PUZZLES – BRAIN TEASERS
FOR
ANALYTICS INTERVIEW

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Analytics jobs require a lot of problem solving and out of the box thinking. Hence, puzzles, logical reasoning problems and questions to test lateral thinking part of most analytics job interviews. But not all puzzles are alike. Some are more technical, some are straight forward (if you know the answer you can solve it) and some are just unsolvable- interviewer is probably trying to test your approach or patience. But to succeed, you must be prepared for all such scenarios. You may also be asked to create algorithms for each of these cases.

Here's how to crack them:

1. Focus on the data provided– usually interview puzzles involve just one or two steps of calculations.

2. Develop a structured approach to answer difficult puzzles

3. Should be able to explain your approach to the interviewer

Some of these examples help you how to master puzzle solving for interviews with approach, straight forward, doubtful, lateral thinking, mathematical, probability puzzles.

Examples for Approach Puzzles

Example-1: A race track has 5 lanes. There are 25 horses and one would like to find out the 3 fastest horses. What is the minimum number of races one would need to conduct to determine the 3 fastest horses?

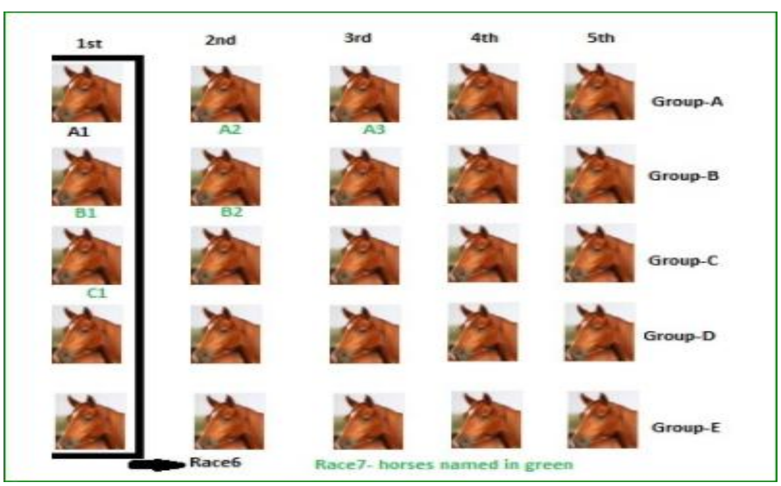
This is a common puzzle asked by many interviewers. The steps are:

Create 5 groups of 5 horses each and conduct five races (1 for each group) and pick up the fastest horse from each group.

The sixth race will be among the 5 winners to find out the 3 fastest horses (mark them A1, B1 and C1)

Seventh race will be among the horses B1, C1, second and third horse from the horse A1's group (A2, A3), second horse from horse B1's group (B2).

The 1st and 2nd position holders in the 7th race are the 2nd and the 3rd fastest horses among all horses.



The logic is simple. By conducting the race among 5 winning horses we can find out the fastest horse but we don't know for sure whether the second fastest horse in that race is faster than the second horse in the fastest horse's group. So, in the final race we must include all probable candidates and conduct the race.

Example-2: Finding out the heaviest coin in among N number of coins. And the trick is to single out the one in lowest number of steps. The approach to such problems are to:

- Divide all the members into X groups and maximize number of members in each group. In this case we could have just 5 horses in each group as there were 5 lanes.
- Shortlist the members from each group and make them compete among themselves (if required form the groups again) and iterate the first step until the problem is solved.
- Develop a structured approach to answer difficult puzzles

Examples for straightforward Puzzles

In many cases interviewer expects you to know the answer but in case you don't you should apply simple logic and explain your approach. I'll site some examples here (mostly related to data science and analytics):

Question: You have 3 jars that are all mislabeled. One jar contains Apple, another contains Oranges and the third jar contains a mixture of both Apple and Oranges.

You are allowed to pick as many fruits as you want from each jar to fix the labels on the jars. What is the minimum number of fruits that you have to pick and from which jars to correctly label them?

Solution:

An interesting point in these kind of puzzles is there is a circular misplacement. Which means if Apple is wrongly labeled as Apple, Apple can't be labeled as Orange- it has to be labeled as A+O.

Now, to answer this question in minimum steps, try to reverse engineer the problem. You know everything is wrongly placed. Which means the A+O jar contains either Apple or Orange (but not both). So, just pick one fruit from A+O and let's say you get an Apple. Name it Apple. As discussed above, jar labeled Apple can't have A+O. So, it can be labeled Orange. The third jar left should be labeled as A+O.

So, you can answer the question by just picking one fruit.

Question: You have a flashlight that takes 2 working batteries. You have 8 batteries but only 4 of them work. What is the fewest number of pairs you need to test to guarantee you can get the flashlight on?

Solution:

Let's say the batteries are A, B, C, D, E, F, G and H

This is somewhat similar to the horse problem discussed in beginning. Except for the fact that we can't compare 2 items directly. If a combination of two batteries can't light the torch either or both can be not working. So, we have to try out in a circular way first.

Try AB, BC and AC. If none of the pairs work at most one out of ABC is working.

Which means at least three batteries among DEFGH must be working.

Try DE. If they do not work then at least two out of FGH should work. Try FG, GH and FH and you'll find out two working batteries.

Question: You are blindfolded and 10 coins are place in front of you on table. You are allowed to touch the coins, but can't tell which way up they are by feel. You are told that there are 5 coins head up, and 5 coins tails up but not which ones are which. How do you make two piles of coins each with the same number of heads up? You can flip the coins any number of times.

Solution:

Randomly select 5 coins and make a pile. Make another pile with 5 other coins.

First pile would look like, say H, H, H, H, T

The other pile should be: T, T, T, T, H

So, now, if you just flip all coins in the second pile and both will have same number of heads.

The third type of puzzles are the doubtful ones and interviewer might ask you such question only to check your ability to support your answers with reasons.

A famous problem of this type is Monty Hall problem (Here's a link to the answer for Monty Hall.). Just keep your calm while answering such problems and be reasonable.

Question: Bag of Coins: You have 10 bags full of coins. In each bag are infinite coins. But one bag is full of forgeries, and you can't remember which one. But you do know that a genuine coin weigh 1 gram, but forgeries weigh 1.1 grams. You have to identify that bag in minimum readings. You are provided with a digital weighing machine.

Solution:

Take 1 coin from the first bag, 2 coins from the second bag, 3 coins from the third bag and so on. Eventually, we'll get 55 (1+2+3…+9+10) coins. Now, weigh all the 55 coins together. Depending on the resulting weighing machine reading, you can find which bag has the forged coins such that if the reading ends with 0.4 then it is the 4th bag, if it ends with 0.7 then it is the 7th bag and so on.

Question: Prisoners and hats: There are 100 prisoners all sentenced to death. One night before the execution, the warden gives them a chance to live if they all work on a strategy together. The execution scenario is as follows –

On the day of execution, all the prisoners will be made to stand in a straight line such that one prisoner stands just behind another and so on. All prisoners will be wearing a hat either of Blue color or Red. The prisoners don't know what color of hat they are wearing. The prisoner who is standing at the last can see all the prisoners in front of him (and what color of hat they are wearing). A prisoner can see all the hats in front of him. The prisoner who is standing in the front of the line cannot see anything.

The executioner will ask each prisoner what color of hat they are wearing one by one, starting from the last in the line. The prisoner can only speak “Red” or “Blue”. He cannot say anything else. If he gets it right, he lives otherwise he is shot instantly. All the prisoners standing in front of him can hear the answers and gunshots.

Assuming that the prisoners are intelligent and would stick to the plan, what strategy would the prisoners make over the night to minimize the number of deaths?

Solution:

The strategy is that the last person will say ‘red’ if the number of red hats in front of him are odd and ‘blue’ if the number of red hats in front of him are even. Now, the 99th guy will see if the red hats in front of him are odd or even. If it is odd then obviously the hat above him is blue, else it is red. From now on, it’s intuitive.

Question: Blind games: You are in a dark room where a table is kept. There are 50 coins placed on the table, out of which 10 coins are showing tails and 40 coins are showing heads. The task is to divide this set of 50 coins into 2 groups (not necessarily same size) such that both groups have same number of coins showing the tails.

Solution: Divide the group into two groups of 40 coins and 10 coins. Flip all coins of the group with 10 coins.

Question: Sand timers: You have two sand timers, which can show 4 minutes and 7 minutes respectively. Use both the sand timers (at a time or one after other or any other combination) and measure a time of 9 minutes.

Solution:

Start the 7-minute sand timer and the 4-minute sand timer.

Once the 4-minute sand timer ends turn it upside down instantly.

Once the 7-minute sand timer ends turn it upside down instantly.

After the 4-minute sand timer ends turn the 7-minute sand timer upside down (it has now minute of sand in it) So effectively 8 + 1 = 9.

Question: Chaos in the bus: There is a bus with 100 labeled seats (labeled from 1 to 100). There are 100 persons standing in a queue. Persons are also labeled from 1 to 100.

People board on the bus in sequence from 1 to n. The rule is, if person ‘i’ boards the bus, he checks if seat ‘i’ is empty. If it is empty, he sits there, else he randomly picks an empty seat and sit there. Given that 1st person picks seat randomly, find the probability that 100th person sits on his place i.e. 100th seat.

Solution:

The final answer is the probability that the last person ends in up in his proper seat is exactly 1/2

The reasoning goes as follows:

First, observe that the fate of the last person is determined the moment either the first or the last seat is selected! This is because the last person will either get the first seat or the last seat. Any other seat will necessarily be taken by the time the last guy gets to 'choose'.

Since at each choice step, the first or last is equally probable to be taken, the last person will get either the first or last with equal probability: 1/2.

Question: Mad men in a circle: N persons are standing in a circle. They are labelled from 1 to N in clockwise order. Every one of them is holding a gun and can shoot a person on his left. Starting from person 1, they start shooting in order e.g. for N=100, person 1 shoots person 2, then person 3 shoots person 4, then person 5 shoots person 6……. then person 99 shoots person 100, then person 1 shoots person 3, then person 5 shoots person 7……and it continues till all are dead except one. What's the index of that last person?

Solution:

Write 100 in binary, which is 1100100 and take the complement which is 11011 and it is 27. Subtract the complement from the original number. So, 100 – 27 = 73.

Try it out for 50 people. 50 = 110010 in binary.

Complement is 1101 = 13. Therefore, 50 – 13 = 37.

For the number in form 2^n, it will be the first person. Let's take an example:

64 = 1000000

Complement = 111111 = 63.

64-63 = 1. You can apply this for any 'n'.

Question: Lazy people need to be smart: Four glasses are placed on the corners of a square Lazy Susan (a square plate which can rotate about its center). Some of the glasses are upright (up) and some upside-down (down).

A blindfolded person is seated next to the Lazy Susan and is required to re-arrange the glasses so that they are all up or all down, either arrangement being acceptable (which will be signaled by say ringing of a bell).

The glasses may be rearranged in turns with subject to the following rules: Any two glasses may be inspected in one turn and after feeling their orientation the person may reverse the orientation of either, neither or both glasses. After each turn the Lazy Susan is rotated through a random angle.

The puzzle is to devise an algorithm which allows the blindfolded person to ensure that all glasses have the same orientation (either up or down) in a finite number of turns. (The algorithm must be deterministic, i.e. non-probabilistic)

Solution:

This algorithm guarantees that the bell will ring in at most five turns:

On the first turn, choose a diagonally opposite pair of glasses and turn both glasses up.

On the second turn, choose two adjacent glasses at least one will be up as a result of the previous step. If the other is down, turn it up as well. If the bell does not ring, then there are now three glasses up and one down.

On the third turn, choose a diagonally opposite pair of glasses. If one is down, turn it up and the bell will ring. If both are up, turn one down. There are now two glasses down, and they must be adjacent.

On the fourth turn, choose two adjacent glasses and reverse both. If both were in the same orientation then the bell will ring. Otherwise there are now two glasses down and they must be diagonally opposite.

On the fifth turn, choose a diagonally opposite pair of glasses and reverse both. The bell will ring.

Question: These kids deserve medals: There are 10 incredibly smart boys at school: A, B, C, D, E, F, G, H, I and Sam. They run into class laughing at 8:58 am, just two minutes before the playtime ends and are stopped by a stern looking teacher: Mr. Rabbit.

Mr. Rabbit sees that A, B, C and D have mud on their faces. He, being a teacher who thinks that his viewpoint is always correct and acts only to enforce rules rather than thinking about the world that should be, lashes out at the poor kids.

“Silence!”, he shouts. “Nobody will talk. All of you who have mud on your faces, get out of the class!”. The kids look at each other. Each kid could see whether the other kids had mud on their faces, but could not see his own face. Nobody goes out of the class.

“I said, all of you who have mud on your faces, get out of the class!”

Still nobody leaves. After trying 5 more times, the bell rings at 9 and Mr. Rabbit exasperatedly yells: “I can clearly see that at least one of you kids has mud on his face!”.

The kids grin, knowing that their ordeal will be over soon. Sure enough, after a few more times bawling of “All of you who have mud on your faces, get out of the class!”, A, B, C and D walk out of the class.

Explain how A, B, C and D knew that they had mud on their faces. What made the kids grin? Everybody knew that there was at least one kid with mud on his face. Support with a logical statement that a kid did not know before Mr. Rabbit’s exasperated yell at 9, but that the kid knew right after it.

Solution:

After Mr. Rabbit's first shout, they understood that at least one boy has mud on his face. So, if it was exactly one boy, then the boy would know that he had mud on his face and go out after one shouting.

Since nobody went out after one shouting, they understood that at least two boys have mud on their faces. If it were exactly two boys, those boys would know (they would see only one other's muddy face and they'd understand their face is muddy too) and go out after the next shouting.

Since nobody went out after the second shouting, it means there are at least three muddy faces and so on, after the fourth shouting, A, B, C and D would go out of the class.

This explanation does leave some questions open. Everybody knew at least three others had mud on their faces, why did they have to wait for Mr. Rabbit's shout at the first place? Why did they have to go through the all four shouting's after that as well?

In multi-agent reasoning, an important concept arises of common knowledge. Everybody knows that there are at least three muddy faces but they cannot act together on that information without knowing that everybody else knows that too. And that everybody knows that everybody knows that and so on. This is what we'll be analyzing. It requires some imagination, so be prepared.

