Writeup for the talks of Dr. Jamie Sikora 9/17

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Dr. Jamie Sikora is an Assistant Professor of VT. He talked about **Quantum Resources** in his presentation. Quantum problems are related to Quantum physics, updating quantum hardware, learning quantum states, creating quantum entanglement, and so on.

To distinguish between real-life problems and quantum problems, Dr. Sikora provided some examples in the presentation, Then he highlighted resource management and clarified it with examples. Later he explained some optimizing problems. He initiated the term **Shadow Price** which is the maximum price assigned to currently unknowable or difficult to calculate costs in the absence of correct market prices. After that, he presented some of the practical Shadow Prices. To clear the concept more, Dr. Sikora then provided some equations and solved them in the seminar.

From so much talk, it is easy to understand that Dr. Jamie Sikora's research interest lies in Quantum Resources. He also mentioned that Quantum Cryptography, Quantum Information, Computational Complexity Theory, Bell Nonlocality, and Generalized Probabilistic Theories are the fields in which his research interests are focussed.

During the presentation, Dr. Sikora provided a Quantum Example and talked about **Hamilton H** (H is just a Hermitian Matrix) which refers to the interactions (say, of electrons) in a quantum system. At very low temperatures, the state of the quantum system is the ground state. The ground state is just the normalized eigenvector of H.
Later, Sr. Sikora presented some formulas to calculate the Shadow Energy and Hermitian Matrix. He also used some of the graphs and images in his presentation to make the concept more understandable. For the second example of Quantum, Dr. Sikora asked the question, how much does it cost to update noisy quantum hardware? It is difficult as what is inside the quantum tunnel, nobody knows. Dr. Sikora then explained some equations to calculate the Shadow Error which is the worst case probability changes noise parameter is increased or decreased. After that, Dr. Sikora gave a funny example, where the interviewer asked a question to the Quantum computer and the Quantum Computer gave the wrong answer but the reply was very fast. By this example, Dr. Sikora tried to say that the goal of quantum computing is to make the computing task super fast with the help of a quantum computer.

Later Dr. Sikora provided the reasons why learning quantum states is important. For the first reason, he mentioned that it is important for baby quantum machine learning. Cryptography is the second reason for which it is important. For the third reason, Dr. SIkora mentioned in order to apply quantum algorithms it is important to learn quantum states. In the talk, he showed the formula to calculate minimum error guessing probability which is called Shadow Guessing Error. After that, he talked about Quantum Entanglement and the corresponding terms related to **Shadow Entanglement**.

Dr. Sikora made a very nice and informative presentation. He outlined the window for Quantum Computing and enriched my knowledge about it. Before the seminar, I had feared that this topic is beyond my understanding. But after attending the seminar at least I believe have a basic idea of what Quantum computing is. He also answered the questions of the students very nicely.