Sampling with replacement

When sampling with replacement is done, population elements are independent of each other. So previous sampling doesn't effect the next sampling. Mathematically, the covariance between two samples is zero.

Sampling with replacement mainly is done when the populations size is small. Sampling with replacement results in independent events that are unaffected by previous outcomes, and independent events are easier to analyze and they result in simple formulas.

Ten coins are tossed: each is equally likely to come down heads or tails. What is the probability that we get exactly three heads? Such type of problems is equivalent to sampling with replacement.

Sampling without replacement

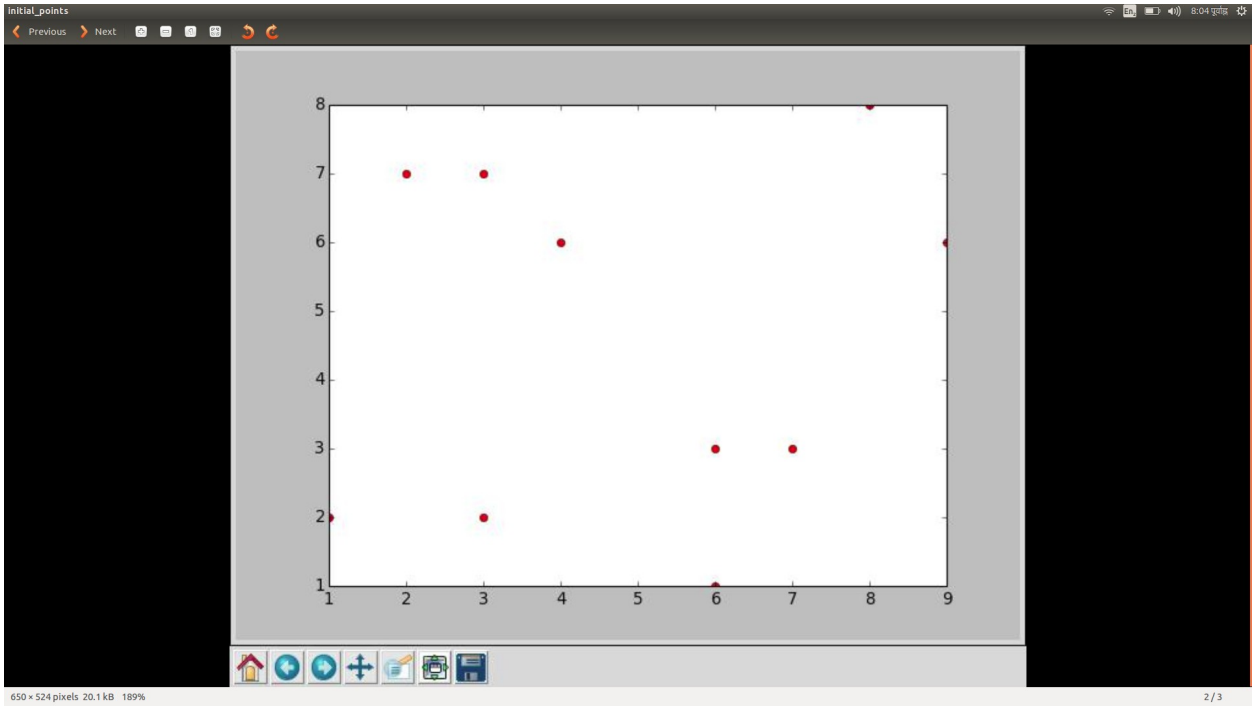
When sampling without replacement is done, population elements are dependent of each other and the previous sampling changes the outcome of next sampling. Mathematically, the covariance between two samples is not zero.

Sampling without replacement has the practical advantage of avoiding wasteful duplication whenever item is selected more than once. When selecting relatively small sample from large population, it makes no significant difference even when sampling without replacement is done.

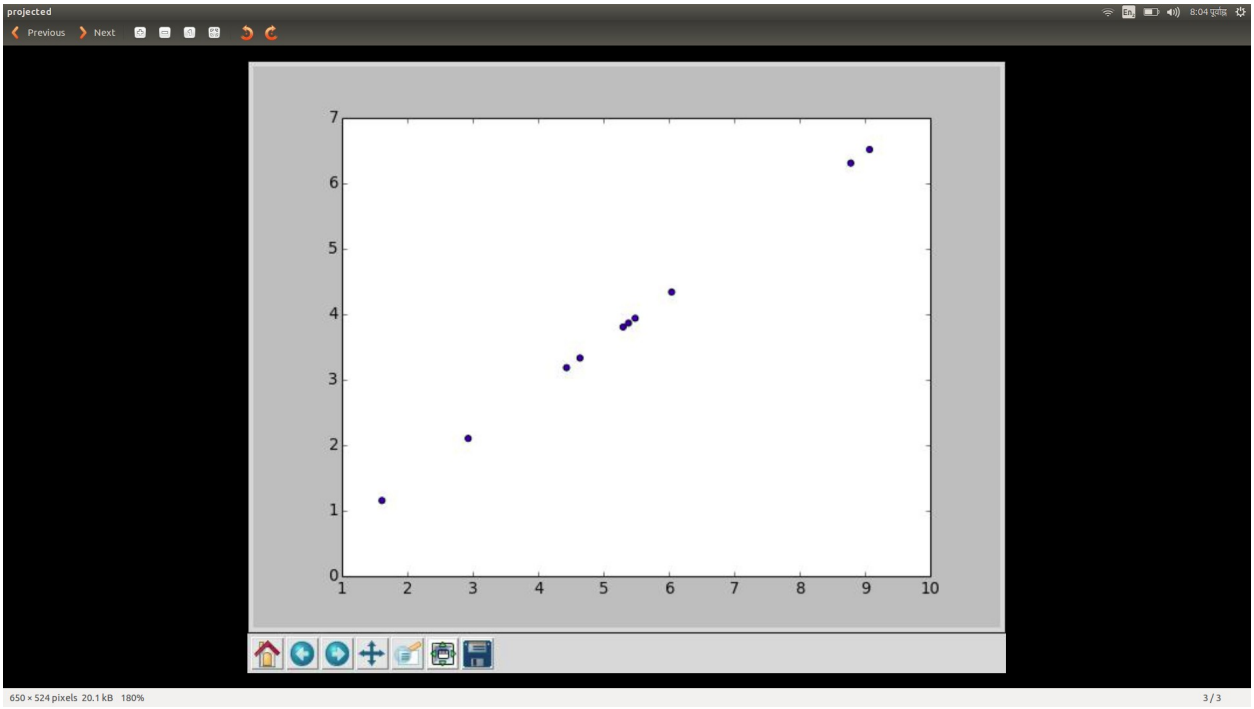
I have 10 coins in my pocket; 3 are copper and 7 are silver. I take out 4 coins, one after another. Such type of problems are sampling without replacement.

PCA

Initial points taken
x = [1, 4, 6, 3, 7, 9, 2, 6, 3, 8]
y = [2, 6, 1, 7, 3, 6, 7, 3, 2, 8]



After projection:



The source code is attached along with this pdf.

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