A knows that B, C and D have mud on their faces. A does not know if B knows that three people have mud on their faces. A knows that B knows that two people have mud on their faces. But A can't expect people to act on that information because A does not know if B knows that C knows that there are two people with mud on their faces. If you think this is all uselessly complicated, consider this:

A can imagine a world in which he does not have mud on his face. (Call this world A) In A's world, A can imagine B having a world where both A and B do not have mud on their faces. (Call this world AB)

A can imagine a world where B imagines that C imagines that D imagines that nobody has mud on their faces. (Call this world ABCD). So, when Mr. Rabbit shouted initially, it could have been that nobody was going out because a world ABCD was possible in which nobody should be going out anyway.

So, here's a statement that changes after Mr. Rabbit's yell. World ABCD is not possible i.e. A cannot imagine a world where B imagines that C imagines that D imagines that nobody has mud on their faces. So now in world ABC, D knows he has mud on his face. And in world ABD, C knows he has mud on his face and so on.

Question: More prisoners and more hats: There are 7 prisoners sitting in a circle. The warden has caps of 7 different colors (an infinite supply of each color). The warden places a cap on each prisoner's head – he can choose to place any cap on any other's head. Each prisoner can see all caps but her/his own. The warden orders everybody to shout out the color of their respective caps simultaneously. If anyone is able to guess her/his color correctly, he sets them free. Otherwise, he sends them in a dungeon to rot and die. Is it possible to devise a scheme to guarantee that nobody dies?

Solution:

Assign to each of the 7 colors a unique number from 0-6. Henceforth, we will only be doing modular arithmetic (modulo 7).

Assign to each of the 7 prisoners a unique number from 0-6. If the number assigned to prisoner P is N, then P always guesses that the sum of the colors assigned to all prisoners is M (modulo 7). Thus, he calculates his own color under this assumption (= (M - sum (colors of the 6 prisoners he can see)) %7).

There will always be a prisoner who guesses the correct sum (as the sum lies in 0-6), and this prisoner therefore correctly guesses his own color.

If there is a solution, then exactly one prisoner is correct (no more). This is because there are 7^7 scenarios.

Each prisoner's response is a function of the colors of the other 6, so if you fix their colors and vary his color, you can see that he will be correct in exactly one-seventh of the cases (=7^6). The sum (across all scenarios) of the number of prisoners who are correct is 7*(7^6) =7^7.

If each scenario is to have at least one person right, this implies that each scenario cannot have more than one person who is right.

Being right about one's, color is equivalent to being right about the sum of colors of all prisoners (modulo 7). (The colors of the other 6 are known.) So, guessing one's color is the same as guessing the sum. How do we make sure that at least one person guesses the correct sum? By making sure that everybody guesses a different sum.

Question: All men must die: One day, an alien comes to Earth. Every day, each alien does one of four things, each with equal probability to:

(i) Kill himself

(ii) Do nothing

(iii) Split himself into two aliens (while killing himself)

(iv) split himself into three aliens (while killing himself)

What is the probability that the alien species eventually dies out entirely?

Solution:

The answer is √2 – 1.

Suppose that the probability of aliens eventually dying out is x.

Then for n aliens, the probability of eventually dying out is xn because we consider every alien as a separate colony. Now, if we compare aliens before and after the first day, we get:

$x = (1 /4) * 1 + (1 /4) * x + (1 /4) * x^2 + (1 /4) * x^3$

$x^3 + x^2 - 3x + 1 = 0$

$(x - 1) (x 2 + 2x - 1) = 0$

We get, $x = 1, -1 - \sqrt{2}$, or $-1 + \sqrt{2}$

We claim that x cannot be 1, which would mean that all aliens eventually die out. The number of aliens in the colony is, on average, multiplied by 0+1+2+3 4 = 1.5 every minute, which means in general the aliens do not die out. (A more rigorous line of reasoning is included below.) Because x is not negative, the only valid solution is $x = \sqrt{2} - 1$.

To show that x cannot be 1, we show that it is at most $\sqrt{2}-1$.

Let xn be the probability that a colony of one bacteria will die out after at most n minutes. Then, we get the relation:

$xn + 1 = 1/4\ (1 + xn + x^2n + x^2n)$

We claim that $xn \le \sqrt{2} - 1$ for all n, which we will prove using induction.

It is clear that $x1 = 1/4 \le \sqrt{2} - 1$. Now, assume $Xu \le \sqrt{2} - 1$ for some k. We have:

$xk+1 \le 1/4\ (1 + Xu + x^2k + x^3k)$

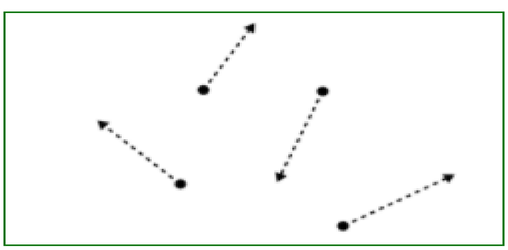
$\le 1/4\ (1 + (\sqrt{2} - 1) + (\sqrt{2} - 1)^2 + (\sqrt{2} - 1)^3)$

$= \sqrt{2} - 1$

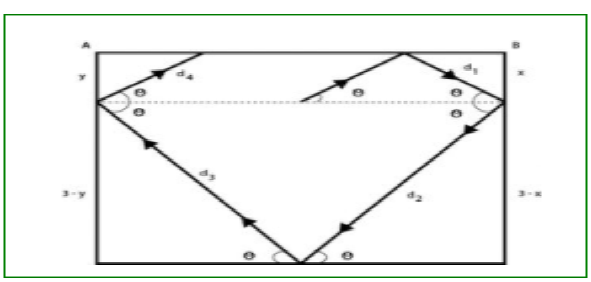
Which completes the proof that $xn \le \sqrt{2} - 1$ for all n. Now, we note that as n becomes large, xn approaches x. **using formal notation, this is:**

$x = \lim (n \to \infty)\ xn \le \sqrt{2} - 1$, so x cannot be 1.

Question: Lumos: A photon starts moving in random direction from the center of square of size 3. Let's say it first colloids to the glass wall AB. What is the expected distance traveled by photon before hitting the wall AB again?



Solution:



Above is a pictorial representation of the photon. We can calculate its distance as shown below:

$d1 = x \operatorname{cosec}(\Theta)$

$d2 = (3 - x) \operatorname{cosec}(\Theta)$

$d3 = (3 - y) \operatorname{cosec}(\Theta)$

$d4 = y \operatorname{cosec}(\Theta)$

Total distance = $d1 + d2 + d3 + d4$

$= 6 \operatorname{cosec}(\Theta)$

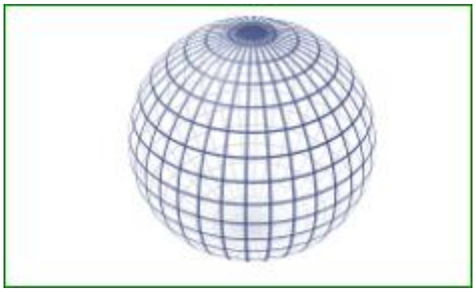
We know, Θ varies between $\Pi/4$ and $3\Pi/4$

Therefore, $E(\text{distance}) = 6\, E(\operatorname{cosec} \Theta)$

$= 6 \times (2/\Pi) \int \operatorname{cosec}(\Theta) d\Theta$ (limits $\Pi/4$ to $3\Pi/4$)

$= 12/\Pi \ln(\sqrt{2} + 1/\sqrt{2} + 1)$

Question: 4 points in a sphere: Consider a unit sphere. 4 points are randomly chosen on it, what is the probability that the center (of sphere) lies within the tetrahedron (/ polygon) formed by those 4 points?



Solution:

Let A, B and C be random points on the sphere with Aa, Bb and Cc being diameters.

The spherical (minor) triangle abc is common to the hemispheres abc, bca and cab (where the notation abc represents the hemisphere cut off by the great circle through a and b and containing the point c, etc.), therefore the probability that a further random point, D, lies on this triangle is:

$1/2 \times 1/2 \times 1/2 = 1/8$

(For center to lie in the tetrahedron D should lie in the triangle i.e. the opposite hemisphere of ABC)

Question: Misogynist country: In a country in which people only want boys, every family continues to have children until they have a boy. If they have a girl, they have another child. If they have a boy, they stop. What is the proportion of boys to girls in the country?

Solution:

Following is the required calculation:

Expected Number of boys for 1 family = 1*(Probability of 1 boy) + 1*(Probability of 1 girl and a boy) + 1*(Probability of 2 girls and a boy) + …

For C couples = 1*(C*1/2) + 1*(C*1/2*1/2) + 1*(C*1/2*1/2*1/2) + …

Expected Number of boys = C/2 + C/4 + C/8 + C/16 + …

Expected Number of boys = C

Expected Number of girls for 1 family = 0*(Probability of 0 girls) + 1*(Probability of 1 girl and a boy) + 2*(Probability of 2 girls and a boy) + …

For C couples = 0*(C*1/2) + 1*(C*1/2*1/2) + 2*(C*1/2*1/2*1/2) + …

Expected Number of girls = 0 + C/4 + 2*C/8 + 3*C/16 + …

Expected Number of girls = C

Therefore, the proportion is C/C = 1:1

Question: The Red wedding:

A bad king has a cellar of 1000 bottles of delightful and very expensive wine. A neighbor queen plots to kill the bad king and sends a servant to poison the wine.

Fortunately (or say unfortunately) the bad king's guards catch the servant after he could poison only one bottle. Alas, the guards don't know which bottle, but know that the poison is so strong that even if diluted 100,000 times it would still kill the king.

Furthermore, it takes one month to have an effect. The bad king decides he will get some of the prisoners in his vast dungeons to drink the wine. Being a clever bad king, he knows that he needs to murder no more than 10 prisoners – believing he can fob off such a low death rate – and will still be able to drink the rest of the wine (999 bottles) at his wedding party in 5 weeks' time.

Explain what is in mind of the king, how will he be able to do so? (he has only 10 prisoners in his prisons)

Solution:

The number the bottles are 1 to 1000. Now, write the number in binary format. We can write it as:

bottle 1 = 0000000001 (10-digit binary)

bottle 2 = 0000000010

- - -.

bottle 500 = 0111110100

bottle 1000 = 1111101000

Now, take 10 prisoners and number them 1 to 10. Let prisoner 1 take a sip from every bottle that has a 1 in its least significant bit. And, this process will continue for every prisoner until the last prisoner is reached. For example:

Prisoner = 10 9 8 7 6 5 4 3 2 1

Bottle 924 = 1 1 1 0 0 1 1 1 0 0

For instance, bottle no. 924 would be shipped by 10,9,8,5,4 and 3. That way if bottle no. 924 was the poisoned one, only those prisoners would die.

After four weeks, line the prisoners up in their bit order and read each living prisoner as a 0 bit and each dead prisoner as a 1 bit. The number that you get is the bottle of wine that was poisoned. We know, 1000 is less than 1024 (2^10). Therefore, if there were 1024 or more bottles of wine it would take more than 10 prisoners.

Question: Life and luck: You and your friend are caught by gangsters and made to play a game to determine if you should live or die. The game is simple.

There is a deck of cards and you both have to choose a card. You can look at each other's cards but not at the card you have chosen. You both will survive if both are correct in guessing the card they have chosen. Otherwise both die.

What is the probability of you surviving if you and your friend play the game optimally?

Solution:

We know, A and B have picked a card at random from a deck. A can see B's card and vice versa. So, A knows (s)he has not picked B's card, but apart from that, (s)he knows that the card is equally probable to be any of the other 51 cards. So, if A guesses B's card, they lose. But if A guesses any other card, there's a 1/51 chance that A is right. This also implies that total probability of success <= 1/51.

A's aim now is to tell any card apart from B's card that gives B the most information about B's own card. So, they can plan beforehand as follows:

Consider the sequence of cards Clubs 1-13, Diamonds 1-13, Hearts 1-13, Spades 1-13. A will tell the card after B's card in this sequence. (If A says 4 of Hearts, it means B has 3 of Hearts. If A says Ace of Clubs, it means B has King of Spades)

With A's guess, which is always different from B's card, B gets to know exactly which card (s)he has and can always guess correctly. So, the probability of success is 1/51, which is the maximum achievable.

Question: Weighing balls: You have 12 balls that all weigh the same except one, which is either slightly lighter or slightly heavier. The only tool you have is a balance scale that can only tell you which side is heavier. Using only three weightings, how can you deduce, without a shadow of a doubt, which is the odd one out, and if it is heavier or lighter than the others?

Solution:

First, we weigh {1,2,3,4} on the left and {5,6,7,8} on the right. There are three scenarios which can arise from this:

If they balance, then we know 9, 10, 11 or 12 is fake. Weigh {8, 9} and {10, 11} (Note: 8 is surely not fake). If they balance, we know 12 is the fake one. Just weigh it with any other ball and figure out if it is lighter or heavier.

If {8, 9} is heavier, then either 9 is heavy or 10 is light or 11 is light. Weigh {10} and {11}. If they balance, 9 is fake (heavier). If they don't balance then whichever one is lighter is fake (lighter).

If {8, 9} is lighter, then either 9 is light or 10 is heavy or 11 is heavy. Weigh {10} and {11}. If they balance, 9 is fake (lighter). If they don't balance then whichever one is heavier is fake (heavier).

If {1,2,3,4} is heavier, we know either one of {1,2,3,4} heavier or one of {5,6,7,8} is lighter but it is guarantees that {9,10,11,12} are not fake. This is where it gets tricky, watch carefully. Weigh {1,2,5} and {3,6,9} (Note: 9 is surely not fake).

If they balance, then either 4 is heavy or 7 is light or 8 is light. Following the last step from the previous case, we weigh {7} and {8}. If they balance, 4 is fake(heavier). If they don't balance then whichever one is lighter is fake (lighter).

If {1,2,5} is heavier, then either 1 is heavy or 2 is heavy or 6 is light. Weigh {1} and {2}. If they balance, 6 is fake (lighter). If they don't balance then whichever one is heavier is fake (heavier).

If {3,6,9} is heavier, then either 3 is heavy or 5 is light. Weigh {5} and {9}. They won't balance. If {5} is lighter, 5 is fake (lighter). If they balance, 3 is fake (heavier).

If {5,6,7,8} is heavier, it is the same situation as if {1,2,3,4} was heavier. Just perform the same steps using 5,6,7 and 8. Unless maybe you are too lazy to try and reprocess the steps, then you continue reading the solution. Weigh {5,6,1} and {7,2,9} (Note: 9 is surely not fake).

If they balance, then either 8 is heavy or 3 is light or 4 is light. Following the last step from the previous case, we weigh {3} and {4}. If they balance, 8 is fake(heavier). If they don't balance then whichever one is lighter is fake (lighter).

