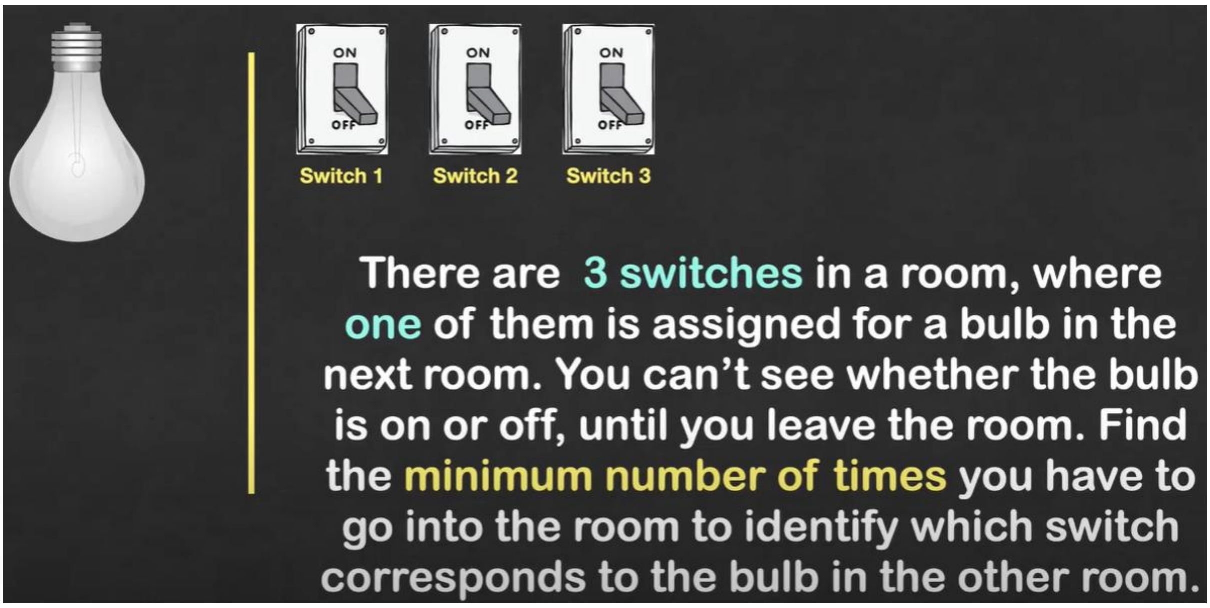
1.



Solution: You only need to go into the room once.

Explanation:

1. **Flip Switch 1 ON** and leave it on for a few minutes (e.g., 2-3 minutes). This is crucial for the heat aspect.
2. **Flip Switch 1 OFF.**
3. **Flip Switch 2 ON.**
4. **Immediately go into the room with the bulb.**

Once you are in the room with the bulb:

- **If the light is ON:** Switch 2 controls the bulb.
- **If the light is OFF but the bulb is warm to the touch:** Switch 1 controls the bulb (because it was on for a while and then turned off).
- **If the light is OFF and the bulb is cold:** Switch 3 controls the bulb (it was never touched).

2.

You are given 8 identical looking balls. One of them is heavier than the rest of the 7. You are provided with a simple mechanical balance and you are restricted to only 2 uses. Find the heavier ball ?

Solution : You can find the heavier ball in a minimum of 2 uses of the mechanical balance.

Explanation:

Weighing 1:

1. Divide the 8 balls into three groups:
   - Group A: 3 balls (e.g., B1, B2, B3)
   - Group B: 3 balls (e.g., B4, B5, B6)
   - Group C: 2 balls (e.g., B7, B8)
2. Place **Group A** on one side of the balance and **Group B** on the other side.
   - **Scenario 1: The balance tips to Group A's side.** This means one of the balls in Group A (B1, B2, or B3) is the heavier one.
   - **Scenario 2: The balance tips to Group B's side.** This means one of the balls in Group B (B4, B5, or B6) is the heavier one.
   - **Scenario 3: The balance remains perfectly balanced.** This means all balls in Group A and Group B are of normal weight. Therefore, the heavier ball must be in Group C (B7 or B8).

