

Referred from **A Practical Guide To Quantitative Finance Interviews**
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Tiger and Sheep

Quant trading interview brain teaser



Problem Statement

One hundred tigers and one sheep are put on a magic island that only has grass.

Tigers can eat grass but would rather eat sheep.

Eat tiger a tiger eats a sheep, it becomes a sheep.

If all tigers are smart, and rational, will the sheep survive?

Base case

To understand the question and answer it for 100 tigers and a sheep, we need a smaller case that helps us form an inductive solution.

What happens if there's only one tiger and one sheep?

Base case

For 1 tiger and 1 sheep,

Of course the tiger eats the sheep as it's not under the threat of being eaten as it turns to sheep.

Base case

What about adding another tiger?

We see that if one more tiger is added then,

Neither of the tigers will eat the sheep. Why?

Base case

Because if any of the tiger eats the sheep, it turns into a sheep
And then gets eaten.

Base case

So,

For no. of tiger = 1, sheep **gets eaten** (i)

For no. of tiger = 2, sheep **doesn't get eaten** (ii)

What about 3 tigers?

Now, since there's 3 tigers,

Any of the tigers can eat the sheep and survive.

Why? Think about it.

What about 3 tigers?

After one tiger eats the sheep, it becomes the sheep and then this case becomes similar to (ii), where only 2 tigers and a sheep remain.

What about 4 and more...

Similarly we see any case with odd no. of tigers can be turned to (i) and case with even no. of tigers can be made similar to (ii).

Makes sense?

Answer

Coming to the case of 100 tigers and a sheep,
We can conclude that the sheep will not be eaten.

Explanation: This case is same as (ii).

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