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Кафедра комп'ютерних систем та мереж

КОНСПЕКТ ЛЕКЦІЙ

з дисципліни "Вступ у спеціальність"
для іноземних студентів
6.050102 „Комп'ютерна інженерія"

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Схвалено та рекомендовано до друку методичною комісією факультету комп’ютерно-інформаційних систем і програмної інженерії Тернопільського національного технічного університету імені Івана Пулюя, протокол №____ від «___» _____2015 р.

LECTURES ON "INTRODUCTION OF THE SPECIALTY"

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Lecture 1 Introduction

1. Subject, aim, task of the course

The discipline's name is "Introduction of the specialty". Its purpose is to give students a clue about "Computer Engineering" specialty (its code is 6.050102). The course will help students to form basic knowledge and skills in initial disciplines of the bachelor curriculum.

The task of the discipline is to make students familiar with general concepts of computer systems and networks, hardware and software of computer systems.

The material of the course will be used in further studying of professional-oriented disciplines.

After finishing the course students should know:

- basic concepts of the theory of information processes and systems
- basic concepts of computer architecture
- key elements of modern hardware and software

Should be able to:

- master modern software at the user level
- analyze any possible failures in computer systems and networks

2. Outline of computer engineering

Computer engineering – discipline that integrates several fields of electrical engineering and computer science required to develop computer hardware and software. Computer engineers usually have training in electronic engineering (or electrical engineering), software design, and hardware-software integration due to the utilization of both hardware and software technologies in the field. Computer engineers are involved in many hardware and software aspects of computing, from the design of individual microprocessors, personal computers, and supercomputers, to circuit design. This field of engineering not only focuses on how computer systems themselves work, but also how they integrate into the larger picture.

Software engineering

Software engineering is the study and an application of engineering to the design, development, and maintenance of software.

Typical formal definitions of **software engineering** are:

- "research, design, develop, and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, and general computing applications."
- "the systematic application of scientific and technological knowledge, methods, and experience to the design, implementation, testing, and documentation of software";
- "the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software";
- "an engineering discipline that is concerned with all aspects of software production";

- and "the establishment and use of sound engineering principles in order to economically obtain software that is reliable and works efficiently on real machines."

Computer (hardware) engineering

Computer engineering is a discipline that integrates several fields of electrical engineering and computer science required to develop computer hardware and software. Computer engineers usually have training in electronic engineering (or electrical engineering), software design, and hardware-software integration instead of only software engineering or electronic engineering. Computer engineers are involved in many hardware and software aspects of computing, from the design of individual microcontrollers, microprocessors, personal computers, and supercomputers, to circuit design. This field of engineering not only focuses on how computer systems themselves work, but also how they integrate into the larger picture.

Usual tasks involving computer engineers include writing software and firmware for embedded microcontrollers, designing VLSI chips, designing analog sensors, designing mixed signal circuit boards, and designing operating systems. Computer engineers are also suited for robotics research, which relies heavily on using digital systems to control and monitor electrical systems like motors, communications, and sensors.

In many institutions, computer engineering students are allowed to choose areas of in-depth study in their junior and senior year, because the full breadth of knowledge used in the design and application of computers is beyond the scope of an undergraduate degree. Other institutions may require engineering students to complete one year of General Engineering before declaring computer engineering as their primary focus.[3][4][5]

3. Careers

Computer Engineering majors have careers anywhere where computers are, which is virtually everywhere. Our graduates can be found doing anything from designing controllers embedded in cars up to building the latest hot game.

Between strong demand and rapid turnover, jobs abound for good systems and applications programmers, hardware designers, network managers, and consultants in many areas. Computer engineers make the Web faster, improve the machines we use, design and build PDAs like the Palm, and iPAQ. CE majors also provide the computational power underlying fields as varied as oil exploration, health care, airplane design, and weather modeling. Applications programmers are responsible for writing instructions to solve specific scientific or commercial problems. Systems programmers develop software which makes computer programming and operations simpler.

