# TOPIC 2– THE COMPUTING AND IT DISCIPLINES

## LEARNING OUTCOMES

By the end of this topics, you will be able to:

1. Describe the a variety of computer disciplines
2. Define the pervasive in IT

## INTRODUCTION

2.1 Computer Engineering

Computer engineering (CE) students study the design of digital hardware and software systems including communications systems, computers and devices that contain computers. For them, programming is focused on digital devices and their interfaces with users and other devices. An important area within computing engineering is the development of embedded systems. Devices such as cell phones, digital audio players, digital video recorders, alarm systems, x-ray machines, and laser surgical tools all require integration of hardware and embedded software, and are all the result of computer engineering.

Computer engineering majors are offered by a fairly large number of universities, almost always within engineering. This major requires significant study of mathematics.

2.2 Computer Science

Computer science (CS) spans the range from theory through programming to cutting-edge development of computing solutions. Computer science offers a foundation that permits graduates to adapt to new technologies and new ideas. The work of computer scientists falls into three categories: a) designing and building software; b) developing effective ways to solve computing problems, such as storing information in databases, sending data over networks or providing new approaches to security problems; and c) devising new and better ways of using computers and addressing particular challenges in areas such as robotics, computer vision, or digital forensics (although these specializations are not available in all computer science programs). Most computer science programs require some mathematical background.

2.3 Information Systems

Information systems (IS) is concerned with the information that computer systems can provide to aid a company, non-profit or governmental organization in defining and achieving its goals. It is also concerned with the processes that an enterprise can implement and improve using information technology. IS professionals must understand both technical and organizational factors, and must be able to help an organization determine how information and technology-enabled business processes can provide a foundation for superior organizational performance. They serve as a bridge between the technical and management communities within an organization.

What information does the enterprise need? How is that information generated? Is it delivered to the people who need it? Is it presented to them in ways that permit them to use it readily? Is the organization structured to be able to use technology effectively? Are the business processes of the organization well designed? Do they use the opportunities created by information technology fully? Does the organization use the communication and collaboration capabilities of information technologies appropriately? Is the organization capable of adapting quickly enough to changing external circumstances? These are the important issues that businesses rely on IS people to address. A majority of IS programs are located in business schools; however, they may have different names such as management information systems, computer information systems, or business information systems.

All IS degrees combine business and computing topics, but the emphasis between technical and organizational issues varies among programs. For example, programs differ substantially in the amount of programming required. Traditionally, many graduates of IS programs have functioned in roles that are similar to the roles for which IT programs explicitly prepare their students. Information systems graduates continue to fill these roles, but the new programs in information technology offer an alternative path to these positions.

## 2.4 Information Technology

Information technology (IT) is a label that has two meanings. In common usage, the term “information technology” is often used to refer to all of computing. As a name of an undergraduate degree program, it refers to the preparation of students to meet the computer technology needs of business, government, healthcare, schools, and other kinds of organizations. IT professionals possess the right combination of knowledge and practical, hands-on expertise to take care of both an organization’s information technology infrastructure and the people who use it.

They assume responsibility for selecting hardware and software products appropriate for an organization. They integrate those products with organizational needs and infrastructure, and install, customize and maintain those applications, thereby providing a secure and effective environment that supports the activities of the organization’s computer users.

In IT, programming often involves writing short programs that typically connect existing components (scripting). Planning and managing an organization’s IT infrastructure is a difficult and complex job that requires a solid foundation in applied computing as well as management and people skills. Those in the IT discipline require special skills – in understanding, for example, how networked systems are composed and structured, and what their strengths and weaknesses are. There are important software systems concerns such as reliability, security, usability, and effectiveness and efficiency for their intended purpose; all of these concerns are vital. These topics are difficult and intellectually demanding.