If {5,6,1} is heavier, then either 5 is heavy or 6 is heavy or 2 is light. Weigh {5} and {6}. If they balance, 2 is fake (lighter). If they don't balance then whichever one is heavier is fake (heavier).

If {7,2,9} is heavier, then either 7 is heavy or 1 is light. Weigh {1} and {9}. If they balance, 7 is fake (heavier). If they don't balance then 1 is fake (lighter).

Question: Bias and unbiased: Robin and Williams are playing a game. An unbiased coin is tossed repeatedly. Robin wins as soon as the sequence of tosses HHT appears. Williams wins as soon as the sequence of tosses HTH appears. The game ends when one of them wins. What are the probabilities of winning for each player?

Solution:

(Robin) HHT – 2/3 (Williams) HTH – 1/3

Let the probability of Robin winning be p. The probability of Williams winning is (1-p). If the first toss is tails, it is as good as the game has not started, hence the probability of Robin winning is p after the first tail.

p = (1/2) *p + ….

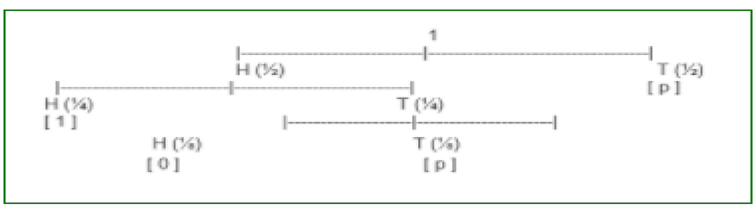
Let the first toss be heads. If the second toss is heads, then Robin definitely wins. Since HH has occurred, and at some point, tails will occur, so HHT will occur. Hence Robin wins with probability 1 for HH.

p = (1/2) *p + (1/2) *((1/2) *1 + ...)

Let the second toss be tails. If the third toss is heads, Robin loses as HTH occurs. If the third toss is tails (HTT) – since two tails have occurred in a row, now it is as good as the game has started from the beginning, so the chances of Robin winning are back to p.

T HH HTH HTT

p = (1/2) *p + 1/2 ((1/2) *1 + 1/2 ((1/2) *0 + (1/2) * p))



p = (1/2) *p + (1/4) *1 + (1/8) *0 + (1/8) *p

Finally, solving this equation gives us p = 2/3.

Question: Chameleons go on a date: On an island live 13 purple, 15 yellow and 17 maroon chameleons. When two chameleons of different colors meet, they both change into the third color. Is there a sequence of pairwise meetings after which all chameleons have the same color?

Solution:

Let <p, y, m> denote a population of p purple, y yellow and m maroon chameleons. Can population <13, 15, 17> be transformed into <45, 0, 0> or <0, 45, 0> or <0, 0, 45> through a series of pair wise meetings?

We can define function:

X (p, y, m) = (0p + 1y + 2m) mod 3

An interesting property of X is that its value does not change after any pairwise meeting because

X (p, y, m) = X (p-1, y-1, m+2) = X (p-1, y+2, m-1) = X (p+2, y-1, m-1)

Now X (13, 15, 17) equals 1. However,

X (45, 0, 0) = X (0, 45, 0) = X (0, 0, 45) = 0**

This means that there is no sequence of pairwise meetings after which all chameleons will have identical color.

Question: The Einstein puzzle: Answer the question using the given information and hints.

1. In a street there are five houses, painted five different colors.
2. In each house lives a person of different nationality
3. These five homeowners each drink a different kind of beverage, smoke different brand of cigar and keep a different pet.

The Question: Who owns the fish?

Hints:

1. The British man lives in a red house.
2. The Swedish man keeps dogs as pets.
3. The Danish man drinks tea.
4. The Green house is next to, and on the left of the White house.
5. The owner of the Green house drinks coffee.
6. The person who smokes Pall Mall rears birds.
7. The owner of the Yellow house smokes Dunhill.
8. The man living in the center house drinks milk.
9. The Norwegian lives in the first house.
10. The man who smokes Blends lives next to the one who keeps cats.
11. The man who keeps horses lives next to the man who smokes Dunhill.
12. The man who smokes Blue Master drinks beer.
13. The German smokes Prince.
14. The Norwegian lives next to the blue house.
15. The Blends smoker lives next to the one who drinks water.

FYI – This question is famously known as Einstein Puzzle.

The Answer

It's the German.

Note: for detailed explanation: https://udel.edu/~os/riddle-solution.html

Question: Lighting Bulb Puzzle:

A light bulb is hanging in a room; Outside of the room, there are three switches, of which only one is connected to the bulb. In the starting situation, all switches are off' and the bulb is not lit. If it is allowed to check in the room only once to see if the bulb is lit or not (this is not visible from the outside), how can you determine with which of the three switches the light bulb can be switched on?

I think this is one of the most loved puzzles of many interviewers and this makes it a "Popular Puzzle".

Solution:

We will first switch on the first switch button and let it remain ON for 5-6 mins. After waiting for 5-6 mins we will switch it off. Then we will switch on the second switch button and will go the room to see if the bulb is lighted or not. If the bulb is lit then off course it is this second bulb, if not we will touch the bulb and see if it is hot or not, if hot we can assume that the it was the first switch that lit the bulb, since we kept the bulb switched on for 5-6 mins. IF not any of these then of course it is the third switch.

Question: Blind man and the island:

A blind man is alone on a deserted island. He has two blue pills and two red pills. He must take exactly one red pill and one blue pill or he will die. How does he do it?

This is kind exactly a puzzle but a riddle. There are many possible answers to this riddle but I shall explain the solution that according to me is the best. I would appreciate if the Ask Analytics readers send other solutions according to them that they think are appropriate.

Solution:

The blind man can expose his pills to the sunlight and feel a noticeable difference in the temperature because of the amount of heat absorbed by each pill.

The red pill will become hotter than the blue pill since it will absorb more heat and thus he will be able to differentiate between the two colors.

As, I told you there are "N" number of different ways to answer this puzzle but this is one of them, appreciate other answers too.

Question: People crossing the bridge Puzzle:

Four people need to cross a rickety bridge at night. Unfortunately, they have only one torch and the bridge is too dangerous to cross without torch. The bridge is only strong enough to support two people at a time. Not all people take the same time to cross the bridge. Times for each person: 1 min, 2 mins, 7 mins and 10 mins. What is the shortest time needed for all four of them to cross the bridge?

Solution:

A = 1 min

B= 2 min

C = 5 min

D = 10 min

A and B cross together =2 mins

A comes back =1 min

C and D cross together = 10 mins

B cross the bridge = 2 mins

A and B cross together = 2 mins

Total Time =2+1+10+2+2=17 mins

Question. Weighing Puzzle:

There are 9 balls with equal size, but 1 ball has more weight than the rest of the balls. We have 1 scale. How would you find that ball that has the extra weight if in the process you have to use the scale the minimum amount of weighs possible?

Solution:

This is a very cliché but one of the most interesting puzzles asked during interviews. Let us try and understand how to go about this puzzle step by step.

Step 1-Divide the balls in 3 groups (of 3 balls each)
Step 2- Weigh any two groups on the weighing scale.
Step 3-If either of the groups is heavy, select that group of balls. And if both are equal, select the 'third group' (which was not selected in Step 2)
Step 4- Randomly select any two balls from the selected group (chosen in step 3) and weigh them.
Step 5- If any of the balls are heavy, that is your ball. If both are equal, the un-selected ball of that group is yours.
So, in order to find that ball which weighs heavier you ideally have to use the scale just TWICE.

Question. Mislabeled Jar Puzzle:

The first box has two white balls. The second box has two black balls. The third box has a white and a black ball. Boxes are labeled but all labels are wrong! You are allowed to open one box, pick one ball at random, see its color and put it back into the box, without seeing the color of the other ball. How many such operations are necessary to correctly label boxes?

Solution:

Just one. How? Let us find out.

Because we know all labels are wrong. So, the BW box must be either BB or WW. Selecting one ball from BW will let you know which one it should really been labeled as (since all the labels are wrong). And the other two boxes can then be worked out logically, Ask Analytics readers are enough smart for that.

Examples of Lateral Thinking Puzzles

Lateral thinking puzzles are strange situations in which you are given a little information and then have to find the explanation.

Question: Trouble with Sons
A woman had two sons who were born on the same hour of the same day of the same year. But they were not twins. How could this be so?

Solution:
They were two of a set of triplets (or quadruplets etc.) This simple little puzzle stumps many people. They try outlandish solutions involving test-tube babies or surrogate mothers. Why does the brain search for complex solutions when there is a much simpler one available?

Question: The Man in the Bar Puzzle
A man walks into a bar and asks the barman for a glass of water. The barman pulls out a gun and points it at the man. The man says 'Thank you' and walks out. This puzzle has claims to be the best of the genre. Most people struggle very hard to solve this one yet they like the answer when they hear it or have the satisfaction of figuring it out.

Solution:
The man had hiccups. The barman recognized this from his speech and drew the gun in order to give him a shock. It worked and cured the hiccups – so the man no longer needed the water.

Question: Cut the Cake Puzzle
You are given a cake, one of its corner is broken. How will you cut the rest into two equal parts?

Solution:
Slice the cake.

Question: Death in a Field
A man is lying dead in a field. Next to him there is an unopened package. There is no other creature in the field. How did he die?

Solution:
The man had jumped from a plane but his parachute had failed to open. It is the unopened package.

Question: The Elder Twin:
One day Kerry celebrated her birthday. Two days later her older twin brother, Terry, celebrated his birthday. How come?

Solution: At the time she went into labor, the mother of the twins was travelling by boat. The older twin, Terry, was born first early on March 1st. The boat then crossed the International Date line (or any time zone line) and Kerry, the younger twin, was born on February the 28th. In a leap year the younger twin celebrates her birthday two days before her older brother.

Question: The Blind Beggar Puzzle:
A blind beggar had a brother who died. What relation was the blind beggar to the brother who died? (Brother is not the answer).

Solution:
The blind beggar was the sister of her brother who died.

Question: The Deadly Dish:
Two men went into a restaurant. They both ordered the same dish from the menu. After they tasted it, one of the men went outside the restaurant and shot himself. Why?

Solution:
The dish that the two men ordered was albatross. They had been stranded many years earlier on a desert island. When the man tasted albatross he realized that he had never tasted it before. This meant that the meat he had been given on the island was not albatross as he had been told. He correctly deduced that he had eaten the flesh of his son who had died when they first reached the island.

Question: Fix the Car?
If one tyre of a car suddenly gets stolen. And after sometime you find the tyre without the screws how will you make your journey complete?

Solution:
Open 3 screws, 1 from each tyre and fix the tyre.

Question: Friday puzzle
A man rode into town on Friday. He stayed for three nights and then left on Friday. How come?

Solution:
The man's horse was called Friday.

Question: Deadly Party Puzzle

A man went to a party and drank some of the punch. He then left early. Everyone else at the party who drank the punch subsequently died of poisoning. Why did the man not die?

Solution:

The poison in the punch came from the ice cubes. When the man drank the punch the ice was fully frozen. Gradually it melted, poisoning the punch.

Examples of Math Puzzles

Question: Chickens and Rabbits:

There are several chickens and rabbits in a cage (with no other types of animals). There are 72 heads and 200 feet inside the cage. How many chickens are there, and how many rabbits?

Solution:

Let c be the number of chickens, and r be the number of rabbits.

$r + c = 72$
$4r + 2c = 200$

To solve the equations, we multiply the first by two, then subtract the second.

$2r + 2c = 144$
$2r = 56$
$r = 28$
$c = 44$
So there are 44 chickens and 28 rabbits in the cage.

Question2: How Long was He Walking

Every day, Jack arrives at the train station from work at 5 pm.
His wife leaves home in her car to meet him there at exactly 5 pm, and drives him home. One day, Jack gets to the station an hour early, and starts walking home, until his wife meets him on the road. They get home 30 minutes earlier than usual. How long was he walking?

Distances are unspecified. Speeds are unspecified, but constant. Give a number which represents the answer in minutes.

Solution:

The best way to think about this problem is to consider it from the perspective of the wife. Her round trip was decreased by 30 minutes, which means each leg of her trip was decreased by 15 minutes.

Jack must have been walking for 45 minutes

Question: Minimum no of Aircraft Puzzle

On Bag shot Island, there is an airport. The airport is the home base of an unlimited number of identical airplanes. Each airplane has a fuel capacity to allow it to fly exactly 1/2 way around the world, along a great circle. The planes have the ability to refuel in flight without loss of speed or spillage of fuel. Though the fuel

is unlimited, the island is the only source of fuel.
What is the fewest number of aircraft necessary to get one plane all the way around the world assuming that all of the aircraft must return safely to the airport? How did you get to your answer?

Notes:

(1) Ignore extra fuel consumption as a result of acceleration, evaporation of fuel, bleeding-heart-liberal fiscal policies, etc.
(2) All the planes have to make it back safely, so you can't give all your fuel away to another plane.
(3) Assume that refueling is an extremely fast process.

Solution:

As per the puzzle given above The fewest number of aircraft is 3!
Imagine 3 aircraft (A, B and C). A is going to fly round the world. All three aircraft start at the same time in the same direction. After 1/6 of the circumference, B passes 1/3 of its fuel to C and returns home, where it is refueled and starts immediately again to follow A and C.

C continues to fly alongside A until they are 1/4 of the distance around the world. At this point C completely fills the tank of A which is now able to fly to a point 3/4 of the way around the world. C has now only 1/3 of its full fuel capacity left, not enough to get back to the home base. But the first 'auxiliary' aircraft reaches it in time in order to refuel it, and both 'auxiliary' aircraft are the able to return safely to the home base.

Now in the same manner as before both B and C fully refueled fly towards A. Again B refuels C and returns home to be refueled. C reaches A at the point where it has flown 3/4 around the world. All 3 aircraft can safely return to the home base, if the refueling process is applied analogously as for the first phase of the flight.

Question: Nugget Numbers

At McDonald's you can order Chicken McNuggets in boxes of 6, 9, and 20. What is the largest number of nuggets that you cannot order using any combination of the above?

Solution: 43
It is possible to achieve all multiples of 3 that are bigger than 6, through the 6s and 9s alone. Adding 6 to 6 will give you 12, and adding 6 to 9 will give 15, and you can obtain all subsequent multiples of 3 by adding sixes to one of 12 or 15.

And all numbers that are 1 less than a multiple of 3, that are 26 or higher (26, 29, 32, 35, 38, 41 etc) are 20 plus a multiple of 3, and as we previously said a multiple of 3 that is bigger than 6 can be achieved.

