

SAMPLE



AIN  
ASERS

IGNITE YOUR  
THINKING

EBOOK ONE

  
MIGHTY  
MINDS

# BRAIN TEASER

## GREEDY THIEVES



Five thieves stole a bag of 100 diamonds from a bank. In order to avoid being caught by the democratic thieves, they devised the following method:

1. The most senior thief will propose a distribution of the diamonds.
2. All thieves, including the proposer, will vote on the proposal.
3. If at least 50% of the thieves vote in favour, the proposal is accepted and the diamonds are divided as proposed. If less than 50% vote in favour, the proposer is executed and the proposal is rejected. The most senior thief who voted in favour starts over with the next proposal.
4. The process is repeated until a proposal is accepted.

You can assume that all thieves are perfectly rational—they want to get as many diamonds as they can, and they will only risk their lives if it is worth it. They are quite clever and very greedy.

How will the diamonds be divided?

### HINT:

- Simplify the problem down to two thieves, then add thieves to arrive at your answer.



# BRAIN TEASER

## RIVER CROSSING



Andrew, Barbara, Cam and Daniel need to cross the river via a rickety bridge, which can only hold two people at a time. Because it is dark, they can only cross the bridge with a torch, so two people must cross so one can return with the torch. They can only walk at the speed of the slower person. Andrew takes ten minutes to cross, Barbara as quickly as possible (19 minutes), Cam takes two minutes and Daniel takes ten minutes.

Andrew is the slowest and takes ten minutes to cross the river, Barbara takes ten minutes, Cam takes two minutes and Daniel takes ten minutes.

How can they all cross the river?

---

---

---

---

---

---

---

---

---

---



# BRAIN TEASER

## FORGOTTEN BIRTHDAY



Alana and Bob's boss, Mr Kingsley, has his birthday on one of the following dates:

- January 2
- January 5
- January 6
- July 6
- July 7
- October 2
- October 5
- November 2
- November 3

Mr Kingsley forgot to tell Alana his birthday, and he only told Bob the day. Alana and Bob then had the following conversation:

1. Bob: I don't know the day, but I know the month.
2. Alana: I don't know the day either, but I know the month.



Alana then spoke to the conversation, then writes Mr Kingsley's birthday without another word being said. What did she write?

---

---

---

---

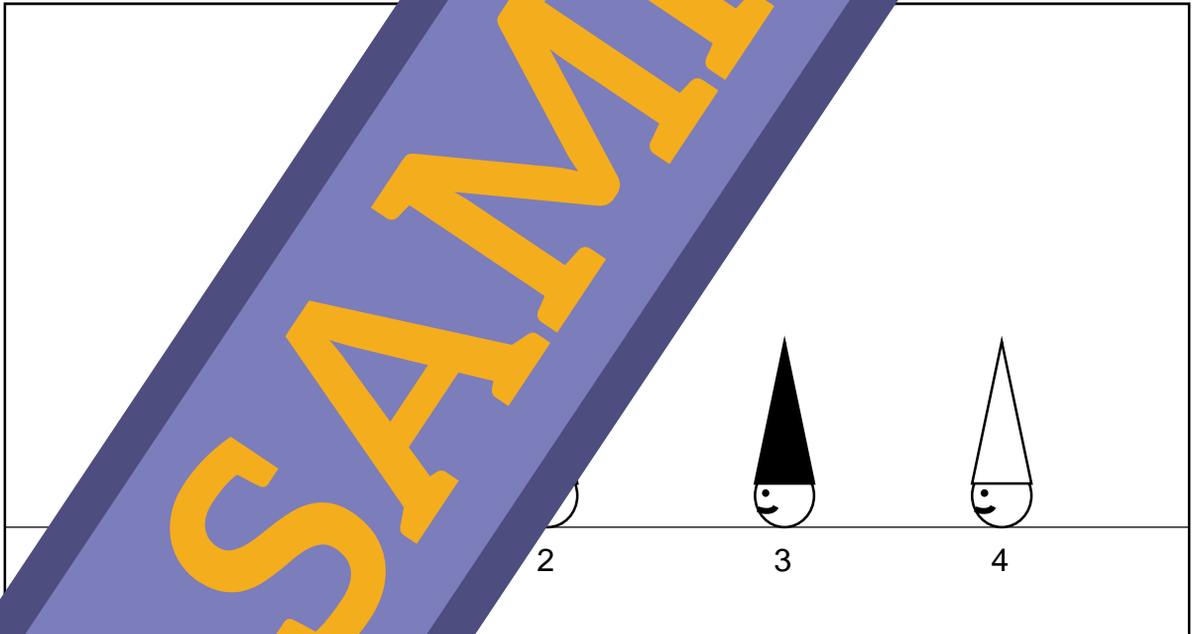
# BRAIN TEASER

## THE PRISONER DILEMMA



Four prisoners are buried up to their necks in a wall and cannot move their heads. They all face the wall. They know that two of them are wearing black hats and two are wearing white hats. They are not allowed to talk or communicate with each other. If they all guess the colour of their hat, they can all go free. If any one of them is wrong, they will all stay in prison for life.

