SFBU
CONNECTION

TURNING DREAMS
INTO REALITY

ALUMNI MEET & GREET PICNIC

San Francisco Bay University had our first in-person Alumni Meet and Greet in over two years at Central Park in Fremont! Alumni and Students had the opportunity to meet, learn from one another, and network. Attendees participated in games to win prizes. It was a great opportunity to connect with the SFBU Community. Thank you to those who participated!

HIGHLIGHTS

SFBU ALUMNI ASSOCIATION WEBSITE

QUANTUM COMPUTING TRENDS

PROFESSOR AHMED BANAFA

IoT, Blockchain, AI Expert | Faculty | Author | Keynote Speaker

Quantum computing is the area of study focused on developing computer technology based on the principles of quantum theory. Tens of billions of public and private capitals are being invested in Quantum technologies. Countries across the world have realized that quantum technologies can be a major disruptor of existing businesses, they have collectively invested $24 billion in quantum research and applications in 2021.

A COMPARISON OF CLASSICAL AND QUANTUM COMPUTING

Classical computing.
Classical computing relies, at its ultimate level, on principles expressed by Boolean algebra. Data must be processed in an exclusive binary state at any point in time or what we call bits. While the time that each transistor or capacitor need be either in 0 or 1 before switching states is now measurable in billionths of a second, there is still a limit as to how quickly these devices can be made to switch state.

As we progress to smaller and faster circuits, we begin to reach the physical limits of materials and the threshold for classical laws of physics to apply. Beyond this, the quantum world takes over, in a quantum computer, a number of elemental particles such as electrons or photons can be used with either their charge or polarization acting as a representation of 0 and/or 1. Each of these particles is known as a quantum bit, or qubit, the nature and behavior of these particles form the basis of quantum computing. Classic computers use transistors as the physical building blocks of logic, while quantum computers may use trapped ions, superconducting loops, quantum dots or vacancies in a diamond.

PHYSICAL VS LOGICAL QUBITS

When discussing quantum computers with error correction, we talk about physical and logical qubits. Physical qubits are the physical qubits in quantum computer, whereas logical qubits are groups of physical qubits we use as a single qubit in our computation to fight noise and improve error correction.

Distinguishing between physical and logical qubits is important. There are many estimates as to how many qubits we will need to perform certain calculations, but some of these estimates talk about logical qubits and others talk about physical qubits. For example: To break RSA cryptography we would need thousands of logical qubits but millions of physical qubits.

Another thing to keep in mind, in a classical computer compute-power increases linearly with the number of transistors and clock speed, while in a Quantum computer compute-power increases exponentially with the addition of each logical qubit.

QUANTUM SUPERPOSITION AND ENTANGLEMENT

The two most relevant aspects of quantum physics are the principles of superposition and entanglement.

Superposition: Think of a qubit as an electron in a magnetic field. The electron's spin may be either in alignment with the field, which is known as a spin-up state, or opposite to the field, which is known as a spin-down state. According to quantum law, the particle enters a superposition of states, in which it behaves as if it were in both states simultaneously. Each qubit utilized could take a superposition of both 0 and 1. Where a 2-bit register in an ordinary computer can store only one of four binary configurations (00, 01, 10, or 11) at any given time, a 2-qubit register in a quantum computer can store all four numbers simultaneously, because each qubit represents two values. If more qubits are added, the increased capacity is expanded exponentially.

Entanglement: Particles that have interacted at some point retain a type of connection and can be entangled with each other in pairs, in a process known as correlation. Knowing the spin state of one entangled particle – up or down – allows one to know that the spin of its mate is in the opposite direction. Quantum entanglement allows qubits that are separated by incredible distances to interact with each other instantaneously (not limited to the speed of light). No matter how great the distance between the correlated particles, they will remain entangled as long as they are isolated. Taken together, quantum superposition and entanglement create an enormously enhanced computing power.

QUANTUM COMPUTERS CATEGORIES

Quantum computers fall into four categories:

Quantum Emulator/Simulator
These are classical computers that you can buy today that simulate quantum algorithms. They make it easy to test and debug a quantum algorithm that someday may be able to run on a Universal Quantum Computer (UQC). Since they don't use any quantum hardware, they are no faster than standard computers.

Quantum Annealer
A special purpose quantum computer designed to only run combinatorial optimization problems, not general-purpose computing, or cryptography problems. While they have more physical Qubits than any other current system they are not organized as gate-based logical qubits. Currently this is a commercial technology in search of a future viable market.

Noisy Intermediate-Scale Quantum (NISQ) computers.
Think of these as prototypes of a Universal Quantum Computer – with several orders of magnitude fewer bits….

They currently have 50-100 qubits, limited gate depths, and short coherence times. As they are short several orders of magnitude of Qubits, NISQ computers cannot perform any useful computation, however they are a necessary phase in the learning, especially to drive total system and software learning in parallel to the hardware development. Think of them as the training wheels for future universal quantum computers.

