

CounterClockWise

Chapter 12 – Quantum Computing

It is a cool crisp Autumn afternoon, and the leaves are turning a beautiful gold and red on the old estate – both of them. Autumn in the deep south is – well – Autumn in the deep south. Since live oaks and other evergreens dominate the flora, there isn't much color. And the trees that ARE deciduous generally have their leaves turn brown and fall to earth when no one is looking.

It is Saturday, and Kevin is in the den watching a football game – sort of. He has a computer on the sofa next to him and his attention is more on his work than on the game. But he IS multitasking sufficiently to keep track of the scores of several games of interest.

Diana is in the kitchen with a group of her female relatives. They are having coffee and a bunt cake that Diana made. Jan and Susan, Diana's second cousins, are serving the cake. They are both a year older than Diana, and the three of them were very close as children. It was their friendship with Diana after Diana's mother died that helped Diana get her life back together.

The three older women were all cousins to Diana's father. It was these three who terrified Diana the most as a child; but at Kevin's insistence, Diana reconciled her relationship with them years ago. Now she was actually very fond of them.

Louise and Regina often greeted the sunrise with a primitive, chanting ceremony on the beach. They wore dark black and red robes with hoods that stayed in place until after the sun had risen.

And together with Miriam, they maintained that they were responsible for Diana being such a bright child...having encouraged Gaea to guide the development of Diana in her Mother's womb.

They found a seashell in the shape of a golden spiral on the beach at their usual sunrise ceremony on the day Diana was born and promised Gaea they would educate Diana in the ways of the literati. They took the perfect seashell as a sign that Diana was particularly attuned to phi and to Nature.

And although they have visited with Diana fairly often lately, very little of Diana's childhood has ever been discussed during those visits. Today a frank discussion is occurring and Miriam is saying, "You know we only wanted what we thought was best for you, Diana."

“I suppose so,” agrees Diana, “but at the time you frightened me. You and Nana seemed to argue all the time.”

“Oh! You poor dear.” Exclaims Louise, “We are so sorry. We always loved you and Nana, but that’s what families do – argue about what is really important to them.”

And Miriam asks, “But why on earth would you be frightened of us?”

Susan, Louise’s daughter, smiles ruefully and says,
“One of these days, Mother, I’m going to take a video of the three of you in your hooded robes venerating the sunrise. It IS pretty scary. It scared me as a child as well.”

And Miriam replies, “We just wanted you girls to follow in our footsteps.”

“Yes,” agrees Regina, “But in spite of all of our efforts, none of you three youngsters persevered enough to make the inner-circle.”

“But Mother,” says Jan, “it isn’t that we didn’t learn the important things from you. We all respect nature and the environment...Susan is even the President of the Delta Preservation Society. If it weren’t for her efforts, the whooping cranes in the delta would be extinct.”

Susan smiles at her cousin and says, “That’s probably not true, Jan...but thanks.”

Jan continues, “And Diana has made a career out of her love for biology...a true testament to the impact you three had on all of our lives.”

And Miriam says to Diana, “Diana, are you aware that Louise was the executor for your Mom’s estate? It was Louise who okayed the expenditure of funds for you to get your Biology degrees at the University of Kentucky.”

“Yes,” says Louise, “and we were all so proud of you the day you graduated.”

Kevin walks past the door and pauses long enough to peek in and greet them all, “Hi, Ladies.” He says simply.

A chorus of “Hi, Kevin” and waves come from the group, but he is already gone.

Regina says, “He is so HOT!”

And feigning shock, Miriam says, “Regina!”

But Regina insists, “Well he IS.”

And Louise sides with Regina, saying, “She’s right, Miriam. I bet he’s good in bed too!”

Now Miriam’s shock is real as she says, “LOUISE!”

But Diana is smiling at the exchange as she agrees with them. But she says, “OK, Aunties, that’s enough. He is already spoken for.”

An hour later, the three older ladies have departed, but Jan and Susan linger a bit as they laugh, joke, and reminisce about how Diana thought all boys were dumb when they were in high-school.

After the two of them leave together, Diana seeks out Kevin in his office. He is still working on his briefing about Quantum Computing. Diana sticks her head in and says,
“My relatives have all left, so I’m going out for a late-afternoon ride. Want to go?”

