Bob the Building

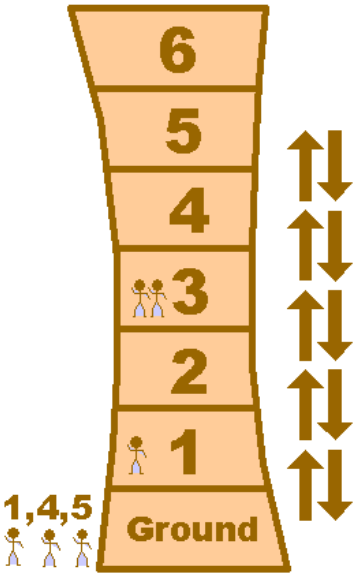
Bob the Building has only one elevator, so as people leave for work (going from floors 1-6 to the ground floor) or come home from work (going from the ground floor to floors 1-6), Bob the Building must work hard to keep them happy!

He had an interesting idea to help. He replaced the elevator buttons on each floor by an electronic people-counter that tells him how many people are waiting for the elevator on each floor.

At noon there are exactly 3 people returning from work (roll three dice to see which floors they want to return to), and exactly 3 people leaving for work (roll three dice to find out what floors they are on).

Bob the Building's Elevator takes one second to move from floor to floor.

Example: Bob the Building's elevator starts on the ground floor and must return people to the 1st, 4th and 5th floors. There are also people waiting on the 1st and 3rd floors to be taken to the ground level.



The fastest that Bob the Building's elevator could possibly deliver all the people to the correct floors would be 10 seconds (see diagram on left).

What is the average amount of time a person must wait in order to be delivered to their correct floor?

Is there a way to improve on this average wait time?

Extensions:

Bob the Building's elevator decided to minimize the average time that people waited.

One day there was an especially warm rainfall, so many people simultaneously wanted to rush outside to enjoy it. If the elevator starts on the ground floor, what is the longest that someone would have to wait till they can get to the ground floor. If someone actually had to wait that long, what is the smallest number of people in Bob the Building?

For three people arriving and three people leaving, will Bob the Building's elevator ever need three up and down trips in order to get people to their destinations? (I'm still working on this.)

Unfortunately, Bob the Building's elevator was recently declared fit to carry a maximum of only three people. Make up a problem.

How do things change if the elevator takes an additional second to slow down to stop at a floor?

The Math in This Problem:

Within the realm of statistics, there are key concepts such as data sets, samples, and averages, which are most commonly calculated by finding the mean. Setting an emphasis on analysis, students are asked to carry out an experiment by constructing a unique set of data using dice then finding out the average using the numbers within their sample. This gives them a general understanding of statistics as later on it becomes more complex, including concepts such as variance, standard deviation, and distributions.