

Studio 4

18.05 Spring 2014

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Studio4.zip

You should download studio4.zip and unzip it into your 18.05 working directory.

It has sample code that will remind you about making histograms and plotting curves.

Board Question: Problem 1: Covariance and correlation

Jack and Jill are dealers at a casino in Las Vegas.

- Every day during their break, Jack and Jill play roulette 10 times together, each betting one dollar on red each time.
- Jill then plays 5 more times alone, betting one dollar each time.

(In Las Vegas the roulette wheel has 18 red, 18 black and 2 green slots.)

- (a)** What are the expected winnings on a random day for each of them?
- (b)** What is the variance of their winnings on a random day?
- (c)** What is the covariance and correlation between their winnings.

Problem 1 continued

Suppose Jill and Jack play roulette the same way for 100 days. Let $JillTotal$ and $JackTotal$ be their total winnings.

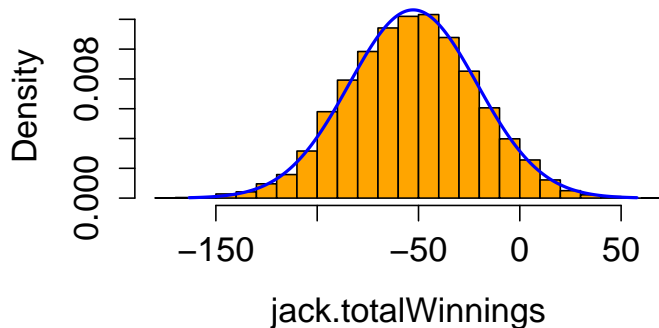
(d) What are the expected values, variances, covariance and correlation of these totals?

(e) Comment on how each of the quantities depends on the number of days.

Problem 2: Simulation; Central Limit Theorem

- (a)** Write R code to simulate JackTotal (Jack's total winnings) for 100 days. Run 5000 trials and plot a density histogram of the results. (The code in studio4.r may be helpful.)
- (b)** Why does the central limit theorem apply to approximating JackTotal.
- (c)** What μ and σ should be used in $N(\mu, \sigma^2)$ to approximate JackTotal? Add a graph of the pdf of $N(\mu, \sigma^2)$ to your histogram in part (a).
- (d)** Using the central limit theorem give a range with about 95% probability of containing JackTotal.
- (e)** What percentage of simulated JackTotal values fall in the range found in part (d).

Histogram of jack.totalWinnings



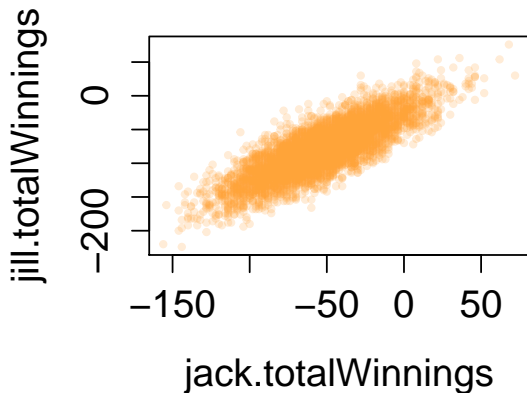
Density histogram and normal pdf for problem 2

Problem 3: Simulation; covariance and correlation

Extend the simulation from problem 2 to include `JillTotal`, Jill's total winnings over 100 days.

- (a)** Plot `JillTotal` vs. `JackTotal` for the simulation data.
- (b)** Compute the (sample) covariance and correlation of `JackTotal` and `JillTotal` from the simulation.

Plot for Problem 3



Plot of simulation of JillTotal vs. JackTotal for problem 3

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18.05 Introduction to Probability and Statistics

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