And all numbers that are 1 more than a multiple of 3, that are 46 or higher (46, 49, 52, 55, 58, 61 etc) are 40 (two lots of 20) plus a multiple of 3, and as before all multiples of 3 that are bigger than 6 can be achieved.

And since all (whole) numbers are either a multiple of 3, one more than a multiple of 3, or one less than a multiple of three, that covers all numbers above 43.

Question: The Pill Problem

A man has a medical condition that requires him to take two kinds of pills, call them P1 and P2. The man must take one P1 pill and one P2 pill each day, or he will die. If he takes more than 1 pill of the same kind per day, he will die. Both pills look exactly the same (same weight, color, shape, size, etc…;).

The pills are taken by first dissolving them in water.

One day, as he is about to take his pills, he takes out one P1 pill from the P1 jar and puts it in a glass of water. Then he accidentally takes out two P2 pills from the P2 jar and puts them in the water. Now, he is in the situation of having a glass of water with three dissolved pills, one P1 pill and two P2 pills. Unfortunately, the pills are very expensive, so the thought of throwing out the water with the 3 pills and starting over is out of the question.

How should the man proceed in order to get the right quantity of P1 and P2 while not wasting any pills?

Solution:

Add one more P1 pill to the glass and let it dissolve.

Take half of the water today and half tomorrow.

So, Percentage of Pill P1 and Pill P2 on both the day in overall be managed equal.

It works under following assumptions:

The dissolved Pills can be used next day.

Question: How Much Money He had initially?

One person has some money in his pocket, He visits four temple on the way. As soon as he enters a temple, his money gets double and he offers Rs. 100 in each temple thus his pocket gets empty after he returns from the fourth temple. Now the question is how much money he had initially?

Solution:
Let’s assume, person starts with Rs x
After 1st temple visit, he is left with Rs (2x-100)
After 2nd temple visit, he is left with Rs (4x-300)
After 3rd temple visit, he is left with Rs (8x-700)
After 4th temple visit, he is left with Rs (16x-1500), which is zero (as he is left with empty pockets)
Hence he started of with x i.e. Rs 1500/16 i.e. Rs 93.75
Answer: Rs 93.75

Question: When is Cheryl’s Birthday?

Albert and Bernard just became friends with Cheryl, and they want to know when her birthday is. Cheryl gives them a list of 10 possible dates.

May 15 May 16 May 19
June 17 June 18
July 14 July 16
August 14 August 15 August 17

Cheryl then tells Albert and Bernard separately the month and the day of her birthday respectively.

Albert: I don't know when Cheryl's birthday is, but I know that Bernard does not know too.
Bernard: At first I don't know when Cheryl's birthday is, but I know now.
Albert: Then I also know when Cheryl's birthday is.

So when is Cheryl's birthday?

Solution:
The solution involves using logic to deduce the dates which can't possibly be Cheryl's birthday.

The dates range from 14 to 19 among the 10 that are given with only 18 and 19 occurring once.
Albert, having seemingly been told the month rather than the day, first says he doesn't know when her birthday is – eliminating both 18 and 19 as possible days.
If Cheryl had told Albert that the month was May or June, then the day could have been May 19 or June 18, and Bernard may have known the right day. But, as the question says, Albert knows Bernard does not, meaning that Cheryl has said her birthday is in either July or August.

Out of the five remaining days in July and August, the day ranges from 14 to 17, with 14 appearing twice.

If Cheryl told Bernard her birthday was on the 14th, then he would not have known but, he does, meaning it can't be on the 14th.

That leaves only 3 possible days: July 16, August 15, and August 17.

After Bernard speaks, saying he knows the birthday given that information, it eliminates August from being a contender since he still wouldn't have known
whether it was August 15 or 17.

Therefore, Cheryl's birthday is on July 16.

Question: Flower Pot Puzzle

Sara has 6 flower pots, each having a unique flower. Pots are arranged in an arbitrary sequence in a row. Sara rearranges the sequence each day but not two pots should be arranged adjacent to each other which were already adjacent to each other in previous arrangement. How many days she can do this or how many such arrangements are possible?

Solution:
we have (62)=15 different pairs of pots. At each days Sara realizes 5 of these pairs as adjacent. Since all these pairs should be different, the number of days is at most 15/5=3. The following example describes the admissible list of arrangements for 3 days.

123456
246135
362514

Question: Prove that p^2 – 1 is Divisible by 24

Prove that p2 – 1 is divisible by 24 if p is a prime number greater than 3?

Solution:
The most elementary proof , without explicitly mentioning any number theory: out of the three consecutive numbers p–1, p, p+1, one of them must be divisible by 3; also, since the neighbors of p are consecutive even numbers, one of them must be divisible by 2 and the other by 4, so their product is divisible by 3·2·4=24 — and of course, we can throw p out since it's prime, and those factors cannot come from it.

Popular Number Puzzles

Commonly asked number puzzles in all kind of interviews. Sequence number, missing number, series number problems etc.

Question: 10-digit Number Puzzle

Find a 10-digit number where the first digit is how many zeros in the number, the second digit is how many 1s in the number etc. until the tenth digit which is how many 9s in the number.

Solution: 6210001000

Question: 24 from 8,8,3,3 Puzzle

How can I get the answer 24 by only using the numbers 8,8,3,3.

You can use add, subtract, multiply, divide, and parentheses.

Solution:
8/(3-(8/3))
= 8/(1/3)
= 24

Question: The Pearl Necklace Puzzle

A pearl necklace has 33 pearls with the largest and most valuable in the middle.
Starting from one end, each successive pearl is worth $100 more than the one before (up to the middle one), but starting from the other end each pearl is worth $150 more than the one before, up to the big pearl. The whole necklace is worth $65 000.

What is the value of the middle pearl?

Solution: The value of the central pearl is $3000.
The pearl at one end (from which they increased in value by $100): $1400.
The pearl at the other end: $600.

Question: Next number in the sequence

What number should replace the question mark to a definite rule?

147,159,174,186,..?

Solution:

201 (add digits to previous number).

Question: Number of brother and sister

If I had one more sister I would have twice as many sisters as brothers. If I had one more brother I would have the same number of each. How many brothers and sisters have I?

Solution:

Three sisters and two brothers.
This can be solved by simple deduction, but if algebra is used let x be the number of sisters and y the number of brothers:
$x+1=2y$
$y+1=x$
Therefore, $y+1+1=2y$
so $y=2$ or $x+1=2x-2$ so $x=3$.

Question: Odd one out?
Which number is the odd one out?
159
248
963
357
951
852

Solution: 248
In the rest there is the same difference between each digit, eg: 8 (–3) 5 (–3) 2.

Question: Speed of car?
If a car had increased its average speed for a 210 mile journey by 5 mph, the journey would have been completed in one hour less. What was the original speed of the car for the journey?

Solution: 30 mph.

Question: How long a player spent on ground?
In a game of eight players lasting for 70 minutes, six substitutes alternate with each player. This means that all players, including the substitutes, are on the pitch for the same length of time. For how long?

Solution: 40 minutes.
(70 × 8)÷ 14.
Total time for eight players = 70 × 8 = 560 minutes.
However, as 14 people are each on the pitch for an equal length of time, they are each on the pitch for 40 minutes (560 ÷ 14).

Examples of Probability Puzzles

Probability puzzles require you to weigh all the possibilities and pick the most likely outcome.

Question: Chances of Having Same Birthday Problem

How many people must be gathered together in a room, before you can be certain that there is a greater than 50/50 chance that at least two of them have the same birthday?

Solution: Only 23 people need be in the room. The probability that there will not be two matching birthdays is then, ignoring leap years, 365x364x363x...x343/365 over 23 which is approximately 0.493. this is less than half, and therefore the probability that a pair occurs is greater than 50-50. With as few as fourteen people in the room the chances are better than 50-50 that a pair will have birthdays on the same day or on consecutive days.

Question: Chances of Second Girl Child Problem

James and Calie are a married couple.
They have two children, one of the child is a boy. Assume that the probability of each gender is 1/2.
What is the probability that the other child is also a boy?

Solution:

1/3
This is a famous question in understanding conditional probability, which simply means that given some information you might be able to get a better estimate.

The following are possible combinations of two children that form a sample space in any earthly family:

Boy – Girl
Girl – Boy

Boy – Boy
Girl – Girl

Since we know one of the children is a boy, we will drop the girl-girl possibility from the sample space. This leaves only three possibilities, one of which is two boys. Hence the probability is 1/3

Question: Pairs of Blue, Brown And Black Socks

In your sock drawer, you have a ratio of 3 pairs of blue socks, 4 pairs of brown socks, and 5 pairs of black socks.
In complete darkness, how many socks would you need to pull out to get a matching pair of the same color?

Solution:

4 think it yourself!

Question: 3 Baskets and 4 Balls Puzzle

You have 3 baskets & each one contains exactly 4 balls, each of which is of the same size. Each ball is either red, orange, white, or yellow, & there is one of each color in each basket.

If you were blindfolded, and balls are randomly distributed and then took 1 ball from each basket, what chance is there that you would have exactly 2 red balls?

Solution: There are 3 scenarios where exactly 3 balls are red:
1 2 3
———–
R R X
R X R
X R R

X is any ball that is not red.

Take the first one, for example: 25% chance the first ball is red, multiplied by a 25% chance the second ball is red, and multiplied by a 75% chance the third ball is not red. 1/4*1/4*3/4 = 4.6875%.
Because there are 3 scenarios where this outcome occurs, you multiply the 4.6875% chance of any one occurring by 3, & you get 14.0625%.

Question: Probability of a Car Passing By

The probability of a car passing a certain intersection in a 20 minute windows is 0.9. What is the probability of a car passing the intersection in a 5 minute window? (Assuming a constant probability throughout)

Solution:

Let's start by creating an equation. Let x be the probability of a car passing the intersection in a 5 minute window.

Probability of a car passing in a 20 minute window = 1 – (probability of no car passing in a 20 minute window)
Probability of a car passing in a 20 minute window = 1 – (1 – probability of a car passing in a 5 minute window)^4
0.9 = 1 – (1 – x)^4
(1 – x)^4 = 0.1
1 – x = 10^(-0.25)
x = 1 – 10^(-0.25) = 0.4377.

Question: Red and Blue Marbles

You have 50 red marbles, 50 blue marbles and 2 jars. One of the jars is chosen at random and then one marble will be chosen from that jar at random. How would you maximize the chance of drawing a red marble? What is the probability of doing so? All 100 marbles should be placed in the jars.

Solution: Think of a way to distribute the marbles such taht odds are maximum. What if you put a single red marble in one jar and the rest of the marbles in the other jar? This way, you are guaranteed at least a 50% chance of getting a red marble (since one marble picked at random, doesn't leave any room for choice). Now that you have 49 red marbles left in the other jar, you have a nearly even chance of picking a red marble (49 out of 99).

So let's calculate the total probability.

P(red marble) = P(Jar 1) * P(red marble in Jar 1) + P(Jar 2) * P(red marble in Jar 2)
P(red marble) = 0.5 * 1 + 0.5 * 49/99
P(red marble) = 0.7474

Thus, we end up with ~75% chance of picking a red marble.

Question: Two Games in a Row

A certain mathematician, his wife, and their son all play a fair game of chess. One day when the son asked his father for 10 dollars for a Sunday night date, his father puffed his pipe for a moment and replied, "Let's do it this way. Today is Thursday. You will play a game of chess tonight, tomorrow, and a 3rd on Saturday. If you win two games in a row, you get the money."

"Whom do I play first, you or mom?"

"You may have your choice," said the mathematician, his eyes twinkling.

The son knew that his father played a stronger game than his mother. To maximize his chance of winning two games in succession, should he play father-mother-father or mother-father-mother?

Solution:
Father-mother-father
To beat two games in a row, it is necessary to win the second game. This means that it would be to his advantage to play the second game against the weaker player. Though he plays his father twice, he has a higher chance of winning by playing his mother second.

Question: Problem with Pearls

I'm a very rich man, so I've decided to give you some of my fortune. Do you see this bag? I have 1001 pearls inside it. 501 of them are white, and 500 of them are black. No, I am not racist. You are blind folded and I'll let you take out any number of pearls from the bag. If you take out the same number of black and white pearls, I will reward you with a number of coins equivalent to the number of pearls you took."

How many pearls should you take out to give yourself a good number of coins while still retaining a good chance of actually getting them?

Solution:

If you took out 2 pearls, you would have about a 50% chance of getting 2 coins. However, you can take even more pearls and still retain the 50% chance.

Take out 5000 pearls. If the remaining pearl is white, then you've won 5000 coins!

Question: 10 identical bottles of pills

We have 10 identical bottles of identical pills (each bottle contain hundreds of pills). Out of 10 bottles 9 have 1 gram of pills but 1 bottle has pills of weight of 1.1 gram. Given a measurement scale, how would you find the heavy bottle? You can use the scale only once.

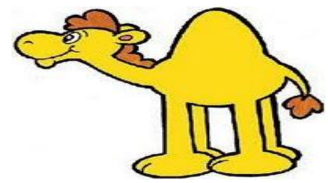
Solution:

First, arrange the bottles on shelf and now take, 1 pill from the first bottle, 2 pills from the second bottle, 3 pills from the third bottle, and so on. Ideally you would have (10)*(11)/2=55 pills weighing 55 grams, when you put the entire pile of pills on the weighing scale. The deviation from 55 g would tell you which bottle contains the heavy pills.

If it is .1 gram more, it is 1st bottle which has heavy pill, if it is .2 more, gram 2nd bottle has heavy pills, if it is .3 more, gram 3rd bottle has heavy pills.

Question: Camel and Bananas Puzzle

The owner of a banana plantation has a camel. He wants to transport his 3000 bananas to the market, which is located after the desert. The distance between his banana plantation and the market is about 1000 kilometer. So he decided to take his camel to carry the bananas. The camel can carry at the maximum of 1000 bananas at a time, and it eats one banana for every kilometer it travels.



What is the most bananas you can bring over to your destination?

Solution:

First of all, the brute-force approach does not work. If the Camel starts by picking up the 1000 bananas and try to reach point B, then he will eat up all the 1000 bananas on the way and there will be no bananas left for him to return to point A.

So we have to take an approach that the Camel drops the bananas in between and then returns to point A to pick up bananas again.

Since there are 3000 bananas and the Camel can only carry 1000 bananas, he will have to make 3 trips to carry them all to any point in between.

