





The Drunkard's Walk Prince

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Once upon a time, in a land far, far away, lived a princess who dreamed of living a life she would be proud to call her own.

15

Her father was the king of the Autoregressive (AR) nation, while her mother was the queen of the Moving Average (MA) nation. When her parents got married, they formed a strong alliance between the two nations, renaming the nations as one: the nation of Autoregressive Moving Averages (ARMA).

The princess, Esmeralda, was the bridge between these two nations and was expected to rule the nation of ARMA after her parents. However, there was one slight hitch in that plan: she did not have a king to rule by her side when she became queen. So, Esmeralda sent a worldwide proclamation that she would marry whoever proved to her that they were pure of heart.

Her parents ruled a land where the purity of heart was measured by whether the subjects' (processes) hearts contained white noise or not. If they contained white noise, known as the Drunkard's Walk, they were considered not pure of heart.



Now, the nation of ARMA was at odds with another nation: the nation of Autoregressive Integrated Moving Averages (ARIMA). While the ARMA nation was peaceful and stuck to their same everyday traditions (stationary), the ARIMA nation preferred to test the limits of science by always moving forward (non-stationary). The ARMA nation believed that the ARIMA nation was moving away from what was natural with all its scientific breakthroughs.

16

The prince of this story, Rohan, came from ARIMA. Once he heard of the princess's proclamation, he was curious.

"How will I prove myself to this princess who has the purest heart when I come from a nation that her parents don't approve of?" he wondered.

Unbeknown to Rohan, his father, King Salmaan, had seen his son's interest in this foreign princess's announcement. He was determined to prevent Rohan from proving himself to Esmeralda at all costs. He believed that if Rohan met and married this princess, then the nation of ARIMA would suffer greatly, and all the scientific advancements he had encouraged his nation to achieve under his rule would be forgotten and replaced with complacency. So, King Salmaan started to hatch a plan to prevent Rohan from ever meeting Esmeralda. King Salmaan's plan was so simple, yet so devious: make Rohan believe that Esmeralda would never marry him, even if he proved to be pure of heart.

One day, King Salmaan called Rohan into his royal chamber to discuss the future of the ARIMA nation. Rohan did not know that his father would subtly suggest that his lineage was far from royal and as such, his heart was not pure.

“Son, get me that book over there labelled Ancestral Tests”, King Salmaan told Rohan, pointing to the shelf of books on his righthand side. Rohan walked over to the bookshelf and gingerly gathered the large book in his arms. “What is this, Papa?” Rohan asked innocently. “This is a book containing the royal ancestral lineage, Rohan. Tonight, you will learn about the family chosen to lead our people.”

Rohan’s curiosity was piqued, and his father had his undivided attention.

“Long ago, when the age of the Time-Series just began, the god of mathematics, Johan, chose the purest ARIMA bloodline to rule our nation. For many years, they ruled with an iron fist, making long strides in the advancements of the sciences. One day, a civil war broke out, and the royal family was forced to flee. It is believed that the entire royal bloodline ended that fateful night. The next morning, the man who started the war, your grandfather, took up the ARIMA throne, and from that day on, our family has been the only one to rule ARIMA.”

“Father, are you saying that our family was never part of the original royal bloodline? We were not even cousins of the royals like you told me when I was younger?” Rohan asked, realisation dawning in his mind.

“Precisely, my son” King Salmaan answered with a glint in his eye.

When Rohan heard this, he realised he would never be able to prove to Princess Esmeralda that his heart was pure. How could he when his ancestors were usurpers?

Heartbroken by this news, Rohan ran out of his father’s royal chamber and straight to the one place where he had always felt at home: the palace kitchen. Chef Ameer, who was like an adoptive father to Rohan,



found him nursing a tall glass of milk and some cake leftover from dinner. He asked Rohan what the matter was and Rohan reluctantly relayed the past hour's events.

"You know," Chef Ameer began, "the legend told among the people doesn't quite match the one your father narrated."

18

"What on earth do you mean, Ameer?"

"I mean, according to us, the royal bloodline did not end that night. Since your father wanted to be the only ruler, it was said that your mother, the queen, had lost the baby and that another woman's son was given to her to raise. Before your mother's passing, she shared with me that YOU were the true heir to the ARIMA throne. Not your father."

Hearing this, Rohan was caught in a dilemma: how could he prove his birth right and also his purity of heart to Esmeralda? He remembered from his lessons that the only way to test if his heart was pure was to do a DNA (Ljung-Box) test. If his heart were pure, then his blood type (p -value of Ljung-Box test statistic) would prove to be far lower than the average blood type ($<$ significance level). Chef Ameer encouraged him to go to the ARMA nation's best doctors to do the test, as it wasn't safe for him in the ARIMA nation as long as his father was in power. Rohan packed his bags and made the long journey to the ARMA nation, where he got the DNA test done by the best doctors ARMA had to offer.

When the results came back, not only was Rohan able to prove to Princess Esmeralda that his heart was pure, but he was also able to gather enough supporters to take back his rightful place as King of ARIMA.

Once Esmeralda's parents handed the nation of ARMA over to her, King Rohan and Queen Esmeralda did what Esmeralda's parents had done: they merged their respective nations, bringing peace, love, traditions, and scientific advancements to all of their subjects.

