Rock, Paper, Scissors Problem

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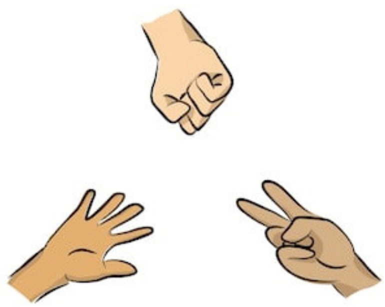
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Here is another problem from the Sherlock Holmes puzzle book by Dr. Watson (aka Tim Dedopulos) ([1] p.141).

Wiggins grinned at me. “You’ve not played Rock Paper Scissors before, Doctor?”

“Doesn’t ring a bell,” I told him.

“Two of you randomly pick one of the three, and shout your choice simultaneously. There are hand gestures, too. If you both get the same, it’s a draw. Otherwise, scissors beats paper, paper beats rock, and rock beats scissors.”

“So it’s a way of settling an argument,” I suggested.

“You were brought up wrong, Doctor,” Wiggins said gravely. “Look, try it this way. I played a series of ten games with Alice earlier. I picked scissors six times, rock three times, and paper once. She picked scissors four times, rock twice, and paper four times. None of our games were drawn.” He glanced at Holmes, who nodded. “So then, Doctor. What was the overall score for the series?”

My Solution

I made a first pass at an example of 10 games (Figure 1), making sure there were no ties. I let 1 represent a win and 0 a loss. I then considered any permutation of the rock-paper-scissors (**R** **P** **S**) pairings to see how it would change the results.

											Wins
Wiggins	**S**	**S**	**S**	**S**	**S**	**S**	**R**	**R**	**R**	**P**	
	1	1	1	1	0	0	1	1	1	0	**7**
Alice	**P**	**P**	**P**	**P**	**R**	**R**	**S**	**S**	**S**	**S**	
	0	0	0	0	1	1	0	0	0	1	**3**

Figure 1

First, I considered Alice’s games. Clearly I could not swap an **S** with a **P** or **R**, since that would produce a forbidden **S** tie with Wiggins. Also, swapping any of Alice’s **P**-**R**s would leave the result unchanged, since they were both paired with Wiggins’s **S**s. So there was no way to change the outcome with a permutation of Alice’s results.

By symmetry this should mean no permutation of Wiggins’s results should matter. But just to verify: again no Wiggins **S** can be swapped with a **P** or **R**, since that would produce a forbidden **S** tie with Alice. Similarly, swapping any of Wiggins’s **P**-**R**s would leave the result unchanged, since they were both paired with Alice’s **S**s.

Therefore, the outcome of the 10 games must have been 7 wins for Wiggins and 3 wins for Alice.

Dr. Watson’s Solution

Wiggins won, 7-3. Since there were no draws, Wiggins’s 6 scissors met Alice’s 4 paper and 2 rock, giving Wiggins 4 out of 6. The other games must have been Alice’s scissors, which met Wiggins’ rock three times, and paper once, giving Wiggins 3 out of 4. So he won 7 out of 10.

References

[1] Dedopulos, Tim, *The Sherlock Holmes Puzzle Collection: The Lost Cases*, Metro Books, Sterling Publishing Co., New York, Carlton Books Ltd., London, 2015.