

# **NIEEE E-SYMPOSIUM WEBINAR SERIES**

## **THE ROLES OF COMPUTER ENGINEERS AND COMPUTER SCIENTISTS IN A DEVELOPING DIGITAL ECONOMY**

### ***Panelist***

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## **PRESENTATION 3**

**REVIEWING THE COMPUTER  
ENGINEERING AND SCIENCE  
DISCIPLINE, DUTIES OF A  
COMPUTER ENGINEER AND  
SCIENTIST WITH THEIR  
ROLES IN A DEVELOPING  
DIGITAL ECONOMY**

# **OBJECTIVES OF THE PRESENTATION**

- Understand the two disciplines – Computer Engineering and Computer Science.
- Highlight on the duties of the Computer Engineer and Computer Scientist.
- Describe the overlapping nature of the computer engineers and scientists along with their required skills, approaches and methods for effective achievement of desired productivity.
- Learn how to collaborate and partner in a developing digital economy

# REMEMBER THESE SAYINGS...



Without Engineers we can't even think about getting a modernized world, where almost every person depends on Technology .

❖ “The science of today is the technology of tomorrow.”

**Edward Teller**

❖ “The scientist is not a person who gives the right answers, he's one who asks the right questions.”

**Claude Levi-Strauss**

❖ Software is a great combination between artistry and engineering.

**Bill Gates**

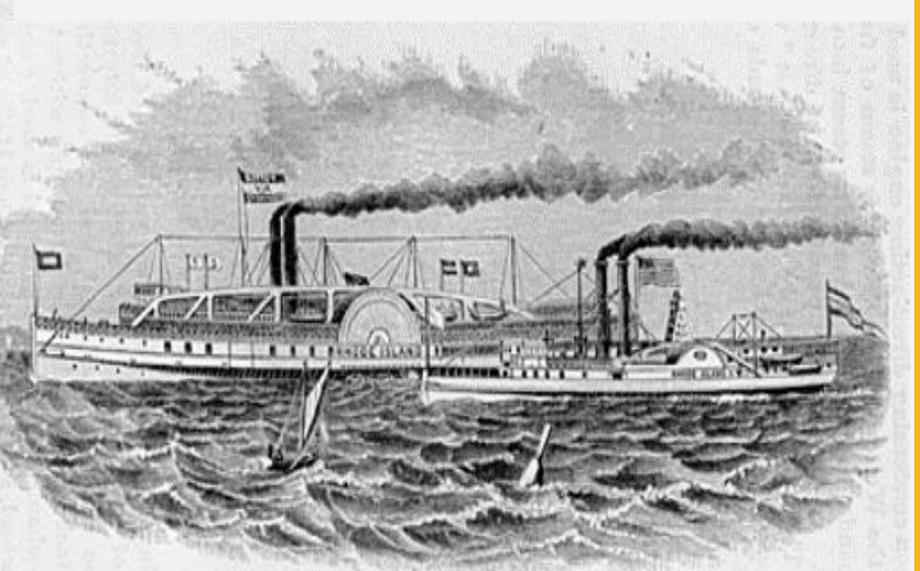
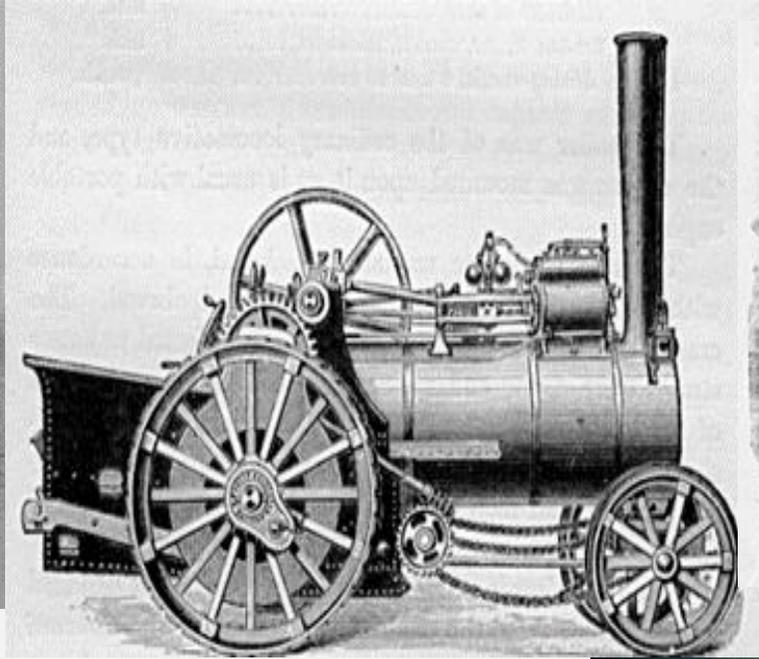
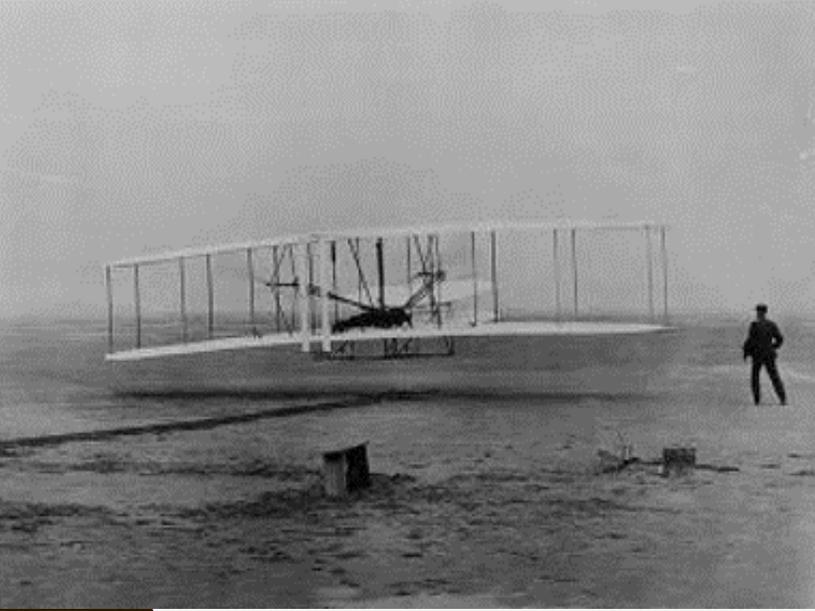
# COMPUTER ENGINEERING