<---p1---><--------p2-----><-----p3---->

A--------------------------------------->B

When bananas are reduced to 2000 then the Camel can shift them to another point in 2 trips and when the number of bananas left are <= 1000, then he should not return and only move forward.

In the first part, P1, to shift the bananas by 1Km, the Camel will have to

1. Move forward with 1000 bananas – Will eat up 1 banana in the way forward
2. Leave 998 banana after 1 km and return with 1 banana – will eat up 1 banana in the way back
3. Pick up the next 1000 bananas and move forward – Will eat up 1 banana in the way forward
4. Leave 998 banana after 1 km and return with 1 banana – will eat up 1 banana in the way back
5. Will carry the last 1000 bananas from point a and move forward – will eat up 1 banana

Note: After point 5 the Camel does not need to return to point A again.

So to shift 3000 bananas by 1km, the Camel will eat up 5 bananas.

After moving to 200 km the Camel would have eaten up 1000 bananas and is now left with 2000 bananas.

Now in the Part P2, the Camel needs to do the following to shift the Bananas by 1km.

1. Move forward with 1000 bananas – Will eat up 1 banana in the way forward
2. Leave 998 banana after 1 km and return with 1 banana – will eat up this 1 banana in the way back
3. Pick up the next 1000 bananas and move forward – Will eat up 1 banana in the way forward

Note: After point 3 the Camel does not need to return to the starting point of P2.

So to shift 2000 bananas by 1km, the Camel will eat up 3 bananas.

After moving to 333 km the camel would have eaten up 1000 bananas and is now left with the last 1000 bananas.

The Camel will actually be able to cover 333.33 km, I have ignored the decimal part because it will not make a difference in this example.

Hence the length of part P2 is 333 Km.

Now, for the last part, P3, the Camel only has to move forward. He has already covered 533 (200+333) out of 1000 km in Parts P1 & P2. Now he has to cover only 467 km and he has 1000 bananas.

He will eat up 467 bananas on the way forward, and at point B the Camel will be left with only 533 Bananas.

Question: 5 Pirates Fight for 100 Gold Coins Puzzle

There are 5 pirates in a ship. Pirates have hierarchy C1, C2, C3, C4 and C5.C1 designation is the highest and C5 is the lowest. These pirates have three characteristics: a. every pirate is so greedy that he can even take lives to make more money. b. Every pirate desperately wants to stay alive. c. They are all very intelligent. There are total 100 gold coins on the ship. The person with the highest designation on the deck is expected to make the distribution. If the majority on the deck does not agree to the distribution proposed, the highest designation pirate will be thrown out of the ship (or simply killed). The first priority of the pirates is to stay alive and second to maximize the gold they get. Pirate 5 devises a plan which he knows will be accepted for sure and will maximize his gold. What is his plan?

Solution:
To understand the answer, we need to reduce this problem to only 2 pirates. So what happens if there are only 2 pirates? Pirate 2 can easily propose that he gets all the 100 gold coins. Since he constitutes 50% of the pirates, the proposal has to be accepted leaving Pirate 1 with nothing.

Now let's look at 3 pirates situation, Pirate 3 knows that if his proposal does not get accepted, then pirate 2 will get all the gold and pirate 1 will get nothing. So he decides to bribe pirate 1 with one gold coin. Pirate 1 knows that one gold coin is better than nothing so he has to back pirate 3. Pirate 3 proposes {pirate 1, pirate 2, pirate 3} {1, 0, 99}. Since pirate 1 and 3 will vote for it, it will be accepted.

If there are 4 pirates, pirate 4 needs to get one more pirate to vote for his proposal. Pirate 4 realizes that if he dies, pirate 2 will get nothing (according to the proposal with 3 pirates) so he can easily bribe pirate 2 with one gold coin to get his vote. So the distribution will be {0, 1, 0, 99}.

Smart right? Now can you figure out the distribution with 5 pirates? Let's see. Pirate 5 needs 2 votes and he knows that if he dies, pirate 1 and 3 will get nothing. He can easily bribe pirates 1 and 3 with one gold coin each to get their vote. In the end, he proposes {1, 0, 1, 0, 98}. This proposal will get accepted and provide the maximum amount of gold to pirate 5.

Question: 2 Player and N Coin – Strategy Puzzle

There are n coins in a line. (Assume n is even). Two players take turns to take a coin from one of the ends of the line until there are no more coins left. The player with the larger amount of money wins.

Would you rather go first or second? Does it matter?
Assume that you go first, describe an algorithm to compute the maximum amount of money you can win.

Note that the strategy to pick maximum of two corners may not work. In the following example, first player loses the game when he/she uses strategy to pick maximum of two corners.

Example 18 20 15 30 10 14

First Player picks 18, now row of coins is

20 15 30 10 14

Second player picks 20, now row of coins is

15 30 10 14

First Player picks 15, now row of coins is

30 10 14

Second player picks 30, now row of coins is

10 14

First Player picks 14, now row of coins is

10

Second player picks 10, game over.

The total value collected by second player is more (20 + 30 + 10) compared to first player (18 + 15 + 14). So the second player wins.

Solution:

Going first will guarantee that you will not lose. By following the strategy below, you will always win the game (or get a possible tie).

(1) Count the sum of all coins that are odd-numbered. (Call this X)

(2) Count the sum of all coins that are even-numbered. (Call this Y)

(3) If X > Y, take the left-most coin first. Choose all odd-numbered coins in subsequent moves.

(4) If X < Y, take the right-most coin first. Choose all even-numbered coins in subsequent moves.

(5) If X == Y, you will guarantee to get a tie if you stick with taking only even-numbered/odd-numbered coins.

You might be wondering how you can always choose odd-numbered/even-numbered coins. Let me illustrate this using an example where you have 6 coins:

Example
18 20 15 30 10 14
Sum of odd coins = 18 + 15 + 10 = 43
Sum of even coins = 20 + 30 + 14 = 64.
Since the sum of even coins is more, the first player decides to collect all even coins. He first picks 14, now the other player can only pick a coin (10 or 18). Whichever is picked the other player, the first player again gets an opportunity to pick an even coin and block all even coins.

Question: Secret Mail Problem

A wants to send a secret message to his friend B in the mail.
But C (A's Friend), who A don't trust, has access to all A's mail. So A put his message in a box with a lock. But A is not allowed to send a key!

How can A send his message through securely?

Solution:

Send the box with the lock to B.

B can't open it, but can put another lock on the box.

B sends this box with the 2 locks back to A, A unlock his lock and send it back to B again.

So there is just B's lock on the box and B can now open it.

Question: Riding against the Wind Puzzle

A horse rider went a mile in 5 minutes with the wind and returned in 7 minutes against the wind. How fast could he ride a mile if there was no wind?

Solution:

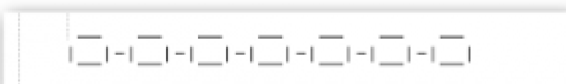
Most of us will proceed like that if a rider goes a mile in 2 minutes with the wind, and returns against the wind in 3 minutes, that 2 and 3 equal 5, should give a correct average, so that time taken should be two and half minutes. We find this answer to be incorrect, because the wind has helped him for only 2 minutes, while it has worked adversely for 3 minutes.

If he could ride a mile in 2 minutes with the wind, it is clear that he could go a 1.5 mile 3 minutes, and 1 mile in 3 minutes against the wind.

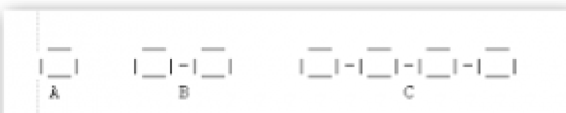
Therefore 2.5 miles in 6 minutes gives his actual speed, because the wind helped him just as much as it has retarded him, so his actual speed for a single mile without any wind would be (2.5)/6 = 5/12 miles/sec

Question: Gold Bar Puzzle

You've got someone working for you for seven days and a gold bar to pay him. The gold bar is segmented into seven connected pieces. You must give them a piece of gold at the end of every day. What and where are the fewest number of cuts to the bar of gold that will allow you to pay him 1/7th each day?



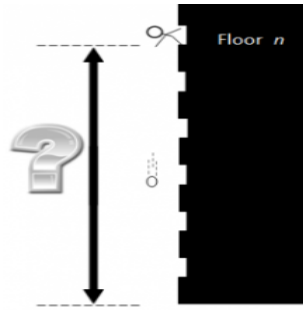
<u>Puzzle Solution</u>:
Lets split the chain as,



Day 1: Give A (+1)
Day 2: Get back A, give B (-1, +2)
Day 3: Give A (+1)
Day 4:Get back A and B, give C (-2,-1,+4)
Day 5:Give A (+1)
Day 6:Get back A, give B (-1,+2)
Day 7:Give A (+1)

Question: 2 Eggs 100 Floors Puzzle

You are given 2 eggs. You have access to a 100-storey building. Eggs can be very hard or very fragile means it may break if dropped from the first floor or may not even break if dropped from 100th floor. Both eggs are identical. You need to figure out the highest floor of a 100-storey building an egg can be dropped without breaking.
Now the question is how many drops you need to make. You are allowed to break 2 eggs in the process.



Solution:

Let x be the answer we want, the number of drops required.

So if the first egg breaks maximum we can have x-1 drops and so we must always put the first egg from height x. So we have determined that for a given x we must drop the first ball from x height. And now if the first drop of the first egg doesn't breaks we can have x-2 drops for the second egg if the first egg breaks in the second drop.

Taking an example, lets say 16 is my answer. That I need 16 drops to find out the answer. Lets see whether we can find out the height in 16 drops. First we drop from height 16,and if it breaks we try all floors from 1 to 15.If the egg don't break then we have left 15 drops, so we will drop it from 16+15+1 =32nd floor. The reason being if it breaks at 32nd floor we can try all the floors from 17 to 31 in 14 drops (total of 16 drops). Now if it did not break then we have left 13 drops. and we can figure out whether we can find out whether we can figure out the floor in 16 drops.

Let's take the case with 16 as the answer

1 + 15 16 if breaks at 16 checks from 1 to 15 in 15 drops
1 + 14 31 if breaks at 31 checks from 17 to 30 in 14 drops
1 + 13 45 .....
1 + 12 58
1 + 11 70
1 + 10 81
1 + 9 91
1 + 8 100

we can easily do in the end as we have enough drops to accomplish the task

Now finding out the optimal one we can see that we could have done it in either 15 or 14 drops only but how can we find the optimal one. From the above table we can see that the optimal one will be needing 0 linear trials in the last step.

So we could write it as

(1+p) + (1+(p-1))+ (1+(p-2)) + ...+ (1+0) >= 100.

Let 1+p=q which is the answer we are looking for

q (q+1)/2 >=100

Solving for 100 you get q=14.
So the answer is: 14
Drop first orb from floors 14, 27, 39, 50, 60, 69, 77, 84, 90, 95, 99, 100… (i.e. move up 14 then 13, then 12 floors, etc) until it breaks (or doesn't at 100)

Question: Grandma and Cake – Logical Puzzle

You are on your way to visit your Grandma, who lives at the end of the valley. It's her anniversary, and you want to give her the cakes you've made. Between your house and her house, you have to cross 5 bridges, and as it goes in the land of make believe, there is a troll under every bridge! Each troll, quite rightly, insists that you pay a troll toll. Before you can cross their bridge, you have to give them half of the cakes you are carrying, but as they are kind trolls, they each give you back a single cake.

How many cakes do you have to leave home with to make sure that you arrive at Grandma's with exactly 2 cakes?

Solution:

2 Cakes

How?
At each bridge you are required to give half of your cakes, and you receive one back. Which leaves you with 2 cakes after every bridge.

Question: How Long Was He Walking

Every day, Jack arrives at the train station from work at 5 pm.
His wife leaves home in her car to meet him there at exactly 5 pm, and drives him home. One day, Jack gets to the station an hour early, and starts walking home, until his wife meets him on the road. They get home 30 minutes earlier than usual. How long was he walking?

Distances are unspecified. Speeds are unspecified, but constant.

Give a number which represents the answer in minutes.

Solution:

The best way to think about this problem is to consider it from the perspective of the wife. Her round trip was decreased by 30 minutes, which means each leg of her trip was decreased by 15 minutes.

Jack must have been walking for 45 minutes

Question: Frog and Well Puzzle

A frog is at the bottom of a 30 meter well. Each day he summons enough energy for one 3 meter leap up the well. Exhausted, he then hangs there for the rest of the day. At night, while he is asleep, he slips 2 meters backwards. How many days does it take him to escape from the well?

Solution:

28 days

Day 1 – It jumps 3 meters. 0 + 3 = 3.
Then falls back 2 at night. 3 – 2 = 1
Day 2 – It jumps 3 meters. 1 + 3 = 4.
Then falls back 2 at night. 4 – 2 = 2.
…

Day 27 – It jumps 3 meters. 26 + 3 = 29.
Then falls back 2 at night. 29 – 2 = 27.
Day 28 – It jumps 3 meters. 27 + 3 = 30

Question: **Cut Painted Cube Puzzle**

A solid, four-inch cube of wood is coated with blue paint on all six sides. Then the cube is cut into smaller one-inch cubes. These new one-inch cubes will have either three blue sides, two blue sides, one blue side, or no blue sides. How many of each will there be?

Solution:

Subtract the outside squares, which will all have some paint on them

16 top
16 bottom
8 more left
8 more right
4 more front
4 more back

= 56

So, only 8 will have no blue side.

The only cubes that will have blue on only one side will be the four center squares of each side of the 64-cube — so, 4 x 6 sides = 24 cubes

The only cubes that will have blue on three sides are the corner pieces — there are 8 corners, so 8 cubes.

The cubes with two sides blue are the edge cubes between the corners — two on each side of the top and bottom, so 2 x 4 sides x 2 (top and bottom) = 16, + the side edge/non-corner pieces, which will be another 2 x 4 = 8

So

No blue side = 8
1 side = 24
2 sides = 24
3 sides = 8

Total = 64 cubes

Question: Chasing Dog Puzzle

There are four dogs each at the corner of a unit square. Each of the dogs starts chasing the dog in the clockwise direction. They all run at the same speed and continuously change their direction accordingly so that they are always heading straight towards the other dog. How long does it take for the dogs to catch each other and where?

Solution:

Each dog started at the corner and moving symmetrically. So each dogs start moving perpendicular to the adjacent dogs. Lets assume v.
So each one start moving with speed v towards the next dog.

If we see realtive speed of the dog1 (v1), w.r.t dog 2, it changes perpendicularly. So it'll not affect the time taken along the direction of the dog1 to dog2 and the speed will be only v always.

