Bins and Balls
Laboratory_07

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1 OVERVIEW

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The idea of the simulation is: at the beginning N bins and N balls are generated and the until the number of balls has expired it keeps dropping the balls in the bins. The dropping policies are the following:

The balls are dropped in a random bin "D" bins are randomly chosen and the ball will be dropped in the least occupied bin. The aim of this simulation is to study the variation in the occupancy level with respect to the dropping policy.

2 Design detail

ASSUMPTION: We have the same number of bins and balls. The number of bins and balls is given as input by the user

- Random Dropping:
  1. The bins are chosen randomly
- Random load balancing:
  1. The d bins whose we want to compare the occupancy level are chosen randomly 2. In case of a tie the bin is chosen randomly

INPUT PARAMETERS:

- N: number of bins and number of balls
- D: number of selected bins for the random load balancing

OUTPUT METRICS:

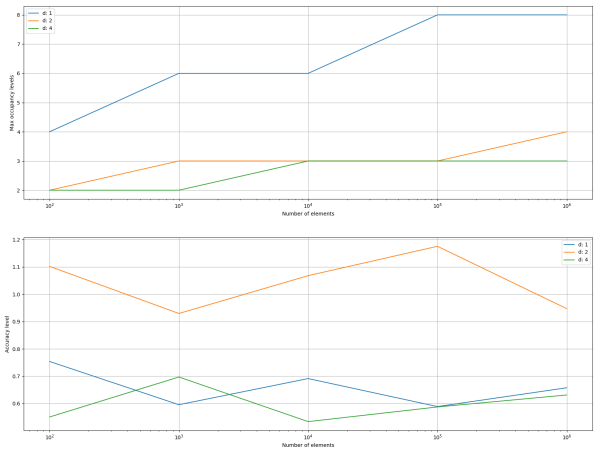
- Average occupancy level among all the bins
- Maximum occupancy level
- Minimum occupancy level

DATA STRUCTURES: A dictionary where the key is the bin's id and the value is the occupancy level
MAIN ALGORITHM: Set a list of N possible values as number of bins and balls
For I in range(N):
- initializes all the N bins - If the policy is random dropping: For I in range(N):
- Choose the bin randomly
- Drop one ball in it
- Else if the random policy is random load balancing:

- For I in range(N):
- Choose D bins
    - Drop the ball into the least occupied one
    - In case of a tie select a random one

Compute the average, min and max occupancy level and check whether the theoretical formula is respected.

3 Results discussion



In the previously showed graphs I plotted the max occupancy with respect to N and the accuracy with respect to N. We assume that the accuracy level is computed as the ratio between the theoretical max occupancy level and the experimental one. We can notice that the experimental value follows the theoretical value because, as N grows, that ratio is more likely to converge to one (which means that the experimental result is converging to the theoretical formula). The randomness of the error is given by an term which is (1 + O(1)) in case of random dropping policy and O(1) in case of random load balancing policy.