The branch of engineering that integrates electronic engineering with computer sciences.

Computer Engineering involves a much more physical approach than computer science does.

Computer Engineering has two major fields of specialization,

- The **Computer Hardware Engineering** (Computer hardware engineers research, develop and design computer systems like processors, circuits, boards and networking routers etc) and
- The **Computer Software Engineering** (Computer software engineers mainly uses principles and concepts of computer science and mathematical analysis for designing, development and testing of software application).



# What is Computer Science?

- **Computer Science** is the study of the foundations of information and computation.
- It is the scientific and **practical approach** to computation and its applications.

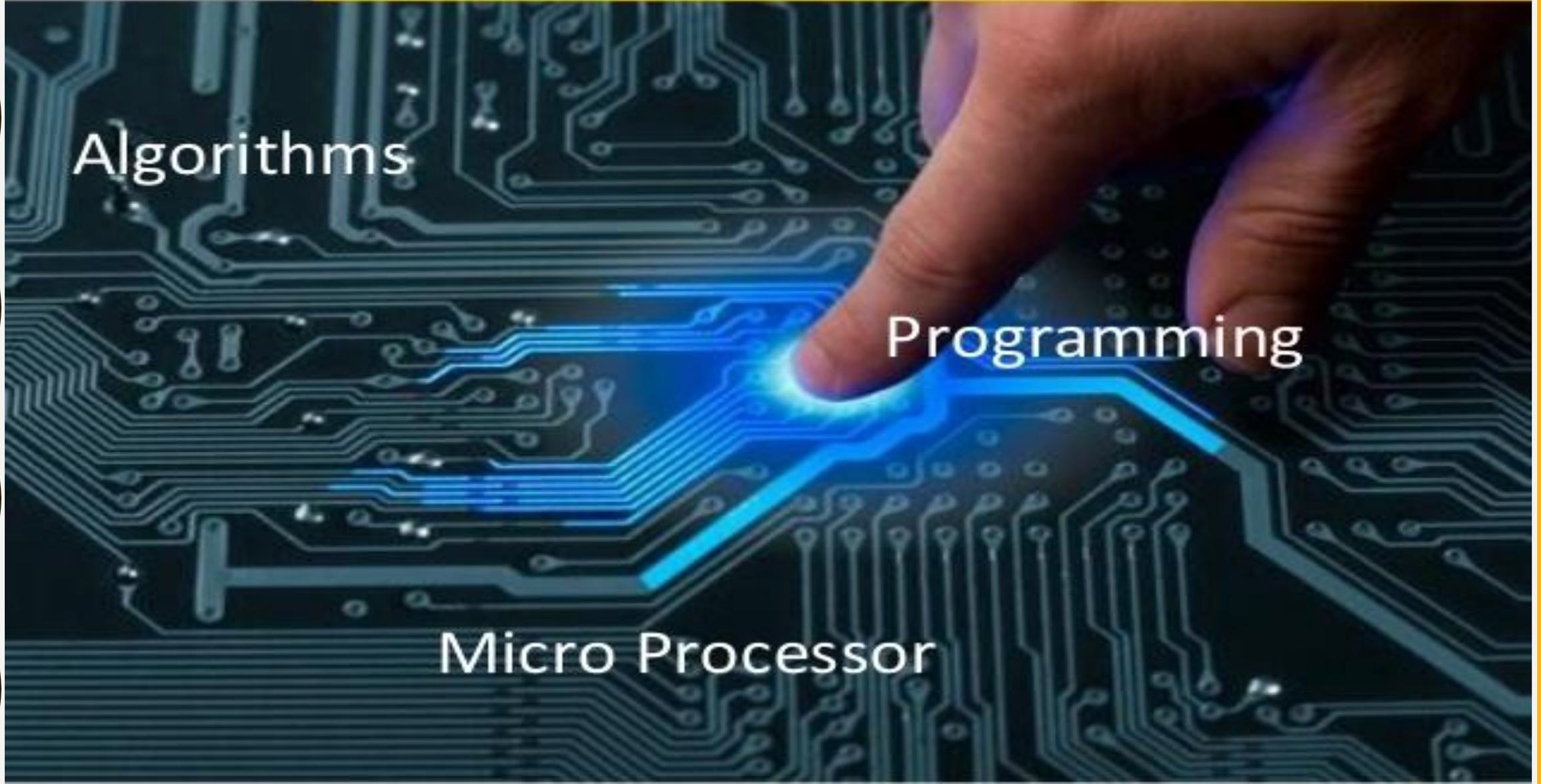


# What is Computer Science?

Algorithms

Programming

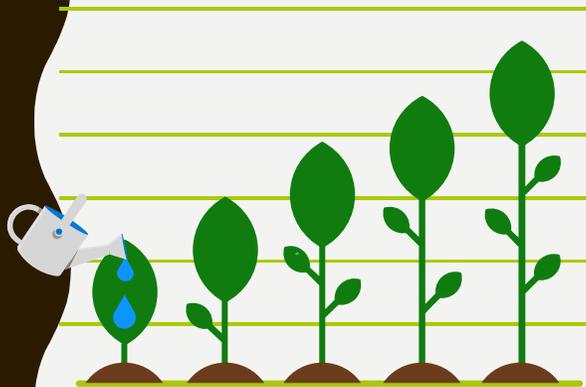
Micro Processor



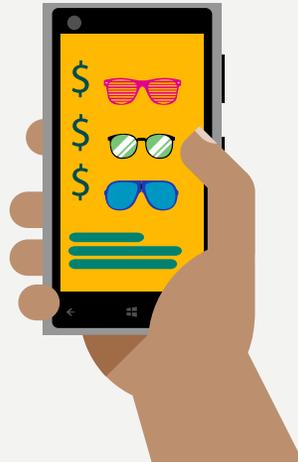
- The study of the design and operation of computer hardware and software, and the application of computer technology to science, business, and the arts.
- **Computer Science, or “CS,” is a broad large subject, which blends all the “STEM” subjects of science, technology, engineering and math, and also includes design.**

