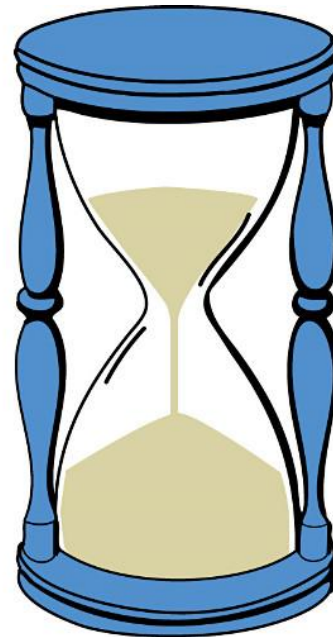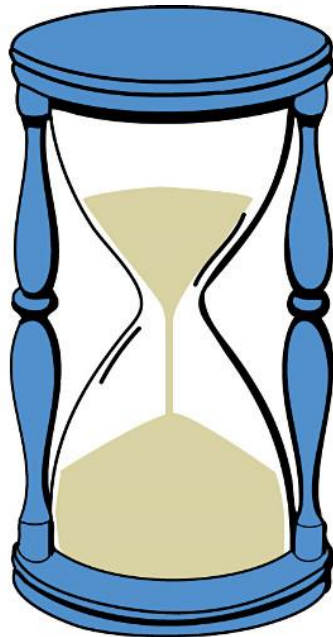# ACM LOGIC GAME

Hourglass

- Using only a four-minute hourglass and a seven-minute hourglass, measure exactly nine minutes - without the process taking longer than nine minutes.

Answer

- Start both hourglasses at 0 minutes.

- Flip over the four-minute glass when it runs out (at 4:00); ditto for the seven-minute glass (at 7:00).

- When the four-minute glass runs out the second time (at 8:00), the seven-minute glass will then have one minute of sand in its lower bulb. Flip the seven-minute glass over again and let the minute of sand run back. When the last grain falls, that will be nine minutes.

How Strong is an Egg?

- You have two identical eggs. Standing in front of a 100 floor building, you wonder what is the maximum number of floors from which the egg can be dropped without breaking it.

- What is the minimum number of tries needed to find out the solution?

Answer

- For example, let's first try at floor 14. If it breaks, then we need 13 more tries to find the solution. If it doesn't break, then we should try floor 27 (14 + 13). If it breaks, we need 12 more tries to find the solution. So the initial 2 tries plus the additional 12 tries would still be 14 tries in total. If it doesn't break, we can try 39 (27 + 12) and so on. Using 14 as the initial floor, we can reach up to floor 105 (14 + 13 + 12 + … + 1) before we need more than 14 tries. Since we only need to cover 100 floors, 14 tries is sufficient to find the solution.

- Therefore, 14 is the least number of tries to find out the solution.

FORK IN THE ROAD

- You are travelling down a country lane to a distant village. You reach a fork in the road and find a pair of identical twin sisters standing there.
  One standing on the road to village and the other standing on the road to Neverland (of course, you don't know or see where each road leads).

- One of the sisters always tells the truth and the other always lies (of course, you don't know who is lying).

- Both sisters know where the roads go.

- If you are allowed to ask only one question to one of the sisters to find the correct road to the village, what is your question?

Answer

- "Hey you, what would you say, if I asked you …?"
- A truth teller is clear, but a liar should lie. However, she is forced by the question to lie two times and thus speak the truth.

The Rope Bridge

- Four people need to cross a rickety rope bridge to get back to their camp at night. Unfortunately, they only have one flashlight and it only has enough light left for seventeen minutes. The bridge is too dangerous to cross without a flashlight, and it's only strong enough to support two people at any given time. Each of the campers walks at a different speed. One can cross the bridge in 1 minute, another in 2 minutes, the third in 5 minutes, and the slow poke takes 10 minutes to cross.

- How do the campers make it across in 17 minutes?

Answer

- 1 and 2 across (2 minutes)

- 1 goes back (3 minutes)

- 5 and 10 go across (13 minutes)

- 2 goes back (15 minutes)

- 1 and 2 cross (17 minutes) - and everyone safe and sound

PANDORA'S BOX

- Based upon the inscriptions on the boxes, which box contains the wedding ring?
- None or just one of them is true

Golden Box
The ring is in this box

Silver Box
The ring is not in this box

Lead Box
The ring is not in the golden box

Answer

- Ring is in the silver box

Prison

- 100 prisoners are stuck in the prison in solitary cells. The warden of the prison got bored one day and offered them a challenge. He will put one prisoner per day, selected at random (a prisoner can be selected more than once), into a special room with a light bulb and a switch which controls the bulb. No other prisoners can see or control the light bulb. The prisoner in the special room can either turn on the bulb, turn off the bulb or do nothing. On any day, the prisoners can stop this process and say "Every prisoner has been in the special room at least once". If that happens to be true, all the prisoners will be set free. If it is false, then all the prisoners will be executed. The prisoners are given some time to discuss and figure out a solution. How do they ensure they all go free?

Answer

- Since this is the only way they will EVER get out of that prison, they decide to work together and make a plan. They select one prisoner (Bob, easier to refer) as the counter.

- Every time any prisoner is selected other than Bob, they follow these steps. If they have never turned on the light bulb before and the light bulb is off, they turn it on. If not, they don't do anything (simple as that). Now if Bob is selected and the light bulb is already on, he adds one to his count and turns off the bulb. If the bulb is off, he just sits there meditates or whatever he wants to. The day his count reaches 99, he calls the warden and tells him "Every prisoner has been in the special room at least once".

- So how does this solution work? Every time a prisoner enters the room first, he turns on the bulb if it is off. This way every prisoner turns on the bulb only once. When Bob enters and sees the bulb on, he knows that one new prisoner has entered the room so he adds one to his count. So when his counter reaches 99, he knows the rest of them have all been in the special room and obviously, he has been in the special room.

Book Pages

- A book has N pages, numbered the usual way, from 1 to N. The total number of digits in the page numbers is 1,095. How many pages does the book have?

Answer

- Every page number has a digit in the units column. With N pages, that's N digits right there. All but the first 9 pages have a digit in the tens column. That's N - 9 more digits.
- All but the first 99 pages have a digit in the hundreds column (accounting for N - 99 more digits).
- I could go on, but not many books have more than 999 pages. A book with 1,095 digits in its page numbers won't, anyway.
- This means that 1,095 must equal:
- N + (N - 9) + (N - 99).
- This can be simplified to:
- 1,095 = 3N - 108.
- That means that 3N = 1,203, or N = 401. That's the answer, 401 pages.