But Kevin begs off, “I better not. I am still wrapping up some loose ends on this brief... Have fun, though.”

“OK,” she says to him, “I might go see if Chaucer remembers he is supposed to come over tomorrow... Bye.”

And pausing in his work long enough to watch her hips sway as she leaves, he calls after her, “Bye, dear.”

Diana drives out of the driveway and takes the scenic route to visit Chaucer. Riding along the water front, she enjoys watching the sun set on the bay. She imagines that she can hear the water boil as the fires of the hot sun are quenched in the murky depths.

By the time she finally pulls into the parking lot of the Outside Inn, it is fully dark. She makes her way inside to find Chaucer doing his bartender thing. He looks up from wiping the bar with what seems to be his only towel and says,
“What’ll it be young lady?”

Deciding it is late enough for a cocktail, she tells him
“Vodka martini please – a little on the light side.”

Teasing her with flattery, Chaucer asks,
“Do you have some ID? You don’t look old enough to partake of the nectar celestial.”

With his choice of phrase setting off alarm bells, Diana eyes him suspiciously as she says,

“ ‘Nectar celestial?’ An interesting phrase from a song in the musical *Kismet*...

“But,” she continues, “How is your part of the quantum computer coming along?”

And Chaucer responds, “We have made a little progress. Kevin is doing the theory and I am trying to create 22nd century materials in a distinctly 21st century setting.” Tomorrow we will give you the full briefing.”

And with her every intuition guiding her phrasing, she says casually, “You know Chaucer, I have known you for 100 years and yet I hardly know anything ABOUT you.”

But saying nothing, Chaucer just raises an eyebrow in her direction and looks questioningly at her.

So Diana continues, “Can you tell me how you came to be working for CounterClockWise – the firm that Kevin will apparently start sometime in the future?”

And Chaucer tries to hide behind a tired defense as he answers, “I can see that when Kevin gives his briefing on our Quantum Computer, I might follow it closely with one on Causality.”

But Diana is having none of it this time. She says, “That’s an insufficient excuse to avoid answering a simple question. It may be usually presumed that the cause chronologically precedes the effect, but because of the twisted nature of our 11-dimensional universe, and in particular our own experience. It is definitely an arguable point!”

And Chaucer replies using a phrase Kevin spoke to her in private one morning, **Sometimes it’s damned hard to communicate with a brilliant woman!**”

Diana is really eyeing him with suspicion now. But deciding to outflank him, she pays her tab and walks out tossing her good-bye over her shoulder, “Bye, Chaucer, see you tomorrow.”

Shaking his head and clearing the counter of her money and glass, Chaucer speaks sotto voce to himself, “Oooops! I’ve GOT to remember how smart that lady is!”

Once back at home, Diana prepares a light supper for herself and Kevin. He brings his work with him to the table and is reading a reference book as he eats. He doesn’t do this often, and when he does she rarely lets him get away with it. She is a firm believer in conversation and dialogue at meal times.

Besides, tonight she intends to enlist his “talent.” In a solicitous, sing-song voice she says, “Keeevinnn?”

But he doesn’t take his eyes from his book as he replies, “Hmmm?”

Trying to sound matter-of-fact, she says, “Sweetie...do you want to have kids?”

Immediately closing his book and giving her his every attention, he asks, “What did you say?”

She can’t help but laugh at his reaction. She replies, “I said... what do you know about Chaucer? Do you know where he comes from? Or how old he is? Or how he got hired by you in the future?”

“Do you know what his specialties are? Or what degrees he holds? Or where he got his education?”

As always, once he gives her his attention, he gives her his complete attention. So he considers her list of questions carefully before answering, “Of all of those questions, I only know that he has three PhD’s -- One in theoretical physics, one in applied mathematics, and one in psychology.”

Only after answering her questions does he let his curiosity come to the surface as he asks her, “Why do you ask?”

But Diana wants a little more data before she answers; so she asks one more question of her husband. “Do you ever talk to him about our private life? Share confidences with him about our love life?”

Kevin is clearly startled by her question and answers forcefully, “Absoltivly, posolutely not!!! Why would you ask a question like that?”