Universal Quantum Computers / Cryptographically Relevant Quantum Computers (CRQC)
This is the ultimate goal. If you could build a universal quantum computer with fault tolerance (i.e., millions of error- corrected physical qubits resulting in thousands of logical Qubits), you could run quantum algorithms in cryptography, search and optimization, quantum systems simulations, and linear equations solvers.

POST-QUANTUM / QUANTUM-RESISTANT CODES

New cryptographic systems would secure against both quantum and conventional computers and can interoperate with existing communication protocols and networks. The symmetric key algorithms of the Commercial National Security Algorithm (CNSA) Suite were selected to be secure for national security systems usage even if a CRQC is developed. Cryptographic schemes that commercial industry believes are quantum-safe include lattice-based cryptography, hash trees, multivariate equations, and super-singular isogeny elliptic curves.

DIFFICULTIES WITH QUANTUM COMPUTERS

- Interference – During the computation phase of a quantum calculation, the slightest disturbance in a quantum system (say a stray photon or wave of EM radiation) causes the quantum computation to collapse, a process known as de-coherence. A quantum computer must be totally isolated from all external interference during the computation phase.

- Error correction – Given the nature of quantum computing, error correction is ultra-critical – even a single error in a calculation can cause the validity of the entire computation to collapse.

- Output observance – Closely related to the above two, retrieving output data after a quantum calculation is complete risks corrupting the data.

SPEAKER SERIES: TRANSITIONING FROM COLLEGE TO A CAREER

GUEST SPEAKER: ASHLEY WEERPASS
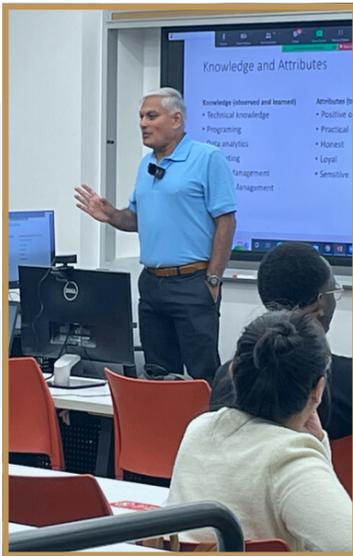
ASHLEY WEERPASS

San Francisco Bay University hosted our Summer 2022 Speaker Series with our featured speaker, Ashley Weerpass presenting "Transitioning from College to a Career". Ashley Weerpass has an extensive background in Technical Business Management. He has worked with Multi-National and Fortune 500 companies for over thirty-five years. He has worked in the United States and abroad, leading technical teams to achieve significant business results. He continues to coach, mentor, and teach others to increase their skills and achieve their life goals. He has an Engineering Undergraduate degree and a Master's in Business Administration. His background includes business strategy development, sales, project management, and management of for-profit businesses. He now works with non-profit organizations to help build strategy and plans for mission success.

Students, alumni, faculty, and staff gathered in the SFBU Lecture Hall to hear Mr. Weerpass' inspiring presentation on navigating career and career development. Our world is a global village and opportunities exist in more than one country. Income can be derived from a variety of means, self-employment, employee, gig-worker, and hybrid work.

THE SFBU BLOG

THE LATEST
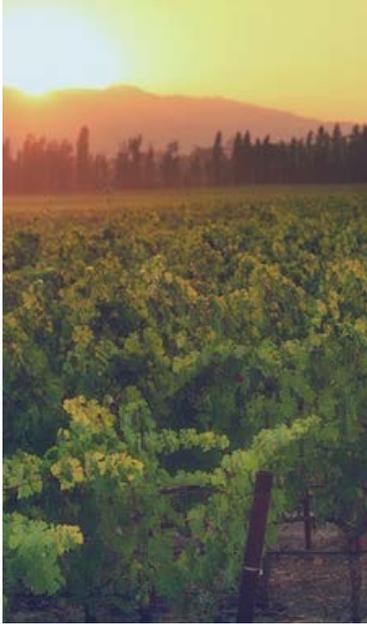
5 Best Day Trips in the Bay Area

SFBU Now Offers Class Online

SFBU's Favorite Bay Area Beaches

THE STUDENT'S GUIDE:

5 Things to Consider When Choosing a Northern California University

READ NOW

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Mon-Fri:
9:00a.m. - 5:30p.m.
Sat-Sun: closed

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Connect with our social media channels to stay updated with news and happenings, and comment about what makes SFBU a great place to live and learn.

Instagram

Facebook

LinkedIn

Twitter

YouTube

Pinterest

UPCOMING EVENTS

SEPT. 1ST

First day of fall trimester and classes begin

SEPT. 12TH

EQ Informational Meeting

SEPT. 14TH

Toastmasters Open House

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UNIVERSITY

AUGUST 2022