Weighing 2:

Now, you will use the second weighing based on the outcome of Weighing 1:

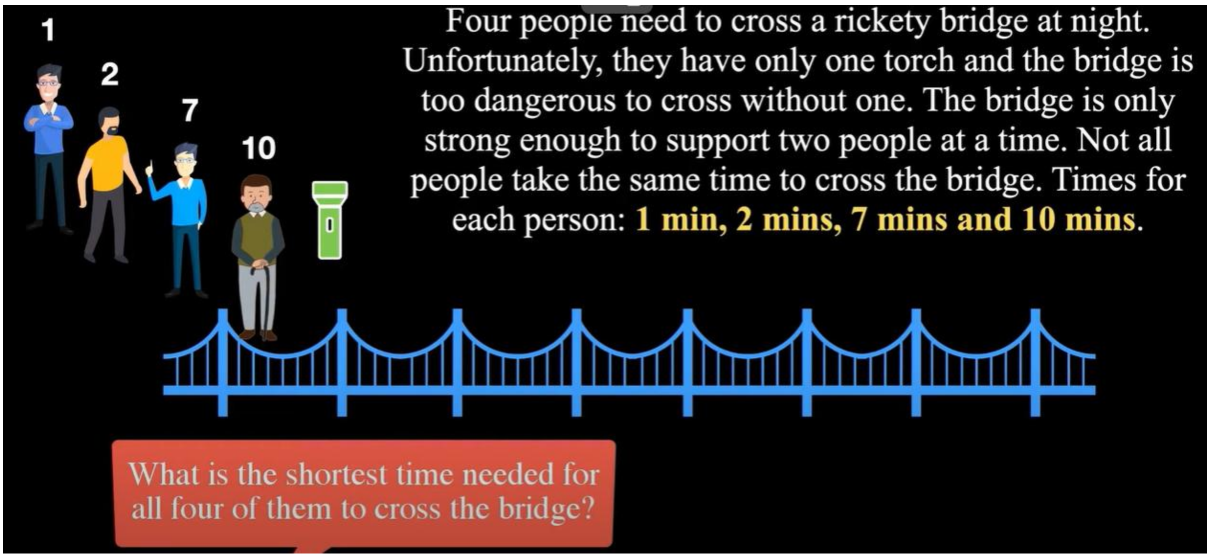
- If Scenario 1 (Group A was heavier):
  Take any two balls from Group A (e.g., B1 and B2). Place B1 on one side of the balance and B2 on the other.

- If the balance tips to B1's side, then **B1** is the heavier ball.
- If the balance tips to B2's side, then **B2** is the heavier ball.
- If the balance remains balanced, then **B3** (the remaining ball from Group A) is the heavier ball.

- **If Scenario 2 (Group B was heavier):**
  Similarly, take any two balls from Group B (e.g., B4 and B5). Place B4 on one side and B5 on the other.
  - If the balance tips to B4's side, then **B4** is the heavier ball.
  - If the balance tips to B5's side, then **B5** is the heavier ball.
  - If the balance remains balanced, then **B6** (the remaining ball from Group B) is the heavier ball.
- **If Scenario 3 (Group C contained the heavier ball):**
  Take the two balls from Group C (B7 and B8). Place B7 on one side of the balance and B8 on the other.
  - If the balance tips to B7's side, then **B7** is the heavier ball.
  - If the balance tips to B8's side, then **B8** is the heavier ball.

In all possible scenarios, you successfully identify the heavier ball in a maximum of two weighings.

3.



Solution : The shortest time needed for all four of them to cross the bridge is 17 mins.