# WHAT IS CS?

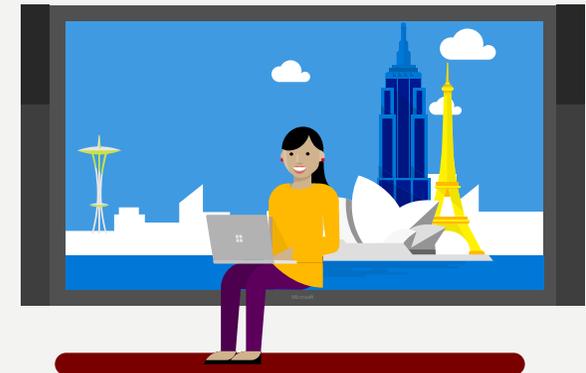
Contributing real-time data to farmers



Changing the way we do business



Removing language barriers in communication

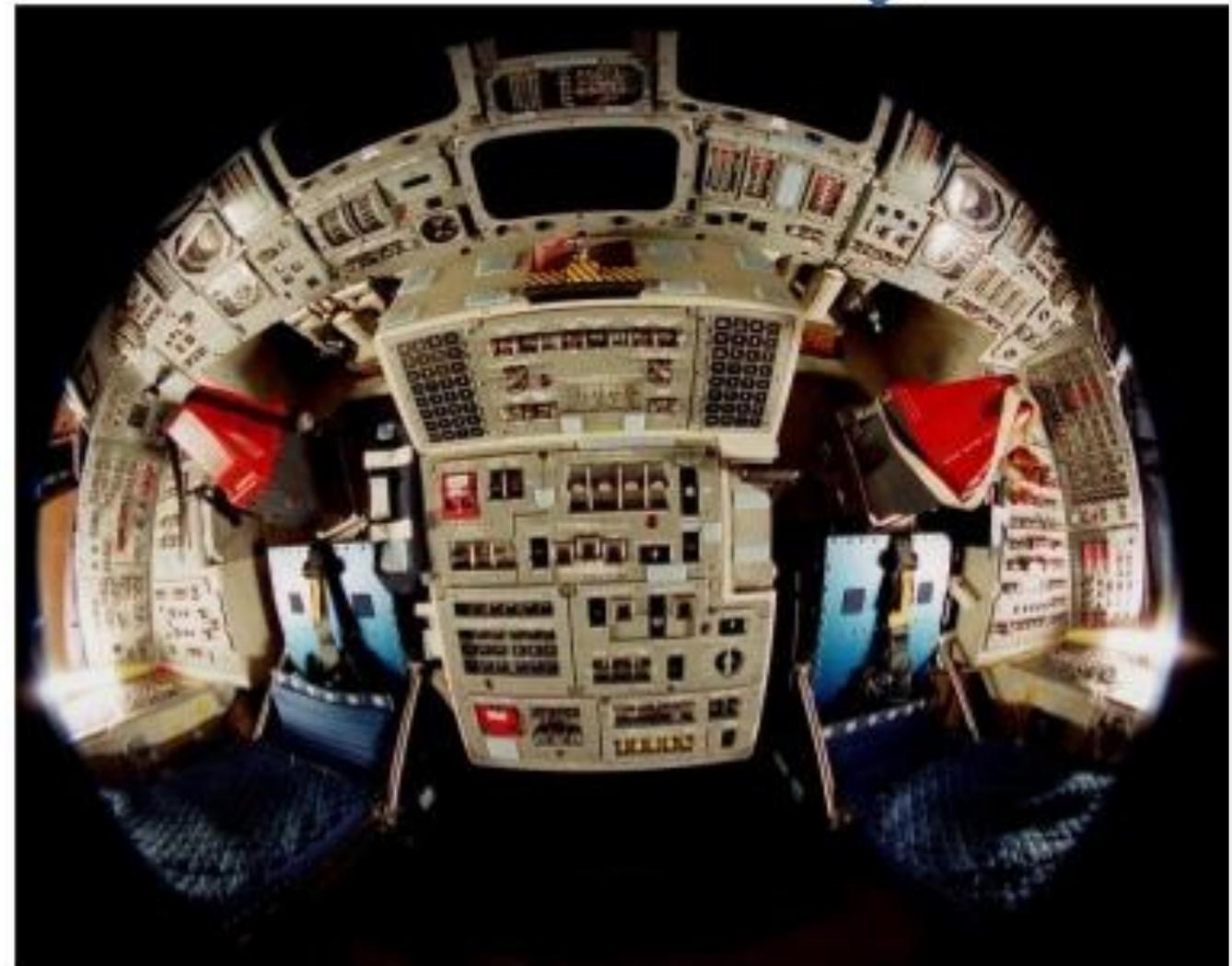


# FRONTIER OF COMPUTER SCIENCE



Robot

Space Shuttle



# CS IS FOR EVERYONE

Knowledge and skills for success in careers across all sectors

Opens doors to, and equalizes, opportunity for all

Teaches important skills, such as:

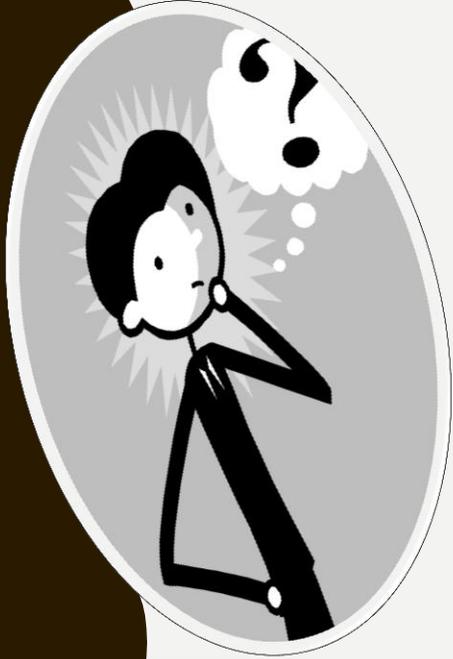
## Creativity

- ⑩ Problem solving
- ⑩ Critical and flexible thinking
- ⑩ Coordinating with others

Essential literacy for today's world

Critical understanding for citizenship, ethics, and social good

# WHO IS A COMPUTER ENGINEER?



- ❑ Graduate of Computer Engineering concerned with analyzing and solving computer-oriented problems.
- ❑ Understands both the hardware and the software of computers.
- ❑ Works in the physical world and involves understanding how to harness the laws of physics and electronics to create better computer components.

# **DUTIES OF A COMPUTER ENGINEER**

- ✓ **Conducting research on software and computer hardware**
- ✓ **Designing and testing computer hardware components, such as processors, circuit boards, memory devices and routers**
- ✓ **Designing, setting up and testing networks**
- ✓ **Managing operating systems**
- ✓ **Designing and testing robots**
- ✓ **Creating programming to support a range of products, from aircraft components to surgical technology.**

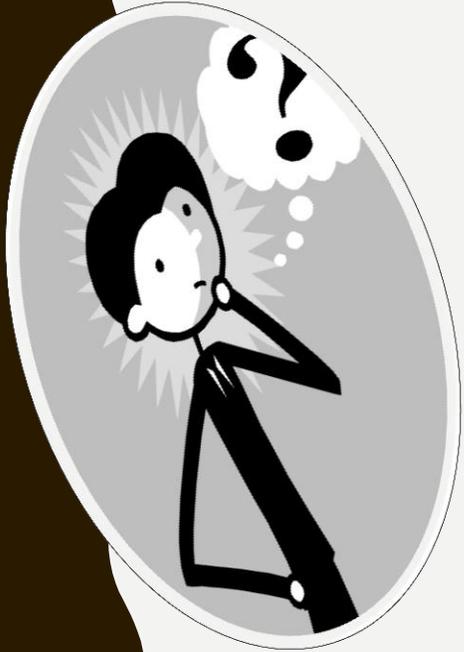
# **OPPORTUNITIES**

**Computer engineers can find employment in different industries and can work in many different capacities.**

**Software or hardware corporations**

- **Aeronautical firms**
- **Defense contractors**
- **The federal government**
- **Gaming and entertainment companies**
- **Financial industry**
- **Healthcare industry**
- **Educational institutions**
- **Research institutions**