Typical employers include firms devoted to the design and production of computer software and hardware, and also aircraft, automotive, telephone, chemical, insurance companies, banks, retailers, utilities, publishers, accounting firms, research organizations, universities, and financial and data processing firms. State and local governments also employ computer engineering graduates, and teachers for college and high school.

Computer software engineering

According to the U.S. Bureau of Labor Statistics (BLS) "computer applications software engineers and computer systems software engineers are projected to be among the faster than average growing occupations from 2012 to 2022". BLS reports an expected growth of 22% for software developers from 2012 to 2022 (down from the 30% 2010 to 2020 estimate). In addition, growing concerns over cyber security add up to put computer software engineering high above the average rate of increase for all fields. However, some of the work will be outsourced in foreign countries. Due to this, job growth will not be as fast as during the last decade.

Computer hardware engineering

According to the BLS, "employment of computer hardware engineers is expected to only increase 7% from 2012 to 2022 ("Slower than average" in their own words when compared to other occupations) and is down from 9 percent in the BLS 2010 to 2020 estimate." Today, computer hardware is somehow equal to Electronic and Computer Engineering (ECE) and has divided to many subcategories, the most significant of them is Embedded system design.

4. Basic terms and definitions

Information – is a sequence of data that can be received, transferred, converted, compressed, registered with some signs of symbolic, figurative, gesture, sound, sensory-motor type.

Input information (data) – information that is perceived by a system from the environment. Such information can also be called as input information relatively to the system.

Output information (relatively to the environment) – the one that the system gives to the environment.

The basic properties of information (and messages):

- completeness;
- relevance/actuality;
- clarity;
- adequacy, accuracy, correctness of the interpretation, receiving and transmission;
- understandable for the information interpreter;
- reliability;
- selectivity;
- targeting;
- confidentiality;
- informative and significance;
- mass;
- ability to be encoded; efficiency;
- compact size, the possibility of compression;
- protection and noise stability;
- accessibility;
- value.

The methods of obtaining and using information can be divided into three groups, sometimes we separate them only conditionally:

1. **Empirical methods** or methods of obtaining empirical information (empirical data);
2. **Theoretical methods** or methods of obtaining theoretical information (theories construction);

3. **Empirically-theoretical methods** (mixed, semi-empirical) or methods of obtaining empirically-theoretical information.

Let's give brief characteristic to the empirical methods

1. Observation – collection of primary data or empirical statements about the system.
2. Comparison – establishing of common and different features in the system/systems we study.
3. Measurement – searching, formulation of empirical facts.
4. Experiment – purposeful transformation of the system (systems) we study to identify its (their) properties.

Besides classical forms of their implementation, recently such forms as surveys, interviews, testing and others are used.

Information system – a system in which its elements, aim, resources, structure (organization) are considered primarily on information level (although there are other levels of consideration, such as energy level).

Information system, IS – a system that is designed for implementation and maintenance information model of the specific area of human activity. The system should provide the following means/tools for information processes:

- collection of information
- transformation and processing
- analysis
- storage and protection
- transmission for use.

Any information system has the following types of major subsystems:

- information support subsystem (data subsystem);
- intellectual support subsystem (information, knowledge);
- technical support subsystem (hardware);
- technological support subsystem (technology);
- communication support subsystem (interface);
- analysis and design subsystem;
- subsystem of assessing the adequacy and quality, verification;
- organizational interaction and management subsystem;
- logistics subsystem (planning and movement of goods and services).

The concept of information technology emerged in the last decade of XX century during the establishment of informatics. The significant feature of information technology is that both its subject and its product is the information, and its tools are the means of computer technology and communications.

Information technology is a set of methods and techniques of obtaining, processing, presentation of information that are aimed at changing its status, properties, form, content and implemented for the benefit of users.

Nowadays when we talk about information technology we often mean computer technology. In particular, IT deals with the use of computers and software for the collection, transformation, processing, storage, protection, transfer of information to the user.

Information technology in various fields of human activities
- Medicine
- Education
- Finance, banking, trade services (ATMs, credit cards, barcodes)
- Jurisprudence
- Military
- Unmanned Aerial Vehicles (UAV)
- Cryptography

- Mechanical Engineering and Metalworking