Explanation:

1. **First Crossing:**
   - Send the **1-minute person** and the **2-minute person** across the bridge together.
   - Time taken: 2 minutes (because the 2-minute person is slower).
   - *Result:* The 1-minute and 2-minute people are now on the other side. The 7-minute and 10-minute people are still on the starting side.
2. **First Return:**
   - The **1-minute person** brings the torch back to the starting side.
   - Time taken: 1 minute.
   - *Total Time So Far:* 2 + 1 = 3 minutes.
   - *Result:* The 1-minute, 7-minute, and 10-minute people are on the starting side. The 2-minute person is alone on the other side.
3. **Second Crossing:**
   - Send the **7-minute person** and the **10-minute person** across the bridge together. This is the crucial step to get the two slowest people over in one go.
   - Time taken: 10 minutes (because the 10-minute person is slower).
   - *Total Time So Far:* 3 + 10 = 13 minutes.
   - *Result:* The 1-minute person is on the starting side. The 2-minute, 7-minute, and 10-minute people are on the other side.

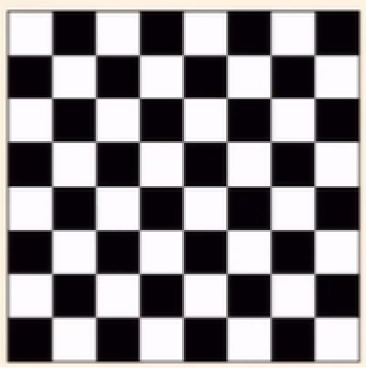
4. **Second Return:**
   - The **2-minute person** (who is on the other side and is the fastest available to return) brings the torch back to the starting side.
   - Time taken: 2 minutes.
   - *Total Time So Far:* 13 + 2 = 15 minutes.
   - *Result:* The 1-minute and 2-minute people are on the starting side. The 7-minute and 10-minute people are on the other side.
5. **Final Crossing:**
   - Send the **1-minute person** and the **2-minute person** across together again.
   - Time taken: 2 minutes.
   - *Total Time So Far:* 15 + 2 = 17 minutes.
   - *Result:* All four people are now safely on the other side.

4. (Google)

There is an 8 by 8 chessboard in which two diagonally opposite corners have been cut off. You are given 31 dominos, and a single domino can cover exactly two squares. Can you use the 31 dominos to cover the entire board?

Solution: No, you cannot use the 31 dominos to cover the entire board.

Explanation:



1. **Standard Chessboard Coloring:** An 8x8 chessboard has 64 squares. These squares are colored alternately black and white. For a standard 8x8 board, there are exactly 32 black squares and 32 white squares.
2. **Effect of Cutting Corners:** When you cut off two diagonally opposite corners, those two corners will always be of the *same color*.
   - For example, if you cut off the top-left (let's say it's white) and the bottom-right (which will also be white), you remove two white squares.
   - This leaves you with a board that has:
     - 32 black squares
     - 30 white squares
3. **Domino Coverage:** Each domino covers exactly two squares. Crucially, a single domino *always* covers one black square and one white square, regardless of how it's placed.
4. **The Imbalance:**
   - You have 31 dominos. If you could cover the board, 31 dominos would cover $31 \times 2 = 62$ squares.
   - For these 31 dominos to cover the board, they would need to cover 31 black squares and 31 white squares.
   - However, after removing the two diagonally opposite corners, your board has 32 black squares and 30 white squares (or vice-versa, depending on which color you define the corner as).

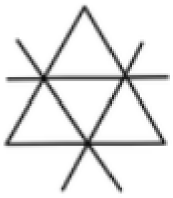
Since the number of black squares and white squares is unequal (32 black and 30 white, or 30 black and 32 white), and each domino must cover one of each color, it's impossible to cover the entire remaining board with 31 dominos. You'll always be left with two squares of the same color uncovered.

5.

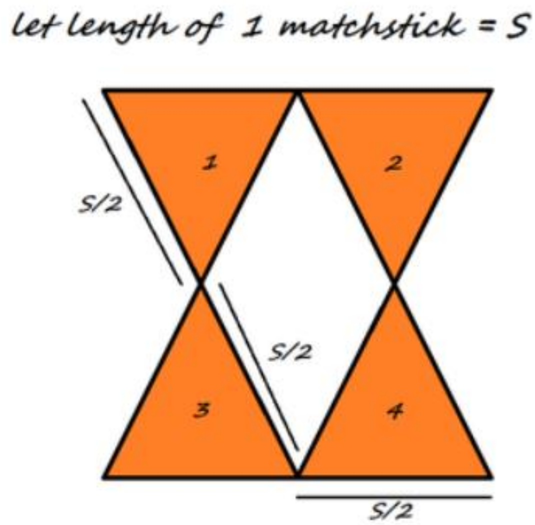
How to make 4 equilateral triangles with 6 identical match sticks?