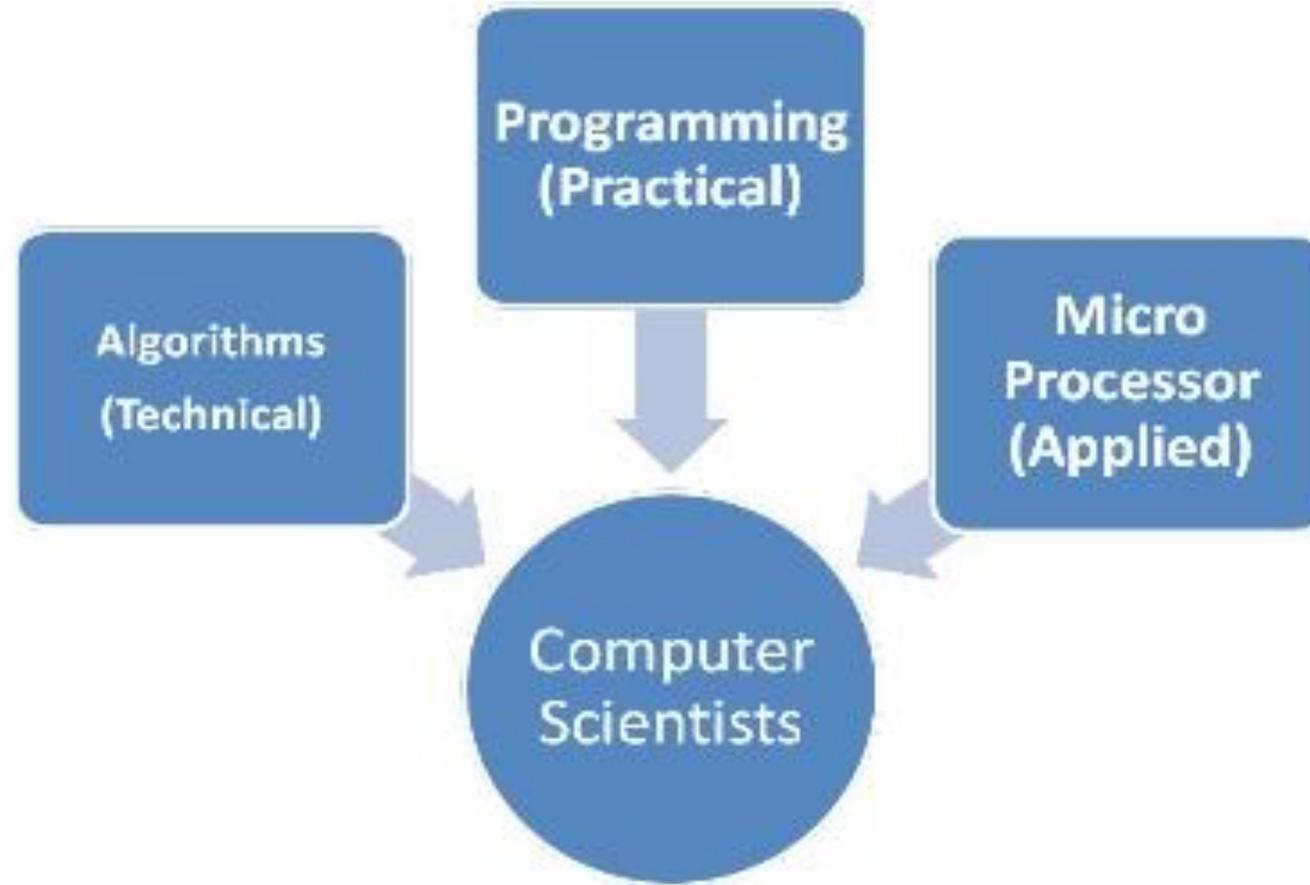
# WHO IS A COMPUTER SCIENTIST?



- ❖ Graduate of Computer Science.
- ❖ Focuses more on the abstract details of software engineering and hardware knowledge of the computer.
- ❖ Creates software patches, programs and operating systems.

**Computer scientists invent new technologies and capabilities in the field, which they apply to real problems in a wide range of other fields, such as science or business, specializing in branches of CS, including programming, data science, robotics, etc.**

The work of computer scientists falls into three categories:



# **DUTIES OF A COMPUTER SCIENTIST**

- ✓ **Develop and/or simplify algorithms**
- ✓ **Create new computing languages**
- ✓ **Determine new methods for working with computers**
- ✓ **Test new systems and designs**
- ✓ **Develop models and theories to address issues in the computer science and related fields**
- ✓ **Present findings to the scientific community**
- ✓ **Improve computer hardware performance**
- ✓ **Increase the efficiency of computer software and/or hardware.**

# **SIMILARITIES BETWEEN COMPUTER SCIENCE AND COMPUTER ENGINEERING**

- **Computer science and computer engineering have similarities as both have overlapping study areas which work side by side.**
- **In many situations, computer scientist and computer engineer work side-by-side to design, maintain and build computers, software and hardware.**
- **Computer science and computer engineering can be talked about without touching software engineering.**
- **These two degrees are very similar in a way that both study computer as a whole.**
- **Both computer scientist and computer engineer study inner working of the computer as well as hardware and software aspects. They also learn to use computer as tool of modern technology.**
- **Both these disciplines are based on good mathematical skills.**
- **The job placement programs for both kinds of majors are almost same environment.**

# OVERLAP BETWEEN THE CE AND CS AREAS

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Because both Computer Engineers and Computer Scientists ultimately work with data and attempt to harness meaning from it, there is significant overlap in coursework that students in the two fields take, as well as in the careers they pursue. This does not minimize the distinctive nature of the two disciplines. It simply acknowledges the fact that these types of computer professionals find context and purpose in similar kinds of projects or in different aspects of the same kinds of projects.

