Problem 1: A Cat, a Parrot, and a Bag of Seed

1. So a man has himself and three other items to get across a riverbank. The two issues are that he only has room for himself and one other item in the boat and that certain items cannot be left as a pair because they will eat each other.
2. So the main constraints to this problem are that the cat and parrot can’t be left alone. The parrot and bag of seed can’t be left alone. So the goal will be to make sure each item gets across without the constraints being applied.
3. The initial solution would be to take the parrot across first. Return empty handed and pick up the cat in order to take it to the other side leaving the bag of seed alone. When getting to the other side, the man drops the cat off while picking up the parrot to return it to the other side so the cat does not eat it. When back on the initial side the man drops off the parrot while picking up the bag of seed to take to the other side. Now the man can drop off the seed return to pick up the parrot and will have successfully transported all items across the riverbank.

A second solution would be again to start off with the parrot, but on the return trip the man would pick up the bag of seed instead of the cat. From there the solution would be almost identical with the return of the parrot to pick up the cat.

1. Both solutions would work equally well. Because of the constraints the first item taken would always be the bird.
2. So I chose to go with the second solution. I think this would be best in the case that if the seed were left on its own that a wild animal would eat it. So the solution is as follows: The man takes the parrot across the riverbank with him leaving the bird on the other side. He then returns to the original side and picks up the bag of seed to take to the other side. When he arrives at the opposite side he drops the bag of seed while also taking the bird back in the boat with him. When he arrives to the original side he drops the bird and then takes the cat to the opposite side. Again making sure that none of the constraints are met. When he takes the cat he can drop it off with no worries of the cat eating the bag of seed. All that is left is for the man to return to the original side pick up the parrot and take it back again to the opposite side.

Problem 2: Socks in the Dark

1. So the problem at hand is that I need to pull socks from a drawer but can’t see the selection until I have pulled them because it is dark. There are 20 socks in total with 10 of them being black, 6 being brown, and 4 being white. The goal is for me to figure out the least amount of socks I would have to pull in order to get a) one matching pair and b) one matching pair of each color.
2. So the main constraint is that I can’t see the sock until I have pulled it because it is dark. My sub goals are as listed above: the least number of socks for one pair and the least number of socks for a pair of each color.
3. So the first solution would be four. Because there are 3 colors 4 socks would guarantee that a pair of one color would be pulled. This would satisfy the first goal in every situation possible. Although the pair could be pulled earlier, it is guaranteed that by the fourth sock a pair would have been pulled.

For the second part of the solution, in order to pull at lest one matching pair of each color the number must be higher to guarantee this outcome. The number socks that need to be pulled is 18. Again, although the pairs could be pulled earlier it would not be guaranteed until the 18th sock.

1. Each solution does meet the goals in full. For both the first sub-goal, the pair would not be guaranteed until the fourth sock. The reason is because in the most unfortunate circumstance the first three socks pulled would be each of the colors in the drawer. Leaving the fourth sock to complete a pair. This is the same with the solution for the second goal. In the most unfortunate circumstance all 10 black and 6 brown would be pulled leaving the white pair to be pulled. This would happen on the 17th and 18th socks.
2. So for the first solution I would pull socks from the drawer knowing by the fourth sock I would get a pair. This is because in the worst situation I would pull a sock of each color leaving the fourth sock to complete a pair. For the second goal, I would pull the socks from the drawer knowing by the 18th sock a pair of each color would be puled. This is because of I were to pull a sock there is the chance that socks 1 through 16 would be all the black and brown socks. This would leave the white pair needed to complete the pairs with the 17th and 18th sock.

Problem 3: Predicting Fingers

1. So the problem is as follows: a girl counts on her fingers going from thumb to pink and reversing each time she reaches the outer fingers. She starts with her thumb as 1, going to the pinky which would be 5, reversing making the ring finger 6 going to the thumb as 9, continuing on. The answer to the first sub goal is given in the question itself. The overall goal is to figure out on what fingers the girl will land on 10, 100, and 1,000.
2. So the sub-goals are finding the fingers on three numbers. The numbers being 10, 100, and 1,000. The only constraint is how the girl counts out the numbers on her fingers. She starts with 1 on her thumb, going 2 on her first finger, 3 on her middle finger, 4 on her ring finger, and five on her pinky. She then reverses it going 6 on her ring finger, 7 on her middle, 8 on her first finger, and 9 on her thumb. This continues until she reaches each of the goals.
3. So the solution to the first goal is given in the question. She would reach 10 on her first finger. The ways to figure the other do can either be done by actually counting out the numbers on my own hand or create a chart to find a pattern. With that done the solutions are that the girl would reach 100 on her ring finger and 1,000 on her first finger.
4. The solutions both meet the requirements and work for all 3 cases. However using a chart would save a lot of time in coming to the answers. Counting out each number on my own finger would take too long and would also be at the risk of losing count during the attempt to reach 1,000.
5. So the solution in full is that the girl will reach 10 on her First finger, as given in the problem itself. She will reach 100 on her ring finger and 1,000 on her first finger. The best way to show will be with a chart.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Thumb | First | Middle | Ring | Pinky |
| 1 | 2 | 3 | 4 | 5 |
| 9 | 8 | 7 | 6 |  |
|  | **10** | 11 | 12 | 13 |
| 17 | 16 | 15 | 14 |  |
|  | 18 | 19 | **20** | 21 |
| 25 | 24 | 23 | 22 |  |
|  | 26 | 27 | 28 | 29 |
| 33 | 32 | 31 | **30** |  |
|  | 34 | 35 | 36 | 37 |
| 41 | **40** | 39 | 38 |  |
|  | 42 | 43 | 44 | 45 |
| 49 | 48 | 47 | 46 |  |
|  | **50** | 51 | 52 | 53 |

Looking at the chart I noticed a pattern in where the 0’s landed. Written in bold we see that the pattern is First, Ring, Ring, First, First. If added a 0 it would land on First as well. This gives the pattern of 2 on First then 2 on Ring and so on.

|  |  |
| --- | --- |
|  |  |
| First | Ring |
| 0 |  |
| 10 |  |
|  | 20 |
|  | 30 |
| 40 |  |
| 50 |  |
|  | 60 |
|  | 70 |
| 80 |  |
| 90 |  |
|  | 100 |

|  |  |
| --- | --- |
| First | Ring |
|  | 100 |
|  | 110 |
| 120 |  |
| 130 |  |
|  | 140 |
|  | 150 |
| 160 |  |
| 170 |  |
|  | 180 |
|  | 190 |
| 200 |  |

|  |  |
| --- | --- |
| First | Ring |
| 0 |  |
|  | 100 |
| 200 |  |
|  | 300 |
| 400 |  |
|  | 500 |
| 600 |  |
|  | 700 |
| 800 |  |
|  | 900 |
| 1000 |  |

With the last three graphs we use the established patterns to figure out the solutions. In the first we use the pattern to find that when counting the girl will land on her ring finger when hitting 100. Then continuing on we can see that every hundred the pattern alternates between the two fingers. So we take that pattern into the third table and see that the girl would land on 1,000 when counting on her fingers.