Finally ready to tell him, but not sure exactly what her concern actually is, she says, “Don’t get excited, love of my life. But there is more to Chaucer than meets the eye. I have a strong intuition about him.”

Kevin has had experience with her “intuition” in the past. So he says, “You call it intuition; I have always credited your amazing, incredibly fine powers of observation and deduction for your insights into people. But what about Chaucer?”

Not wanting to influence any answers he might think he has discovered, she says, “You are the one with the callidity index off the scale. Turn your attention to Chaucer for a few weeks and see what you get.”

Knowing from past experience she isn't going to tell him, he cannot help but ask anyway, "OK, but why?"

"I really don't know," she says. "I just know there is more to Chaucer than we know."

Quoting a character from the movie *Princess Bride*, Kevin says to her, "As you wish, my love."

And finished eating, he rises from the table and requests, "Now let me get back to work...you and Chaucer are expecting a first-class briefing tomorrow and I have finishing touches to apply."

The next morning finds Kevin and Diana in the briefing room. Kevin is ready to talk about quantum computing, but Chaucer is uncharacteristically late.

He says, "I don't know what happened to Chaucer, Diana. But let's begin without him. He knows most of this anyway."

"OK," she replies, "but I have a funny feeling of emptiness."

"That's strange," he says, "...I am feeling something similar. But let me tell you a little about quantum computers."

"PLAY!" he says, and the Mark3 begins,

"Quantum computers promise to perform calculations believed to be impossible for ordinary computers. And it is well that this is so. The computers we need in order to compute, encode, and transmit every bit of information necessary to deconstruct and reconstruct a living organism must be infinitely more capable than the Binary-digital (bit) based computers of today.

"In a quantum computer, the fundamental unit of information (called a quantum bit or *qubit*), is not binary – A qubit can exist not only in a state corresponding to the logical state 0 or 1 as in a classical bit, but also in states corresponding to a blend or *superposition* of these classical states. In other words, a qubit can exist as a zero, a one, or any state in between.

"Because of the quantum connection, quantum computers promise to perform calculations that are impossible for ordinary computers. Unfortunately, quantum computers are extremely difficult to build.

"So the future of using various properties of precariously isolated particles as qubits is very cloudy.

“But there are other approaches. One very promising approach is called a topological quantum computer.

“First take two slabs of gallium arsenide semiconductor, press them together, cool them to near absolute zero, and turn on a strong magnetic field.

“Then electrons trapped at their interface will behave as if they are in two dimensions instead of three.

“Electrons in flatland (physicists call them two-dimensional electron gases) have some very unusual and useful properties...they act like weird, theoretical particles called nonabelian anyons. (And no I am not making this up!)

“And once you have nonabelian anyons, then you can use their topological properties as qubits.

“You might say we are computing with quantum knots. And quantum knots are very stable – they are not subject to losing their information by interactions with their surroundings. For example the error rate for a “NOT GATE” built out of anyons could easily be 10^{-30} or better...one error every ten billion, billion, trillion operations.

“As an example of the power of a quantum computer compared to a conventional computer, consider the problem of encryption. Today’s encryption methods involve multiplying and factoring prime numbers with hundreds of digits. Such encryption methods are considered secure because a conventional computer would take billions of years to perform this task.

“A quantum computer could accomplish this in a matter of seconds.”

Here, Kevin takes over from Mark3 and says,

“At this point, Chaucer was supposed to tell us a little of the hardware, we will need in order to make this a reality. We not only need to build Electrons-in-Flatland, we need quantum knots, braids, and logic gates.”

Diana asks for clarification, “What is a braid in this context?”

He answers, “That’s something Chaucer could describe better than I.”

“OK,” she says, “let’s go find Chaucer.”

Kevin pauses for a moment, tilts his head as if listening. His eyes scan around as if he is looking for something, but he is neither seeing with his eyes nor listening with his ears. And looking at his wife, he says to her, “I agree with your intent, but I already know that he is gone.”

Now she tilts her head to the side looking at Kevin as she asks, “What do you mean...gone?”

Kevin simply re-iterates his conclusion,
“Gone is gone... Chaucer is gone...but lets go see what we can see.”

End Chapter 12