So if they have started at corners with the distance of the length of the square (d).

Time = d/v. They'll meet at the center.

Question: Red and Blue Balls in a Bag

You have 20 Blue balls and 10 Red balls in a bag. You put your hand in the bag and take off two at a time. If they're of the same color, you add a Blue ball to the bag. If they're of different colors, you add a Red ball to the bag. What will be the color of the last ball left in the bag?

Note: Assume you have a big supply of Blue and Red balls for this purpose. When you take the two balls out, you don't put them back in, so the number of balls in the bag keeps decreasing.

Once you tackle that, what if there are 20 blue balls and 11 red balls to start with?

Solution:

There can be 3 possible cases taking off 2 balls from bag.
a) If we take off 1 Red and 1 Blue, in fact we will take off 1 Blue
b) If we take off 2 Red, in fact we will take off 2 Red (and add 1 Blue)
c) If we take off 2 Blue, in fact we will take off 1 Blue

So In case of (a) or (c), we are only take off one Blue ball. Also, we always take off Red balls two by two.

1) 20 Blue, 10 Red balls
If there are 10 (even) number of Red balls, we can not have one single Red ball left in the bag, so the last ball will be Blue.

2) 20 Blue, 11 Red balls
Now as the no. of Red balls is odd, there will be one single Red ball in the bag with other Blue balls, and whenever we remove 1 Red and 1 Blue ball, we end up taking off only the Blue ball. So the Red ball will be the last ball in the bag.

Question: Cashier's Puzzle

An engineer goes to a bank with a check of $200 and asks the cashier "Give me some one-dollar bills, ten times as many twos and the balance in fives!".

What will the cashier do? 

Solution:

The smallest amount of one-dollar and two-dollar bills the cashier may give to the old man is 1×1 + 10×2 = 21.

He must give the old man a multiple of 21 i.e. 21 or 42 or 63 or 84 or 105 or 126 or 147 or 168 or 187 without exceeding 200. Out of all these numbers only 105 can be added to a multiple of 5 to sum up to make 200 altogether.

So he must give the balance of 95 in five-dollar bills.

Therefore, the cashier must give 5 one-dollar bills, 50 two-dollar bills and 19 five-dollar bills.

Question: Supersonic bee and trains

Two trains enter a tunnel 200 miles long, traveling at 100 mph at the same time from opposite directions. As soon as they enter the tunnel a supersonic bee flying at 1000 mph starts from one train and heads toward the other one. As soon as it reaches the other one it turns around and heads back toward the first, going back and forth between the trains until the trains collide in a fiery explosion in the middle of the tunnel. How far did the bee travel?

Solution:
This puzzle is a little tricky one. One's thinking about solving this problem goes like this "ok, so i just need to sum up the distances that the bee travels…" but then you quickly realize that its a difficult (not impossible) summation.

The tunnel is 200 miles long. The trains meet in the middle traveling at 100 mph, so it takes them an hour to reach the middle. The bee is traveling 1000 mph for an hour (since its flying the whole time the trains are racing toward one another) – so basically the bee goes 1000 miles.

Question: Probability of finding a job

A candidate is selected for interview for 3 posts. The number of candidates for the first, second and third posts are 3,4 and 2 respectively. What is the probability of getting at least one post?

Solution:
The probability the candidate does not get an offer from the first interview is 2/3. The probability she doesn't get an offer from the second is 3/4, and the probability she doesn't get an offer from the third is 1/2.

So the probability she does not get an offer at all is 2/3·/34·1/2=1/4. Here we are assuming (unrealistically) independence.

Thus the probability she gets at least one offer is 3/4.

We made the totally unreasonable assumption that job offers are given at random, that if there are 3 people interviewed, exactly one, chosen at random, will get an offer. That's not quite the way the world works!

Question: Age of 3 children

Two old friends, Jack and Bill, meet after a long time.
Jack: Hey, how are you man?
Bill: Not bad, got married and I have three kids now.
Jack: That's awesome. How old are they?
Bill: The product of their ages is 72 and the sum of their ages is the same as your birth date.
Jack: Cool… But I still don't know.
Bill: My eldest kid just started taking piano lessons.
Jack: Oh now I get it.

How old are Bill's kids?

Solution:

This is a very good logical problem. To do it, first write down all the real possibilities that the number on that building might have been. Assuming integer ages one get the following which equal 72 when multiplied:

2, 2, 18 – sum = 22
2, 4, 9 – sum = 15
2, 6, 6 – sum = 14
2, 3, 12 – sum = 17
3, 4, 6 – sum = 13
3, 3, 8 – sum = 14
1, 8, 9 – sum = 18
1, 3, 24 – sum = 28
1, 4, 18 – sum = 23
1, 2, 36 – sum = 39
1, 6, 12 – sum = 19

The sum of their ages is the same as your birth date. That could be anything from 1 to 31 but the fact that Jack was unable to find out the ages, it means there are two or more combinations with the same sum. From the choices above, only two of them are possible now. For any other number, the answer is unique and the Jack would have known after the second clue. So he asked for a third clue. The clue that the eldest kid just started taking piano lessons is really just saying that there is an “oldest”, meaning that the younger two are not twins.

2, 6, 6 – sum(2, 6, 6) = 14
3, 3, 8 – sum(3, 3, 8) = 14

Hence, the answer is that the elder is 8 years old, and the younger two are both 3 years old.
The answer is **3, 3 and 8**.

Question: River Crossing Puzzle

Sailor Cat needs to bring a wolf, a goat, and a cabbage across the river. The boat is tiny and can only carry one passenger at a time. If he leaves the wolf and the goat alone together, the wolf will eat the goat. If he leaves the goat and the cabbage alone together, the goat will eat the cabbage.
How can he bring all three safely across the river?

Solution:

The trick to this puzzle is that you can keep wolf and cabbage together. So the solution would be

The sailor will start with the goat. He will go to the other side of the river with the goat. He will keep goat there and will return back and will take cabbage with him on the next turn. When he reaches the other side he will keep the cabbage there and will take goat back with him.

Now we will take wolf and will keep the wolf at the other side of the river along with the cabbage. He will return back and will take goat along with him. This way they all will cross the river.

Question: 100 Prisoners and a Light bulb

There are 100 prisoners are in solitary cells, unable to see, speak or communicate in any way with each other. There's a central living room with one light bulb, the bulb is initially off. No prisoner can see the light bulb from his own cell. Every day, the warden picks a prisoner at random, and that prisoner goes to the central living room. While there, the prisoner can toggle the bulb if he wishes. Also, the prisoner has the option of asserting the claim that all 100 prisoners have been to the living room. If this assertion is false (that is, some prisoners still haven't been to the living room), all 100 prisoners will be shot for their stupidity. However, if it is indeed true, all prisoners are set free. Thus, the assertion should only be made if the prisoner is 100% certain of its validity.

Before the random picking begins, the prisoners are allowed to get together to discuss a plan. What plan should they agree on, so that eventually, someone will make a correct assertion?

Solution:

In evaluation of the problem, there is no limit on the number of times that a prisoner can go into the cell, however the prisoners need a way to communicate with each other on who when into the cell. Therefore one person is chosen as the counter.

Every time any prisoner is selected other than counter person, 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 Counter person 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 and do nothing. The day his count reaches 99, he calls the warden and tells him "Every prisoner has been in the special room at least once".

Question: 3 Bulbs and 3 Switches

This puzzle is perhaps not as 'pure' as the others, it doesn't reduce to a mathematical model. But it is quite a common question asked in interviews so it's worth looking at it…

Problem:

You are in a room with 3 switches which correspond to 3 bulbs in another room and you don't know which switch corresponds to which bulb. You can only enter to the room with the bulbs and back once. You can NOT use any external equipment (power supplies, resistors, etc.). How do you find out which bulb corresponds to which switch?

Solution:

Before reading the answer if you are interested in a **clue**?

Clue: Light Bulbs get hot when they're on.

Clue didn't help you

Here is the solution for you.

Switch on switches 1 & 2, wait a minute and switch off number 2.

Enter the room. Whichever bulb is on is wired to switch 1, whichever is off and hot is wired to switch number 2, and the third is wired to switch 3.

Question: Measure 4 gallon of water from 3 gallon and 5 gallon water jar

How to measure exactly 4 gallon of water from 3 gallon and 5 gallon jars, Given, you have unlimited water supply from a running tap.

4 gallon water measure puzzle

Solution:

Step 1. Fill 3 gallon jar with water. (5p – 0, 3p – 3)

Step 2. Pour all its water into 5 gallon jar. (5p – 3, 3p – 0)

Step 3. Fill 3 gallon jar again. (5p – 3, 3p – 3)

Step 4. Pour its water into 5 gallon jar until it is full. Now you will have exactly 1 gallon water remaining in 3 gallon jar. (5p – 5, 3p – 1)

Step 5. Empty 5 gallon jar, pour 1 gallon water from 3 gallon jar into it. Now 5 gallon jar has exactly 1 gallon of water. (5p – 1, 3p – 0)

Step 6. Fill 3 gallon jar again and pour all its water into 5 gallon jar**,** thus 5 gallon jar will have exactly 4 gallon of water. (5p – 4, 3p – 0)

We are done!

Question: Ant and Triangle Problem

Three ants are sitting at the three corners of an equilateral triangle. Each ant starts randomly picks a direction and starts to move along the edge of the triangle. What is the probability that none of the ants collide?

Solution:

So let's think this through. The ants can only avoid a collision if they all decide to move in the same direction (either clockwise or anti-clockwise). If the ants do not pick the same direction, there will definitely be a collision. Each ant has the option to either move clockwise or anti-clockwise. There is a one in two chance that an ant decides to pick a particular direction. Using simple probability calculations, we can determine the probability of no collision.

P(No collision) = P(All ants go in a clockwise direction) + P(All ants go in an anti-clockwise direction) = 0.5 * 0.5 * 0.5 + 0.5 * 0.5 * 0.5 = **0.25**

Question: Burning Rope Timer Puzzle

A man has two ropes of varying thickness (Those two ropes are not identical, they aren't the same density nor the same length nor the same width). Each rope burns in 60 minutes. He actually wants to measure 45 mins. How can he measure 45 mins using only these two ropes?
He can't cut the one rope in half because the ropes are non-homogeneous and he can't be sure how long it will burn.

Solution:
He will burn one of the rope at both the ends and the second rope at one end. After half an hour, the first one burns completely and at this point of time, he will burn the other end of the second rope so now it will take 15 mins more to completely burn. so total time is 30+15 i.e. 45mins.

Question: Heaven or Hell Puzzle

You are standing before two doors. One of the path leads to heaven and the other one leads to hell. There are two guardians, one by each door. You know one of them always tells the truth and the other always lies, but you don't know who the honest one is and who the liar is.

You can only ask one question to one of them in order to find the way to heaven. What is the question?

Solution:
The question you should ask is "If I ask the other guard about which side leads to heaven, what would he answer?" It should be fairly easy to see that irrespective of whom you ask this question, you will always get an answer which leads to hell. So you can chose the other path to continue your journey to heaven.

This idea was famously used in the 1986 film Labyrinth.

Here is the explanation if it is yet not clear.

Let us assume that the left door leads to heaven.

If you ask the guard which speaks truth about which path leads to heaven, as he speaks always the truth, he would say "left". Now that the liar, when he is asked what "the other guard (truth teller)" would answer, he would definitely say "right".

Similarly, if you ask the liar about which path leads to heaven, he would say "right". As the truth teller speaks nothing but the truth, he would say "right" when he is asked what "the other guard (liar)" would answer. So in any case, you would end up having the path to hell as an answer. So you can chose the other path as a way to heaven.

Question: 10 Coins Puzzle

You are blindfolded and 10 coins are place in front of you on table. You are allowed to touch the coins, but can't tell which way up they are by feel. You are told that there are 5 coins head up, and 5 coins tails up but not which ones are which. How do you make two piles of coins each with the same number of heads up? You can flip the coins any number of times.

Solution:
Make 2 piles with equal number of coins. Now, flip all the coins in one of the pile.

How this will work? lets take an example.

So initially there are 5 heads, so suppose you divide it in 2 piles.

Case:

P1 : H H T T T
P2 : H H H T T

Now when P1 will be flipped
P1 : T T H H H

P1(Heads) = P2(Heads)

Another case:

P1 : H T T T T
P2 : H H H H T

Now when P1 will be flipped
P1 : H H H H T

P1(Heads) = P2(Heads)

Question: King and Wine Bottles

A bad king has a cellar of 1000 bottles of delightful and very expensive wine. A neighboring queen plots to kill the bad king and sends a servant to poison the wine. Fortunately (or say unfortunately) the bad king's guards catch the servant after he has only poisoned one bottle. Alas, the guards don't know which bottle but know that the poison is so strong that even if diluted 100,000 times it would still kill the king. Furthermore, it takes one month to have an effect. The bad king decides he will get some of the prisoners in his vast dungeons to drink the wine. Being a clever bad king he knows he needs to murder no more than 10 prisoners – believing he can fob off such a low death rate – and will still be able to drink the rest of the wine (999 bottles) at his anniversary party in 5 weeks' time. Explain what is in mind of the king, how will he be able to do so? (of course he has less than 1000 prisoners in his prisons)

Solution:
Think in terms of binary numbers. (Now don't read the solution, give a try).

Number the bottles 1 to 1000 and write the number in binary format.

bottle 1 = 0000000001 (10 digit binary)

bottle 2 = 0000000010

bottle 500 = 0111110100

bottle 1000 = 1111101000

Now take 10 prisoners and number them 1 to 10, now let prisoner 1 take a sip from every bottle that has a 1 in its least significant bit. Let prisoner 10 take a sip from every bottle with a 1 in its most significant bit. etc.

prisoner = 10 9 8 7 6 5 4 3 2 1

bottle 924 = 1 1 1 0 0 1 1 1 0 0

For instance, bottle no. 924 would be sipped by 10,9,8,5,4 and 3. That way if bottle no. 924 was the poisoned one, only those prisoners would die.

After four weeks, line the prisoners up in their bit order and read each living prisoner as a 0 bit and each dead prisoner as a 1 bit. The number that you get is the bottle of wine that was poisoned.
1000 is less than 1024 (2^10). If there were 1024 or more bottles of wine it would take more than 10 prisoners.

Question: 3 Mislabeled Jars

This problem is also called Jelly Beans problem. This is the most commonly asked interview puzzle.

You have 3 jars that are all mislabeled. One jar contains Apple, another contains Oranges and the third jar contains a mixture of both Apple and Oranges.