- **Both Computer Engineers and Computer Scientists advance computing technology and solve problems using computing technology.**
- **If we consider computing technology in terms of scale,**
  - **Computer Engineers operate at the microscopic and macroscopic ends of the spectrum, whereas**
  - **Computer Scientists work in the middle parts of the spectrum.**

More specifically, **Computer Engineers** deal with the physics of semiconductor electronics so that they may design hardware from the integrated circuit level (small), as well as with the integration of hardware and software optimized to run on it to realize complete, special-purpose computing systems (large). **Computer Scientists** write the software, design the databases, devise the algorithms, format the communications, and secure the data that are processed by the hardware to make the integrated system function.

# A CONCRETE EXAMPLE: AN IPHONE

## **Apple employs both Computer Scientists and Computer Engineers to design each new version of the iPhone.**

- ❖ Computer Engineers (and Electrical Engineers) designed the chips that house the integrated circuits that make the iPhone's various components (cell radio, screen, controls, memory, microprocessor) function, and they figured out how to get the various components to work with each other. That involves looking at the device at both the microscopic level and the integrated systems level.
- ❖ Computer Scientists wrote the operating system that manages the memory and concurrently running applications, the apps in the app store that run on top of that operating system, the packing and unpacking of data into packets for network communication and the encrypting of data so that prying eyes can't see it. The computer scientists provide the glue pieces that bring turn the computer engineers' beginning product – the component designs – into the computer engineers' end product – the device on which people text, browse the web, and play Angry Birds.

From This Example, It Is Easy To Imagine,  
With So Much Dependence On Each  
Other's Functions For Realizing A Finished  
Product, Why There Is Significant Overlap.

**In All Cases Of Overlap, Computer  
Scientists Focus More On The Software  
Development Aspect Of The  
Specialization, And Computer Engineers  
Study The Hardware Design And  
Integration Of Hardware And Software  
Needed To Implement That  
Specialization.**

## List Of Specialization Areas In Computer Engineering With An Asterisk (\*) On Those In Which Computer Scientists Also Specialize In.

- **Microprocessor and microcontroller systems**
- **Assembly language (\*)**
- **Coding, cryptography, and information protection (\*)**
- **Distributed computing (\*)**
- **Computer vision and pattern recognition (\*)**
- **Computer graphics and multimedia applications \***

**Internet computing and wireless networks (\*)**  
**Computer architecture and embedded digital systems design**  
**Network security and privacy (\*)**  
**Real-Time Systems (\*)**  
**Computer internetworking and Network Protocols (\*)**  
**Embedded software for real-time microcontrollers (\*)**  
**Algorithms, compilers, and operating systems (\*)**  
**Human-computer interaction (\*)**

# WHAT ARE THE DIFFERENCES BETWEEN COMPUTER SCIENTISTS AND COMPUTER ENGINEERS?

- **Computer Science** is a broader term which is based on the study of programming and hardware parts of the computer while **Computer Engineering** is concerned with the application of engineering process for creation and maintenance and design of software.
- **Computer Engineers** focus on hardware implementation while **Computer Scientists** focus on theories and algorithms.

**Computer Engineering** is a combination of electrical engineering and computer science while **Computer Science** does not deal with the study of circuits, physics but do study programming and theory behind it.

**Computer Scientists** job titles can be Programmer, System Analyst, Business Analyst, Software Developer and Software Engineer. For the **Computer Engineers** can be Hardware Engineer, Software Engineer, and System Engineer.

**Computer Science's** Most Popular Job Opportunities Are Website Designer Or Developer, Systems Analyst, Computer Programmer/App Programmer, Data Scientist And UX/UI Designer.

For **Computer Engineering**, The Most Popular Career Paths Are QC (Quality Control) Engineer, Mechanical Engineer, Electrical Engineer, Computer Architecture Developer, Mobile Device Engineer And Computer Hardware Engineer.

## **WHAT ARE THE ROLE OF COMPUTER SCIENCE AND COMPUTER ENGINEERING FOR DEVELOPING NATION?**

- **The role varies, depending on the nation's level of development.**
- **In an underdeveloped nation (e.g., any of central African nations), CS role is a relatively minor *supporting* technology and the best use of resources is to develop infrastructure and the economy. CS, in the form of IT, can improve efficiency but such countries will primarily depend on software developed elsewhere.**

- **The most advanced nations (US, many European countries) will find more uses for software and will be major producers of software. Countries in between these extremes (e.g., Mexico) will fall in the middle, with some internal software products and limited international sales of such.**
- **But until a nation have a strong, advanced economy, software will play only a supporting role in development.**
- **Role of computer science on developing countries would be to build an online infrastructure, so all sectors and even the government can operate online. You can deliver information at a faster rate than ever possible and having an infrastructure to support a growing country will definitely improve the overall condition of that country.**