## 2.5 Software Engineering

Software engineering (SE) is concerned with developing and maintaining software systems that behave reliably and efficiently, are affordable to develop and maintain, and satisfy all the requirements that customers have defined for them. It is important because of the impact of large, expensive software systems and the role of software in safety-critical applications. It integrates significant mathematics, computer science and practices whose origins are in engineering. Students can find software engineering in two contexts: computer science programs offering one or more software engineering courses as elements of the CS curriculum, and in separate software engineering programs. Degree programs in computer science and in software engineering tend to have many courses in common; however, there are few SE programs at the bachelor's level. Software engineering focuses on software development and goes beyond programming to include such things as eliciting customers' requirements, and designing and testing software.

SE students learn how to assess customer needs and develop usable software that meets those needs. Both computer science and software engineering curricular typically require a foundation in programming fundamentals and basic computer science theory. They diverge in their focus beyond these core elements. Computer science programs tend to keep the core small and then expect students to choose among more advanced courses (such as systems, networking, database, artificial intelligence, theory, etc.). In contrast, SE programs generally expect students to focus on a range of topics that are essential to the SE agenda (problem modeling and analysis, software design, software verification and validation, software quality, software process, software management, etc.). While both CS and SE programs typically require students to experience team project activity, SE programs tend to involve the students in significantly more of it, as effective team processes are essential to effective SE practices.

In addition, a key requirement specified by the SE curriculum guidelines is that SE students should learn how to build software that is genuinely useful and usable by the customer and satisfies all the requirements defined for it. Most people who now function in the U.S. as serious software engineers have degrees in computer science, not in software engineering. In large part this is because computer degrees have been widely available for more than 30 years and software engineering degrees have not. Positions that require development of large software systems often list "Software Engineer" as the position title. Graduates of computer science, computer engineering, and software engineering programs are good candidates for those positions, with the amount of software engineering study in the programs determining the suitability of that graduate for such a position.

Most IT professionals who have computing degrees come from CS or IS programs. It is far too soon for someone who wants to work as a software engineer or as an information technology practitioner to be afraid that they won't have a chance if they don't graduate from a degree program in one of the new disciplines. In general, a CS degree from a respected program is the most flexible of degrees and can open doors into the professional worlds of CS, SE, IT, and sometimes CE. A degree from a respected IS program allows entry to both IS and IT careers. Media attention to outsourcing, offshoring, and job migration has caused many to be concerned about the future of computing-related careers. It is beyond the scope of this web site to address these issues.

## 2.6 Difference between computer science and information technology

At a glance, IT (information technology) careers are more about installing, maintaining, and improving computer systems, operating networks, and databases. Meanwhile, computer science is about using mathematics to program systems to run more efficiently, including in design and development.

While computer science education isn't necessary for an IT career, some IT education is fundamental for a computer science degree that later leads to job opportunities. IT can be specialized in many different ways, but CS graduates have opportunities immediately available to them that IT qualified workers don't.

The work environments expected from both careers can vary widely, too. Most IT professionals work as part of a team in an organization, serving internal needs or working directly with clients. Computer scientists, however, work in businesses, colleges, video game development companies, or as freelancers. Regardless of which appeals more, there's plenty of potential for career growth and lucrative job opportunities in both fields.

## 2.7 Pervasive Theme in IT

Pervasive computing, also called ubiquitous computing, is the growing trend of embedding computational capability (generally in the form of microprocessors) into everyday objects to make them effectively communicate and perform useful tasks in a way that minimizes the end user's need to interact with computers as computers. Pervasive computing devices are network-connected and constantly available.

Unlike desktop computing, pervasive computing can occur with any device, at any time, in any place and in any data format across any network and can hand tasks from one computer to another as, for example, a user moves from his car to his office. Pervasive computing devices have evolved to include:

- laptops;
- notebooks;
- smartphones;
- tablets;
- wearable devices;
- and sensors (for example, on fleet management and pipeline components, lighting systems, appliances).

Often considered the successor to mobile computing, ubiquitous computing generally involves wireless communication and networking technologies, mobile devices, embedded systems, wearable computers, radio frequency ID (RFID) tags, middleware and software agents. Internet capabilities, voice recognition and artificial intelligence (AI) are often also included.

The importance because pervasive computing systems are capable of collecting, processing and communicating data, they can adapt to the data's context and activity. That means, in essence, a network that can understand its surroundings and improve the human experience and quality of life.