You are allowed to pick as many fruits as you want from each jar to fix the labels on the jars. What is the minimum number of fruits that you have to pick and from which jars to correctly label them?

Labels on jars are as follows:

Solution:

Let's take a scenario. Suppose you pick from jar labelled as Apple and Oranges and you got Apple from it. That means that jar should be Apple as it is incorrectly labelled. So it has to be Apple jar.
Now the jar labelled Oranges has to be Mixed as it cannot be the Oranges jar as they are wrongly labelled and the jar labelled Apple has to be Oranges.

Similar scenario applies if it's a Oranges taken out from the jar labelled as Apple and Oranges. So you need to pick just one fruit from the jar labelled as Apple and Oranges to correctly label the jars.

Question: Red and Blue Marbles Puzzle

You have two jars, 50 red marbles and 50 blue marbles. You need to place all the marbles into the jars such that when you blindly pick one marble out of one jar, you maximize the chances that it will be red. When picking, you'll first randomly pick a jar, and then randomly pick a marble out of that jar. You can arrange the marbles however you like, but each marble must be in a jar.

Solution:

Say we put all the red marbles into JAR A and all the blue ones into JAR B. then our chances for picking a red one are:

1/2 chance we pick JAR A * 50/50 chance we pick a red marble
1/2 chance we pick JAR B * 0/50 chance we pick a red marble

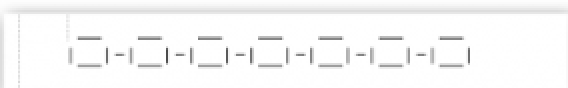
You would try different combinations, such as 25 of each colored marble in a jar or putting all red marbles in one jar and all the blue in the other. You would still end up with a chance of 50%.

What if you put a single red marble in one jar and the rest of the marbles in the other jar? This way, you are guaranteed at least a 50% chance of getting a red marble (since one marble picked at random, doesn't leave any room for choice). Now that you have 49 red marbles left in the other jar, you have a nearly even chance of picking a red marble (49 out of 99).

So the maximum probability will be :
jar A : (1/2)*1 = 1/2 (selecting the jar A = 1/2, red marble from jar A = 1/1)
jar B : (1/2)*(49/99) = 0 (selecting the jar B = 1/2, red marble from jar B = 49/99)
Total probability = 74/99 (~3/4)

Question: Gold Bar Puzzle

You've got someone working for you for seven days and a gold bar to pay him. The gold bar is segmented into seven connected pieces. You must give them a piece of gold at the end of every day. What and where are the fewest number of cuts to the bar of gold that will allow you to pay him 1/7th each day?



Puzzle Solution:
Lets split the chain as,

Day 1: Give A (+1)
Day 2: Get back A, give B (-1, +2)
Day 3: Give A (+1)
Day 4:Get back A and B, give C (-2,-1,+4)
Day 5:Give A (+1)
Day 6:Get back A, give B (-1,+2)
Day 7:Give A (+1)

Question: 100 Doors Puzzle

You have 100 doors in a row that are all initially closed. you make 100 passes by the doors starting with the first door every time. the first time through you visit every door and toggle the door (if the door is closed, you open it, if its open, you close it). the second time you only visit every 2nd door (door #2, #4, #6). the third time, every 3rd door (door #3, #6, #9), ec, until you only visit the 100th door.

What state are the doors in after the last pass? Which are open which are closed?

Puzzle asked in: Google/Adobe/Amazon/Oracle

Solution:

You can figure out that for any given door, say door #38, you will visit it for every divisor it has. so has 1 & 38, 2 & 19. so on pass 1 i will open the door, pass 2 i will close it, pass 19 open, pass 38 close. For every pair of divisors the door will just end up back in its initial state. so you might think that every door will end up closed? well what about door #9. 9 has the divisors 1 & 9, 3 & 3. but 3 is repeated because 9 is a perfect square, so you will only visit door #9, on pass 1, 3, and 9… leaving it open at the end. only perfect square doors will be open at the end.

Question: Minimum no of Aircraft Puzzle

On Bagshot Island, there is an airport. The airport is the home base of an unlimited number of identical airplanes. Each airplane has a fuel capacity to allow it to fly exactly 1/2 way around the world, along a great circle. The planes have the ability to refuel in flight without loss of speed or spillage of fuel. Though the fuel is unlimited, the island is the only source of fuel.
What is the fewest number of aircraft necessary to get one plane all the way around the world assuming that all of the aircraft must return safely to the airport? How did you get to your answer?

__Notes:__

(1) Ignore extra fuel consumption as a result of acceleration, evaporation of fuel, bleeding-heart-liberal fiscal policies, etc.
(2) All the planes have to make it back safely, so you can’t give all your fuel away to another plane.
(3) Assume that refueling is an extremely fast process.

Solution:

As per the puzzle given above The fewest number of aircraft is 3!
Imagine 3 aircraft (A, B and C). A is going to fly round the world. All three aircraft start at the same time in the same direction. After 1/6 of the circumference, B passes 1/3 of its fuel to C and returns home, where it is refueled and starts immediately again to follow A and C.

C continues to fly alongside A until they are 1/4 of the distance around the world. At this point C completely fills the tank of A which is now able to fly to a point 3/4 of the way around the world. C has now only 1/3 of its full fuel capacity left, not enough to get back to the home base. But the first 'auxiliary' aircraft reaches it in time in order to refuel it, and both 'auxiliary' aircraft are the able to return safely to the home base.

Now in the same manner as before both B and C fully refueled fly towards A. Again B refuels C and returns home to be refueled. C reaches A at the point where it has flown 3/4 around the world. All 3 aircraft can safely return to the home base, if the refueling process is applied analogously as for the first phase of the flight.

Question: Boys and Girls

In a country where everyone wants a boy, each family continues having babies till they have a boy. After some time, what is the proportion of boys to girls in the country? (Assuming probability of having a boy or a girl is the same)

Solution:
"very simple". Half the couples have boys first, and stop. The rest have a girl. Of those, half have a boy second, and so on.
So suppose there are N couples. There will be N boys.

1/2 have a boy and stop: 0 girls
1/4 have a girl, then a boy: N/4 girls
1/8 have 2 girls, then a boy: 2*N/8 girls
1/16 have 3 girls, then a boy: 3*N/16 girls
1/32 have 4 girls, then a boy: 4*N/32 girls
…
Total: N boys and
1N 2N 3N 4N
– + – + – + — +… = ~N

Therefore, the proportion of boys to girls will be pretty close to 1:1

Question: Squares on a chess board?

How many squares are on a chess board?

If you thought the answer is 64, think again! 🙂

How about all the squares that are formed by combining smaller squares on the chess board (2×2, 3×3, 4×4 squares and so on)?

A 1×1 square can be placed on the chess board in 8 horizontal and 8 vertical positions, thus making a total of 8 x 8 = 64 squares. Let's consider a 2×2 square. There are 7 horizontal positions and 7 vertical positions in which a 2×2 square can be placed. Why? Because picking 2 adjacent squares from a total of 8 squares on a side can only be done in 7 ways. So we have 7 x 7 = 49 2×2 squares. Similarly, for the 3×3 squares, we have 6 x 6 = 36 possible squares. So here's a breakdown.

1×1 8 x 8 = 64 squares
2×2 7 x 7 = 49 squares
3×3 6 x 6 = 36 squares
4×4 5 x 5 = 25 squares
5×5 4 x 4 = 16 squares
6×6 3 x 3 = 9 squares
7×7 2 x 2 = 4 squares
8×8 1×1 = 1 square

$1^2 + 2^2 + 3^2 + . . . n^2$

Total = 64 + 49 + 36 + 25 + 16 + 9 + 4 + 1 = **204** squares

Question: Prove that $p^2 - 1$ is Divisible by 24

Prove that p2 – 1 is divisible by 24 if p is a prime number greater than 3?

Solution:
The most elementary proof , without explicitly mentioning any number theory: out of the three consecutive numbers p–1, p, p+1, one of them must be divisible by 3; also, since the neighbors of p are consecutive even numbers, one of them must be divisible by 2 and the other by 4, so their product is divisible by 3·2·4=24 — and of course, we can throw p out since it's prime, and those factors cannot come from it.

Question: Possible Paths across a Rectangular Grid

Consider a rectangular grid of 4×3 with lower left corner named as A and upper right corner named B. Suppose that starting point is A and you can move one step up(U) or one step right(R) only. This is continued until B is reached. How many different paths from A to B possible?

Now let's look at some sample paths we can figure out by inspection.

If we start at A and move towards B, we find we can follow the path

RRRUU (Where R = Right one unit, U = Up one unit),

UURRR,
RURUR,
RRUUR,
and so on.
By analyzing our good routes, we see that every good route consists of 5 moves and we have 3 R moves and 2 U moves. We can use this to generalize a formula to find the number of possible routes.

Since as we've shown, order does not matter in our paths (we can have an R in any place of our 5 moves), we can use our combination formula:

C(N,R) = N!/(N-R)! * R!

The number of how many good routes we have can be found by finding how many combinations of 3 R's we can have in our 5 moves, so we want to calculate:

C(5,3) = 5!/(5-3)! * 2! = 10

If you want programming solution of above problem,

Question: 10 Coins Puzzle

You are blindfolded and 10 coins are place in front of you on table. You are allowed to touch the coins, but can't tell which way up they are by feel. You are told that there are 5 coins head up, and 5 coins tails up but not which ones are which. How do you make two piles of coins each with the same number of heads up? You can flip the coins any number of times.

Solution:
Make 2 piles with equal number of coins. Now, flip all the coins in one of the pile.

How this will work? lets take an example.

So initially there are 5 heads, so suppose you divide it in 2 piles.

Case:

P1 : H H T T T
P2 : H H H T T

Now when P1 will be flipped
P1 : T T H H H

P1(Heads) = P2(Heads)

Another case:

P1 : H T T T T
P2 : H H H H T

Now when P1 will be flipped
P1 : H H H H T

P1(Heads) = P2(Heads)

Question: 13 Caves and a Thief Puzzle

There are 13 caves arranged in a circle. There is a thief in one of the caves. Each day the the thief can move to any one of adjacent cave or can stay in same cave in which he was staying the previous day. And each day, cops are allowed to enter any two caves of their choice.

What is the minimum number of days to guarantee in which cops can catch the thief?

Note:
Thief may or may not move to adjacent cave.
Cops can check any two caves, not necessarily be adjacent.

Solution:
Let's assume the thief is in cave C1 and going clockwise and cops start searching from cave C13 and C12 on your first day.
Cave C13 and C11 on second day,
C13 and C10 on third day and so on till C13 and C1 on 12th day.
So basically the aim is to check C13 everyday so that if thief tries to go anti clockwise you immediately catch it and if goes clockwise cops will catch him in maximum 12 days (this include the case where he remains in Cave C1).

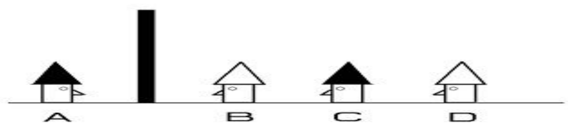
Answer is **12**.

Question: Prisoners and Hats Puzzle

Four prisoners are arrested for a crime, but the jail is full and the jailer has nowhere to put them. He eventually comes up with the solution of giving them a puzzle so if they succeed they can go free but if they fail they are executed.

The jailer puts three of the men sitting in a line. The fourth man is put behind a screen (or in a separate room). He gives all four men party hats. The jailer explains that there are two black and two white hats; that each prisoner is wearing one of the hats; and that each of the prisoners is only to see the hats in front of them but not on themselves or behind. The fourth man behind the screen can't see or be seen by any other

prisoner. No communication between the prisoners is allowed.
If any prisoner can figure out and say to the jailer what color hat he has on his head all four prisoners go free. If any prisoner suggests an incorrect answer, all four prisoners are executed. The puzzle is to find how the prisoners can escape, regardless of how the jailer distributes the hats.



Solution:
Prisoner A and B are in the same situation – they have no information to help them determine their hat color so they can't answer. C and D realize this.

Prisoner D can see both B and C's hats. If B and C had the same color hat then this would let D know that he must have the other color.

When the time is nearly up, or maybe before, C realizes that D isn't going to answer because he can't. C realizes that his hat must be different to B's otherwise D would have answered. C therefore concludes that he has a black hat because he can see B's white one.

Question: IIT Students and Hats Puzzle

The riddle is Nine IIT students were sitting in a classroom. Their professor wanted them to test. Next day the professor told all of his 9 students that he has 9 hats, The hats either red or black color. He also added that he has at least one hat with red color and the no. of black hats is greater than the no. of red hats. The professor keeps those hats on their heads and ask them tell me how many red and black hats the professor have? Obviously students cannot talk to each other or no written communication, or looking into each other eyes; no such stupid options and no tricks.
Professor goes out and comes back after 20 minutes but nobody was able to answer the question. So he gave them 10 more minutes but the result was the same. So he decides to give them final 5 minutes. When he comes everybody was able to answer him correctly.
So what is the answer? And why?

Solution:
After first interval of 20 minutes :
Let's assume that their is 1 hat of red color and 8 hats of black color. The student with red hat on his head can see all 8 black hats, so he knows that he must be wearing a red hat.
Now we know that after first interval nobody was able to answer the prof that means our assumption is wrong. So there cannot be 1 red and 8 black hats.
After second interval of 10 minutes :
Assume that their are 2 hats of red color and 7 hats of black color. The students with red hat on their head can see all 7 black hats and 1 red hat, so they know that they must be wearing a red hat.

Now we know that after second interval nobody was able to answer the prof that means our assumption is again wrong. So there cannot be 2 red and 7 black hats.
After third interval of final 5 minutes :
Now assume that their is 3 hats of red color and 6 hats of black color. The students with red hat on their head can see all 6 black hats and 2 red hats, so they know that they must be wearing a red hat.
Now we know that this time everybody was able to answer the prof that means our assumption is right. So there are 3 red hats and 6 black hats. Now as everybody gave the answer so there can be a doubt that only those 3 students know about it how everybody came to know ?
Then here is what i think, the professor gave them FINAL 5 minutes to answer, so other guys will think that the professor expects the answer after 3rd interval (according to prof it must be solved after 3 intervals), so this is the clue for others.

Question: Car Wheels Problem

A car has 4 tyres and 1 spare tyre. Each tyre can travel a maximum distance of 20000 kilometers before wearing off. What is the maximum distance the car can travel. You are allowed to change tyres (using the spare tyre) unlimited number of times.

Note: All tyres are used upto their full strength.