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# CS can

- **Build systems that exploit existing infrastructure. For example, in much of Africa, there is no internet, but even the poorest village might have at least one smart phone thanks to certain government programs. Computer scientists can build banking, micro-loan servicing, health care, and mail services on top of that technology (small screens, slow CPUs, limited access, pay-per-megabyte/pay-per-message) to raise the standard of living.**
- **Model things effectively, whether irrigation systems or epidemics or population or wildlife migration or likely spots to find natural resources, to help the governments of those countries manage what they have and avoid exploitation**
- **Start a computer-related business using local people. This could be a call center, but it could also be some kind of outsourced content creation or data validation task that can be done after a short period of training.**

# **WHAT ARE THE ROLES OF COMPUTER ENGINEERS AND COMPUTER SCIENTIST IN A DEVELOPING DIGITAL ECONOMY IN TERMS OF INFRASTRUCTURE, APPLICATIONS AND SERVICES?**

**Digital economy, also known as Web Economy or the Internet Economy, is one collective term for all economic transactions that occur on the internet.**

**With the advent of technology and the process of globalization, the digital and traditional economies are merging into one through the aid of the computer engineer and computer scientist.**

**DE focuses on digital technologies and is based on digital and computing technologies.**

**DE covers all business, economic, social, cultural etc. activities that are supported by the web and other digital communication technologies undertaken by the computer engineer and computer scientist.**

**The computer engineering and science profession makes important contributions to the economy, both from the direct addition to economic output from the work they do, and the contribution of the sectors in which they work.**

**One can also consider the long run return to the economy of improvements in physical infrastructure, in which both CE and CS has played a vital role, and the contributions they make to the knowledge economy and to sustainability.**

Computer Engineers deal with the creation, improvement, and protection of the environment, providing facilities for living, health, industry and transportation, including infrastructures, applications and services in different fields such as large buildings, hospitals, roads, bridges, canals, railroad lines, airports, water supply systems, dams, irrigation, harbours, etc and other science and engineering facilities within a given region which produces high economic values.

- **An example can be seen in this pandemic period where there was a lot of collaborations between the engineers and scientists in creating health facilities, automated programs, robots, ventilators, hospital beds, etc to assist the medical personnel in the fight of the Covid-19.**

**The backbone of the digital economy is hyper connectivity which means growing interconnectedness of people, organisations, and machines that results from the Internet, mobile technology and the internet of things (IoT).**

**There are three main components of digital economy, namely, the e-business, e-business infrastructure and e-commerce. These components are made possible by the computer engineer and computer scientist.**

- The ways in which **computer engineers** and **computer scientists** connect with others, with information, and with the world is being transformed through a combination of technologies. These technologies assist us in solving high-level problems, while big data assist us in complex decision-making. This is the **Fourth Industrial Revolution**, and it is going to have a massive impact on the economy as well. The rise of the sharing economy, blockchain technology, and changes in manufacturing driven by 3D- and 4D-printing are noted.

- **There has been an immense growth of digital platforms and their influence on our lives, as digital economy has been integrated into every aspect of the user's life, thereby influencing what consumers see on different social media (Twitter, Instagram and Facebook) and popular websites (YouTube).**

**~ through the efforts of CE and CS.**

# CONCLUSION

Both the Computer Engineer and the Computer Scientist study the use of the digital computer as a tool that makes possible much of modern technology and the overlap between the two fields is significant. Both disciplines study the inner workings of computers and both study hardware as well as software aspects of computer systems. They study programming and basic computer operation.

# RECOMMENDATION

- As the two disciplines work hand-in-hand with overlapping duties, and so there should be continuous collaboration and partnership between them and not a feud or enmity of superiority roles.
- The computer engineers and computer scientists should be much more interdisciplinary so as to enhance the lines between the traditional engineering and science discipline.
- Computer Engineers and Computer Science will have to join forces with biologist, chemist, meteorologist, economics, planners, political scientists, and community leaders in unprecedented ways to lead the society on a sustainable economic path.

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# CLOSING REMARKS

- **DREAM...**
- **Innovate... Create... Disseminate...**
- **Think outside the mid-size box (topic scope)**
- **Collaborate and partner**
- **Be meticulous**
- **Be passionate about YOUR profession!**

# **ACKNOWLEDGMENT**

- **NIEEE MANAGEMENT AND STAKEHOLDERS**
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*Thank You!*

*Daalu .. Nagode .. Ese*