Class 1: Brain Teasers

Hey Guys! Welcome to this challenging but rewarding class. In this class, I'm going to teach you some awesome mathematical methods that have applied into the capital markets.

In our first class, I would like to do some warm-up and provide those brain teasers for you. They do not require you any advanced knowledge, however, all of them are tricky and I guess you won't come up with the answer very soon. I suggest you spend **1-1.5 hours** on those four questions in total before our first meeting. Again, it's not necessary for you to solve any of those problems, just think about them and write any ideas towards each problem. I will hold group discussion on the first class and let you brainstorm the ideas in teams :)

The four questions below are all related to strategies making. It's important to make creative and accurate strategies in financial markets. You win by making feasible trading strategies ahead of others.

Taking fully use of the information given and avoid unknown information during strategies making.

1. Burning ropes

You have two ropes, each of which takes I hour to bum. But either rope has different densities at different points, so there's no guarantee of consistency in the time it takes different sections within the rope to bum. How do you use these two ropes to measure 45 minutes?

Finding invariant properties when making strategies

2. Box packing

You have an 8 x 8 chess board with two small squares at the opposite diagonal comers removed. You have many bricks with dimension 1 x 2. Can you pack 31 bricks into the remaining 62 squares?

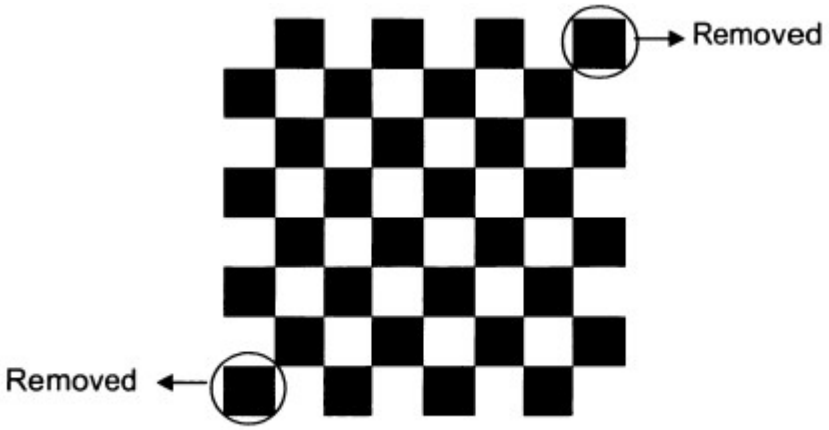

Figure 2.2 Chess board with alternative black and white squares

The "Screwy Pirates" problem is well-known in game theory and quant interview. This is much complex compared to previous two. When analyzing a complex problem, try to break it into simple and solvable sub-problems. In algorithm making, we call it "divide and conquer".

3. Screwy Pirates

Five pirates looted a chest full of 100 gold coins. Being a bunch of democratic pirates, they agree on the following method to divide the loot:

The most senior pirate will propose a distribution of the coins. All pirates, including the most senior pirate, will then vote. If more than 50% of the pirates (3 pirates in this case) accept the proposal, the gold is divided as proposed. If not, the most senior pirate will be kicked out of the boat and the process starts over with the next most senior pirate ... The process is repeated until a plan is approved. You can assume that all pirates are perfectly rational: they want to stay alive first and to get as much gold as possible second.

How will the gold coins be divided in the end?

This one will help you improve your ability in analyzing all possible outcomes of a strategy.

4. Defective ball

You have 12 identical balls. One of the balls is heavier OR lighter than the rest (you don't know which). Using just a balance that can only show you which side of the tray is heavier. How can you determine which ball is the defective one with 3 measurements?

Hint: First do it for 9 identical balls and use only 2 measurements, knowing that one is heavier than the rest.

*Note: all those questions are excerpted from book <A Practical Guide to Quantitative Finance Interviews> by Xinfeng Zhou