Solution:
25000
Divide the lifetime of spare tire into 4 equal part i.e., 5000 and swap it at each completion of 5000 Kms distance.
Let four tyres be A, B, C and D and spare tyre be S.
5000 KMs: Replace A with S.
10000 KMs: Put A back to its original position and replace B with S
15000 KMs: Put B back to its original position and replace C with S
20000 KMs: Put C back to its original position and replace D with S

Question: Probability of getting one rupee coin from bag

A bag contains (x) one rupee coins and (y) 50 paise coins. One coin is taken from the bag and put away. If a coin is now taken at random from the bag, what is the probability that it is a one rupee coin?

Answers:

Case I: Let the first coin removed be one rupee coin One rupee coins left = $(x – 1)$ Fifty paise coins left = y.
Probability of getting a one rupee coin in the first and second draw = $x/(x + y) \times (x – 1)/(x – 1 + y)$
Case II: Let the first coin removed be fifty paise coin One rupee coins left = x Fifty paise coins left = $y – 1$.
Probability of getting a fifty paise coin in the first and one rupee coin in second draw
= $y / (x + y) \times x / (x + y – 1)$
Total probability = sum of these two = $x/(x + y)$ [after simplification].

Question: Probability of picking 2 socks of same color

There are 6 pairs of black socks and 6 pairs of white socks. What is the probability to pick a pair of black or white socks when 2 socks are selected randomly in darkness?

This question was asked in Aamaon.

Solution:

Ways to pick any 2 socks from 24 socks = 24C2
Ways to pick 2 BLACK socks from 12 BLACK socks = 12C2

Probability of picking 2 BLACK socks (P1)= 12C2 / 24C2 = 66/276
Probability of picking 2 WHITE socks (P2)= 12C2 / 24C2 = 66/276

Probability of picking any 2 same color socks = P1+P2 = 66/276 + 66/276 = 11/23

Question: 3 Doors and Heaven

A person dies, and he arrives at the gate to heaven. There are 3 doors in the heaven. One of the door leads to heaven, second one leads to a 1-day stay at hell and then back to the gate and the third one leads to a 2 day stay at hell and then back to the gate. Every time the person is back at the gate, the 3 doors are reshuffled. How long will it take the person to reach heaven?

Solution:

According to probability 1/3 of the time, the door to heaven will be chosen, so 1/3 of the time it will take 0 days. 1/3 of the time, the 1-day door is chosen, of those, the right door will be chosen the next day. Similarly, 1/3 of the time, the 2 day door is chosen, of those, the right door will be chosen after the 2 days.

So lets say it will take N days. 1/3 of the cases are done in 0 days as before. 1/3 of the cases are 1+N. 1/3 are 2 + N.

N = 1/3 * 0 + 1/3 * (1 + N) + 1/3 * (2 + N)
N = 1 + 2N/3
Therefore, N/3 = 1 ; N = 3.

So it will take on average 3 days to reach to heaven.

Question: How can four employees calculate the average of their salaries without knowing other's salary

This solution has a limitation that information is partially passed and there needs some trust level.

Salary of A: i

Salary of B: j

Salary of C: k

Salary of D: l

A passes to B (i + a) where a is a number that A knows B takes this a passes to C (i + j + a + b). C takes this and passes to D (i + j + k + a + b + c). D takes this and passes to A (i + j + k + l + a + b + c + d)

Now one after another they remove their constants.
Ex: A now passes to B: i + j + k + l + b + c + d (He has removed a)

B passes to C after removing of his constant (b).

Thus Finally D gets x + y + z + u + d. He takes away his constant and now he has i + j + k + l.

So the average is:(i + j + k + l) / 4.

Let us know if you know any other solution.

Question: Blind bartender's problem

Four glasses are placed on the corners of a square table. Some of the glasses are upright (up) and some upside-down (down). A blindfolded person is seated next to the table and is required to re-arrange the glasses so that they are all up or all down, either arrangement being acceptable, which will be signaled by the ringing of a bell. The glasses may be re-arranged in turns subject to the following rules. Any two glasses may be inspected in one turn and after feeling their orientation the person may reverse the orientation of either, neither or both glasses. After each turn the table is rotated through a random angle. The puzzle is to devise an algorithm which allows the blindfolded person to ensure that all glasses have the same orientation (either up or down) in a finite number of turns. The algorithm must be non-stochastic i.e. it must not depend on luck.

Solution:

- On the first turn choose a diagonally opposite pair of glasses and turn both glasses up.

- On the second turn choose two adjacent glasses. At least one will be up as a result of the previous step. If the other is down, turn it up as well. If the bell does not ring then there are now three glasses up and one down(3U and 1D).
- On the third turn choose a diagonally opposite pair of glasses. If one is down, turn it up and the bell will ring. If both are up, turn one down. There are now two glasses down, and they must be adjacent.
- On the fourth turn choose two adjacent glasses and reverse both. If both were in the same orientation then the bell will ring. Otherwise there are now two glasses down and they must be diagonally opposite.
- On the fifth turn choose a diagonally opposite pair of glasses and reverse both. The bell will ring for sure.

Question: The Fox and the Duck Puzzle

A duck, pursued by a fox, escapes to the center of a perfectly circular pond. The fox cannot swim, and the duck cannot take flight from the water. The fox is four times faster than the duck. Assuming the fox and duck pursue optimum strategies, is it possible for the duck to reach the edge of the pond and fly away without being eaten? If so, how?

Solution:

From the speed of the fox it is obvious that duck cannot simply swim to the opposite side of the fox to escape.

Fox can travel 4r in the time duck covers r distance. Since fox have to travel half of the circumference Pi*r and Pi*r < 4r

So how could the duck make life most difficult for the fox? If the duck just tries to swim along a radius, the fox could just sit along that radius and the duck would continue to be trapped.

At a distance of r/4 from the center of the pond, the circumference of the pond is exactly four times the circumference of the duck's path.

Let the duck rotate around the pond in a circle of radius r/4. Now fox and duck will take exact same time to make a full circle. Now reduce the radius the duck is circling by a very small amount (Delta). Now the Fox will lag behind, he cannot stay at a position as well.

Say, the duck circles the pond at a distance r/4 – e, where e is an infinitesimal amount. So as the duck continues to swim along this radius, it would slowly gain some distance over the fox. Once the duck is able to gain 180 degrees over the fox, the duck would have to cover a distance of 3r/4 + e to reach the edge of the pond. In the meanwhile, the fox would have to cover half the circumference of the pond (i.e the 180 degrees). At that point,

(pi * r) > 4 * (3r/4 + e)

So time taken to travel 3r/4 is quicker than 3.14*r at four times the speed.(0.14*r distance is left)

The duck would be able to make it to land and fly away.

Question: 8 Balls Puzzle

You have 8 balls. One of them is defective and weighs less than others. You have a balance to measure balls against each other. In 2 weighing, how do you find the defective one?

Solution:

Defective ball is light

Make three Groups G1 – 3 balls G2 – 3 balls G3 – 2 balls

First weight- G1 and G2 if G1 = G2 then defective ball in G3 ,
weigh the the 2 balls in G3 if EQUAL then 3rd ball of G3 is defective
else whichever lighter in 1st or 2nd is defective ball

else if G1 < G2 defective ball in G1
weigh 1 and 2 ball of G1 if EQUAL then 3rd ball of G1 is defective
else whichever lighter in 1st or 2nd is defective ball

else if G1 > G2 defective in G2
Again in 1 comparison we can find the odd ball.

So by following above steps in 2 steps, lighter ball can be find out.

Question: 25 horses and 5 lanes

There are 25 horses and 5 lanes. You have no idea about which horse is better than other.
Find in minimum possible races, the first three fastest running horses.

Solution:

We will have 5 races with all 25 horses
Let the results be
u1,u2,u3,u4,u5
v1,v2,v3,v4,v5
x1,x2,x3,x4,x5
y1,y2,y3,y4,y5
z1,z2,z3,z4,z5

Work through a process of elimination:

Where u1 faster than u2 , u2 faster than u3 etc and
We need to consider only the following set of horses
u1,u2,u3
v1,v2,v3
x1,x2,x3
y1,y2,y3
z1,z2,z3

Race 6
We race u1,v1,x1,y1,z1
Let speed(u1)>speed(v1)>speed(x1)>speed(y1)>speed(z1)

We get u1 as the fastest horse
We can ignore y1,y2,y3,z1,z2 and z3 automatically since those can not be in the top 3.

Now we left with
u2,u3,
v1,v2,v3,
x1,x2,x3,

Race 7
Race u2,u3,v1,v2 and x1 (x2,x3 is ignored since v1,x1 are faster than both, so obvious choices are u2,u3,v1,v2 and x1)
The first and second will be second and third of the whole set

So we need minimum of 7 races to find the 3 fastest horses.

Question: Heavy and Light Balls Puzzle

You have 2 ball of each A,B,C colors and each color have 1 light and 1 heavy ball. All light balls are of same weight same goes for heavy. Find out weight type of each ball in minimum chances. You can use a two sided balance system (not the electronic one).

Solution:

Simply, you can check by taking 2 balls of same color. Now, comparing those balls with other balls but this will take 3 chances for each color type ball.

Answer is 2 chances.

So, Make a table for all conditions for all 6 balls that will help in understanding and solving this problem.

A1,A2,B1,B2,C1,C2

First weight A1,B1 and B2,C1 -> 3 cases equal ,left is heavy or left is light.

Case 1:
Equal, if equal weight simply B1,B2 will solve the problem.

Case 2:
If A1+B1 > B2+C1, then we know B1 > B2. Also just that A1>=C1.

Next compare A1,B1 and A2,C1
If A1+B1 = A2+C1 means A2 is heavy and A1=C1 light
If A1+B1 > A2+C1 means A2 is light and A1=C1 heavy
A1+B1 < A2+C1 will not happen because B1 is any way heavier.

Case 3:

If A1+B1 > B2+C1

Similar to above case we can check it.

Question: Prisoner and two Doors Puzzle

Court takes decision to relax the sentence given to criminal if he can solve a puzzle. Criminal has to take decision to open one of the doors.

Behind each door is either a lady or a tiger. They may be both tigers, either both ladies or one of each.

If the criminal opens a door to find a lady he will marry her and if he opens a door to find a tiger he will be eaten alive. Of course, the criminal would prefer to be married than eaten alive.

Each of the doors has a statement written on it.

The statement on door one says, “In this room there is a lady, and in the other room there is a tiger.”
The statement on door two says,“ In one of these rooms there is a lady, and in one of these rooms there is a tiger.”

The criminal is informed that one of the statements is true and one is false. Which door should the criminal open?

Solution:

Criminal should open door number 2.

How?
Lets assume statement on the first door is true then second statement will also be true(as there will be a lady in one door and a tiger in other door), but as we already know that only one statement can be true, so first statement can not be true.

Now if first statement is false, it implies these possible scenarios

Door 1 Door 2
Tiger Tiger
Lady Lady
Tiger Lady

But as second statement is true, so it means behind one of the door there is a lady and in other door there is a tiger so options with both lady and both tigers are ruled out and only third option remains valid, thus the criminal should choose door number 2.

Question: Sand Timer Puzzle

You have two sand timers with you. One can measure 7 minutes and the other sand timer can measure 11 minutes. This means that it takes 7 minutes for the sand timer to completely empty the sand from one portion to the other.

You have to measure 15 minutes using both the timers. How will you measure it ?

Solution:

Mathematically

7 Minutes Sand Timer Finished.

Time Remaining in 11 minutes timer – 4 minutes

Reversing the 7 minutes timer – 4 minutes will elapse. 3 Minutes will left.

Once 11 minutes gets over reverse the 11 minutes timer again to use that 3 minutes. 8 Minutes left.

Now Reverse 7 minutes timer to measure 7+8 = 15 minutes.

Question: The Pill Problem

A man has a medical condition that requires him to take two kinds of pills, call them P1 and P2. The man must take one P1 pill and one P2 pill each day, or he will die. If he takes more than 1 pill of the same kind per day, he will die. Both pills look exactly the same (same weight, color, shape, size, etc… ;).

The pills are taken by first dissolving them in water.

One day, as he is about to take his pills, he takes out one P1 pill from the P1 jar and puts it in a glass of water. Then he accidentally takes out two P2 pills from the P2 jar and puts them in the water. Now, he is in the situation of having a glass of water with three dissolved pills, one P1 pill and two P2 pills. Unfortunately, the pills are very expensive, so the thought of throwing out the water with the 3 pills and starting over is out of the question.

How should the man proceed in order to get the right quantity of P1 and P2 while not wasting any pills?

Solution:

Add one more P1 pill to the glass and let it dissolve.

Take half of the water today and half tomorrow.

So, Percentage of Pill P1 and Pill P2 on both the day in overall be managed equal.

It works under following assumptions:

The dissolved Pills can be used next day.

Question: 3 Doors and Angel

You are given a choice of three doors by an Angel. You can choose only one of the doors among the three. Out of these three doors two contains nothing and one has a jackpot.

After you choose one of the doors angel reveals one of the other two doors behind which there is a nothing. Angel gives you an opportunity to change the door or you can stick with your chosen door.

You don't know behind which door we have nothing. Should you switch or it doesn't matter?

Solution: You choose one of the door. So probability of getting the jackpot – 1/3.

Let's say that the jackpot is in Door no 1 and you choose Door no 1. So the angel will either open door no 2 or door no 3. Let's look at the sample space of this Puzzle.

Case ->	Door1	Door2	Door3
Case 1 :	Jackpot	Nothing	Nothing
Case 2 :	Nothing	Jackpot	Nothing
Case 3 :	Nothing	Nothing	Jackpot

Want to keep your guess:

Let's suppose that you guessed *correctly*. Then it makes no difference what the game show host does, the other door is always the wrong door. So in that case, by keeping your choice, the probability that you win is 1/3 x 1 = 1/3.

But let's suppose you guessed *incorrectly*. In that case, the remaining door is guaranteed to be the correct door. Thus, by keeping your choice, the probability of winning is 2/3 x 0 = 0.

Your total chances of winning by keeping your guess is: 1/3 + 0 = 1/3.

Want to change your guess:

Again, let's suppose that you guessed *correctly*. By changing your guess the probability that you win is 1/3 x 0 = 0.

But let's suppose you guessed *incorrectly*. Again, this means that the remaining door *must* be the correct one. Therefore by changing your choice, the probability of winning is 2/3 x 1 = 2/3.

Your total chances of winning by changing your guess is: 2/3 + 0 = 2/3.

Hence it is advisable to switch.