cotinine level (ng/ml) and carbon monoxide (CO) level (ppm) recorded. The data are displayed in the scatterplot.



Summary statistics

$$\sum_{i=1}^{40} y_i = 9964 \sum_{i=1}^{40} x_i = 843 \sum_{i=1}^{40} {x_i}^2 = 21233$$

$$\sum_{i=1}^{40} y_i^2 = 2873554 \sum_{i=1}^{40} x_i y_i = 232807$$

a) Comment on whether you think that cotinine level and CO are related.

b) Do cotinine and CO have a significant correlation?