After a minute of silence, one



The prisoner who yells out is:

\_\_\_\_\_



# BRAIN TEASER

## THE SUSPECTS' DILEMMA



This is a small introduction to game theory, which you will only learn in university if you do economics. You can use game theory to solve this problem. The answer is that they will both confess and they will both spend four years in prison. If you are a bit more creative because if they both stay silent they will only spend one year in prison, let's look at what both Tony and Bryan would do.

This is most easily represented as a matrix (see below):

		Tony	
		Stay quiet	Confess
Bryan	Stay quiet	B: 5 years T: None	B: 4 years T: 4 years
	Confess	B: 4 years T: 4 years	B: 4 years T: 4 years

In the table above, the most beneficial **collective outcome** is if both stay quiet and both go to jail for one year. However, the thieves are not friends and they will not coordinate. We need to see whether there are more favourable outcomes for each of them. Let's look at Bryan. If Tony stays quiet, his best strategy is to confess and go to jail for four years. If Tony confesses, Bryan's best strategy is to confess and go to jail for four years. In both cases, four years is better than five years in prison. So, if Tony confesses, Bryan is better off confessing. The same is true for Tony. If Bryan stays quiet, Tony's best strategy is to confess and go to jail for four years. If Bryan confesses, Tony's best strategy is to confess and go to jail for four years. In both cases, four years is better than five years in prison. So, if Bryan confesses, Tony is better off confessing. The same is true for Bryan. In both cases, four years is better than five years in prison. So, if both confess, both go to jail for four years. This is what is known as the Nash Equilibrium, a concept developed by mathematician John Nash, who was the subject of the



# BRAIN TEASER

## CLOCK ANGLES



You look at an analogue clock and it is 3:20. What is the angle between the hour hand and the minute hand?

---

---

---

---

---

---

---

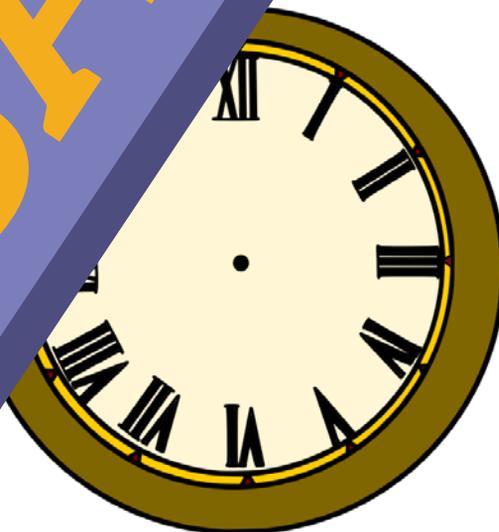
---

---

---

---

---



# BRAIN TEASER

## FARE SHARE



A wealthy man pays a taxi driver \$270 to drive him to the airport and back again. Two thirds down the road at point A, a friend of the wealthy man can ride with the wealthy man from there to the airport. The taxi driver offers to share the fare. The wealthy man, although not needing the taxi, said, "Yes, but only if you can calculate your share of the fare."

---

---

---

---

---

---

---

---

---

---

SAMPLE



# BRAIN TEASER

## HILL SPEED



The key to solving this problem is realising that travelling at 20km/h and 50km/h is not equivalent to simply average the speeds. You must find the average speed.

To do this, let the distance =  $d$  km and the time down the hill be  $t_2$ .

$$t_1 = d \div 20 \text{hrs}$$

$$t_2 = d \div 50 \text{hrs}$$

The average speed is the total distance divided by the total time ( $t_1 + t_2$ ).

Average speed =  $2d \div (t_1 + t_2)$

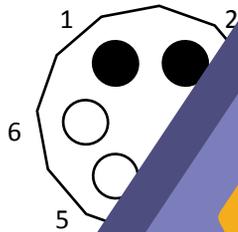


# BRAIN TEASER

## OLYMPIC SHOOTING



The diagram below illustrates the two bullets in the chamber. The probability of the gun not firing after a spin is  $\frac{1}{4}$ .



The diagram below illustrates the next spin of the cylinder. The probability of the gun firing on the next shot is  $\frac{3}{4}$ .

If one chamber contains a bullet, the next chamber to be fired must have been chambers 6, 5, 4 or 3. If the barrel moves clockwise, the next chamber to be fired must be either chamber 2 or 1. The probability of the gun firing on the next shot is  $\frac{3}{4}$ . The probability of the gun not firing on the next shot is  $\frac{1}{4}$ . The probability of the gun firing on the next shot is  $\frac{3}{4}$ . The probability of the gun not firing on the next shot is  $\frac{1}{4}$ .



The probability of the gun firing on the next shot and a  $\frac{3}{4}$  chance that the gun will fire on the next shot. This is a better probability than the probability of the gun firing on the next shot so the best response would be to fire the gun on the next shot.