Solution:

Method I :



Method II :



6.

You are a king of an empire. You have a servant working in your palace. He works all the seven days and you only pay him in the form of gold bar. You must pay the worker for his work every day at the end of the day. If you are only able to make two breaks in the gold bar, how will you pay the servant if the servant works for the equal time every day and thus equal amount must be paid at the end of the day?

Solution:

You will make two breaks in the gold bar to divide it into three pieces of specific lengths:

1. **Break 1:** Divide the bar into a 1-day piece and a 6-day piece.
2. **Break 2:** Divide the 6-day piece into a 2-day piece and a 4-day piece.

So, you will have three pieces of gold bar: **1 day, 2 days, and 4 days** worth of gold.

How to Pay the Servant Daily:

- **End of Day 1:** Give the servant the **1-day piece**.
- **End of Day 2:** Take back the 1-day piece. Give the servant the **2-day piece**.
- **End of Day 3:** Give the servant the **1-day piece** (which you got back on Day 2).
- **End of Day 4:** Take back the 1-day and 2-day pieces. Give the servant the **4-day piece**.
- **End of Day 5:** Give the servant the **1-day piece** (which you got back on Day 4).
- **End of Day 6:** Take back the 1-day piece. Give the servant the **2-day piece** (which you got back on Day 4).
- **End of Day 7:** Give the servant the **1-day piece** (which you got back on Day 6).

This method allows you to pay the servant exactly one day's worth of gold at the end of each day, using only two breaks in the original gold bar.

7.

KN ACADEMY
E-LEARNING

You have two identical ropes, which are non-uniform in composition. Each rope takes 60 minutes to burn (But non-uniformly, for example: 90% of the rope may burn in 5 min and rest 10% may take 55 min or any such composition). You don't have any watch but a lighter. How will you calculate 45 minutes?

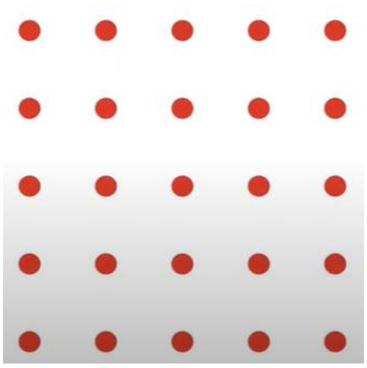
Solution:

1. **At the exact same moment:**
   - Light **both ends** of Rope 1.
   - Light **one end** of Rope 2.
2. **What happens:**
   - Rope 1, being lit from both ends, will burn completely in exactly **30 minutes** (half of its 60-minute total burn time).
3. **When Rope 1 finishes burning (at the 30-minute mark):**
   - Immediately light the **other end** of Rope 2.

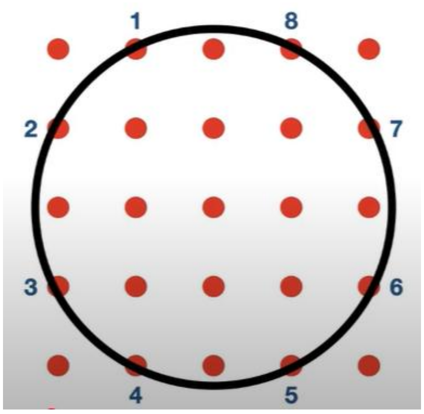
4. The final calculation:
   - Rope 2 has already been burning from one end for 30 minutes. Since it's non-uniform, we don't know how much *length* has burned, but we know it has 30 minutes of its total burning time remaining (because it would have taken 60 minutes to burn from one end, and 30 minutes have passed).
   - By lighting the other end of Rope 2, you effectively make the remaining portion burn out in half the time it would have taken if only one end was burning.
   - So, the remaining 30 minutes of burn time for Rope 2 will be completed in an additional 15 minutes ($30 \text{ minutes}/2 = 15 \text{ minutes}$).
5. Total Time:
   - The total time elapsed will be the first 30 minutes (when Rope 1 burned out) plus the additional 15 minutes (for the remainder of Rope 2 to burn out).
   - $30 \text{ minutes} + 15 \text{ minutes} = \mathbf{45 \text{ minutes}}$.

8.

There is a square grid comprising 25 dots. A circle is attached to the grid. What is the largest number of dots the circle can pass through?



Solution:



8 is the largest number of dots , the circle can pass through

9.

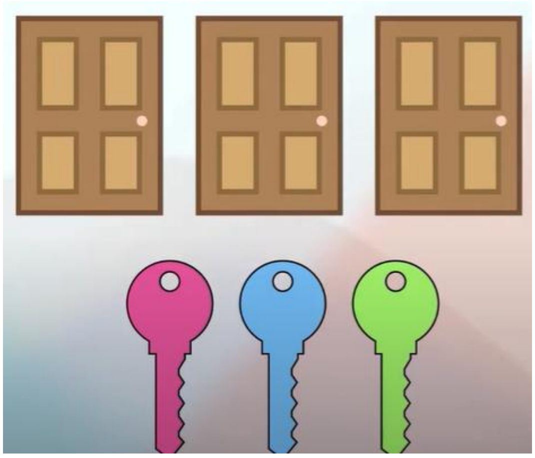
Question: Suppose you have a 4 liter jug and a 9 liter bucket . The buckets have no measurement lines on them either. How could you measure exactly 6 liter using only those buckets and you have as much extra water as you need ?

Solution:

1. **Fill the 9-liter bucket completely.** (You now have 9 liters)
2. **Pour water from the 9-liter bucket into the 4-liter jug until the jug is full.** (This leaves $9 - 4 = 5$ liters in the 9-liter bucket and 4 liters in the jug).
3. **Empty the 4-liter jug.**
4. **Pour the 5 liters from the 9-liter bucket into the 4-liter jug.** (The 4-liter jug now has 4 liters, and 1 liter remains in the 9-liter bucket).
5. **Empty the 4-liter jug.**
6. **Pour the 1 liter from the 9-liter bucket into the 4-liter jug.** (The 4-liter jug now has 1 liter).
7. **Fill the 9-liter bucket completely.** (You now have 1 liter in the 4-liter jug and 9 liters in the 9-liter bucket).
8. **Carefully pour water from the 9-liter bucket into the 4-liter jug until the 4-liter jug is full.** Since the 4-liter jug already has 1 liter, you will pour $4 - 1 = 3$ liters from the 9-liter bucket.
9. **The 9-liter bucket will now contain $9 - 3 = 6$ liters.**

10.

There are three keys that open locks of three different gates. In how many attempts, you can figure out the key for each gate?



Solution:

- **Gate 1:** You pick a key. If it doesn't open the gate, you try another. At most, you'll need 2 attempts to find the correct key for the first gate. Once you find the correct key for Gate 1, you set it aside.
- **Gate 2:** You are left with two keys. You pick one. If it doesn't open the gate, the other key must be the correct one. At most, you'll need 1 attempt to find the correct key for the second gate. Once you find the correct key for Gate 2, you set it aside.
- **Gate 3:** Only one key remains, and it must be the correct key for the third gate. You won't need any additional attempts.

Therefore, the maximum number of attempts you would need to figure out the key for each gate is $2 + 1 + 0 = 3$ attempts.

In the worst-case scenario:

1. For the first gate, you try a key, it's wrong. You try a second key, it's wrong. The third key must be correct. (2 attempts)
2. For the second gate, you have two keys left. You try one, it's wrong. The other key must be correct. (1 attempt)
3. For the third gate, only one key is left, so it's guaranteed to be correct. (0 attempts)

Total maximum attempts = $2 + 1 + 0 = 3$.