**Topic 4 ICT Concepts**

**digital revolution**

Information and communication technologies (ICT) are a **set of technologies** developed to improve the efficiency of information use and improve communication.

Thanks to ICT, it has become easier for people to communicate at a distance,

**quickly find** various information and learn something new.

The digital era has evolved through four phases,

**In the first phase** computers were huge, complex and expensive devices.

They **existed** in limited numbers, primarily housed in big corporations and government agencies.

**The second stage** was presented by personal computing which is characterized by small, standalone computers powered by local software.

**The third phase** of the digital revolution materialized as computers became networked and when the

Internet was opened to public use.

**Cloud computing** characterized the fourth phase of the digital revolution. Cloud computing provides access to information, applications, communications and storage over the Internet.

**Data refers** to the symbols that represent people, events, things, and ideas. In everyday conversation people use the terms data and information interchangeably. Nevertheless, some technology professionals make a distinction between the two terms. They define data as is any

**raw facts** or observations that describe a particular phenomenon that represents people, events, things and ideas.

**Data** becomes information when it is presented in a format that people can understand and use. Data is used by machines, such as computers, information is used by humans.

**Information** is simply data that has a particular meaning within a specific context. Information may be data that has been processed in some way.

**data processing**, the input is data, the output is useful information. So, data processing is a series of actions or operations that convert data into useful information.

digital devices (types)

Now commonly used computer categories include personal computers, servers, mainframes and supercomputers.

A **personal computer** is a microprocessor-based computing device designed to meet the computing needs of an individual. It provides access to a wide variety of local and cloud-based applications.

The term **server** has several meanings. It can refer to computer hardware, to a specific type of software, or to a combination of hardware and software. In any case, the purpose of a server is to serve computers on a network by supplying them with data.

A **mainframe** computer is a large and expensive computer capable of processing data for hundreds or thousands of users.

**Mainframes** are generally used by businesses or governments to provide centralized storage, processing and management for large amounts of data.

A computer falls into the **supercomputer** category if it is one of the fastest computers in the world. Because of the speed, supercomputers can tackle complex tasks and compute-intensive problems that just would not be practical for other computers.

hardware components (component system, clamshell, slate devices)

**Computer hardware** is a collective term used to describe any of the physical components of an analog or digital computer. The term hardware distinguishes the tangible aspects of a computing device from software, which consists of written, machine-readable instructions or programs that tell physical components what to do and when to execute the instructions.

Computer have three main hardware sections:

**· The CPU** – a microprocessor chip which used for processes data and coordinates activities of other chips; CPU or central processing unit have three typical parts: the control unit,

which examines instructions from memory and executes them; the arithmetic and logic unit(ALU), which performs arithmetic and logical operations; the registers, high-speed units of memory used to store and control data.

· **The main memory** – holds the instructions and data which are being processed by the CPU. Have a two main sections:

**RAM(Random** Access Memory) and

**ROM(**Read Only Memory); We have many types of storage: magnetic disk and optical disc, hard disk – magnetic disk with a large storage capacity,

**flash memory** - is solid rewritable memory: it is non-volatile.

**· Peripherals** are the physical units attached to the computer.

**E-waste** contains a list of chemicals that are harmful to people and the environment. When electronics are **mishandled** during disposal, these chemicals end up in our soil, water, and air.

We can solve the problem of e-waste by being more **mindful about** where our e-waste ends up. We can limit how much we produce and the impact it has on the environment.

**With the flo**od of e-waste growing around the world, recycling alone will not be enough. In order to reduce e-waste,

**manufacturers need** to design electronics that are safer and more durable, repairable and recyclable.

**Most importantly**, this means using less toxic materials.

**5.** **Topic 5 Software**

**software** - all non-hardware components of a computer. determines the tasks a digital device can help you accomplish.

**The instructions** that tell a computer how to carry out a task are referred to as a computer **program**.

These programs **form the software**

that prepares a computer to do a specific task,

**such as document production, virus protection**, file management, or Web browsing.

The **two main categories** are

system software and application software.

**Operating systems** are classified as system software. **Device drivers,** utilities, and programming languages are also system software.

**Application** software categories include music, graphics, mapping, finance, and entertainment.

**AS designed** to help people accomplish **real-world tasks**, whereas

**SS** is designed for computer-centric tasks.

**An Operating System** (OS) is the low-level software that supports a computer's basic functions, such as

**scheduling tasks** and performs all the basic tasks like file management,

**memory management**, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

**An Operating System** is an interface between a computer user and computer hardware.

Applications and Apps: mobile, Web, local.

A Web app is software that is accessed with a

**Web browser**. Instead of running locally, much of the program code for the software

runs on a remote computer connected to the Internet or other computer network. Most Web apps require no installation at all on your local computer or handheld device.

A **mobile app** is designed for a handheld device, such as a smartphone, or tablet computer. mobile apps run from the handheld device, so they have to be downloaded and installed.

**Games and entertainment** seem to dominate mobile apps, whereas shopping and social apps dominate the Web apps category.

**Local applications** are installed on a computer's hard disk. When you install a local application, all of its files are placed in the

**appropriate folders** on your computer's hard disk, and then your computer performs any software or hardware configurations necessary to make sure the program is ready to run.

A **copyright** is a form of legal protection that grants the author of an original work an exclusive right to copy, distribute, sell, and modify that work.

**A software license**, or license agreement, is a legal contract that defines the ways in which you may use a computer program.

Based on licensing rights, proprietary software is distributed as commercial software, demoware, **shareware, freeware,**

**and open source software**.

Software piracy refers to illegal using, copying and/or distributing a piece of software that’s subject to copyright. According to the Business Software Alliance (BSA), about 36% of all software in current use ]

**is stolen**.

Software piracy has more than 1 form, such as сopying a software program that

**you purchased legitimately** in order to distribute it to other end users like friends, family, or anyone else through online means

**like torrenting**; using a method known as

**“cracking”** to access protected & copyrighted software that you didn’t purchase and others.

**6. Comp netw.** Today we cant imagine our life without any networks. Nowadays networks are everywhere and everyone wants to be connected.

**Network** – group of devices that connected between each other. Networks can be classified according to their size and geographic scope:

**PAN** – occupies a small area, not more than 10 meters. **LAN** – one building or 2 buildings that stands close. **MAN** – covers cities.

**WAN** – large geographic area, world. The most important network device is a

**router,** which acts as a central distribution point for getting data to its destination.

**Data** in a net. with wired connections travels from one device to another over cables. Wired connections are fast, secure and simple to configure. An example of wired net. technology is

**Ethernet.** A wireless net. transports data through the air. Wireless connections transport data as

**RF signals** (radio frequency),

**microwaves** and **infrared light beams**. The most popular wireless technology is

**WI-FI**. **Net. protocol** – set of rules, that are necessary to communicate comp. with other net. devices.

**Netw. architecture:** Client-to-client – type of net., that has a dedicated server - (star). Peer-to-peer – …, without any server.

**Topologies:** Star – one central point for all devices.Bus – all nodes are connected to the same circuit**.** Full mesh – connects each network device to many other net. devices**.** Partial mesh – some devices are connected to many others**.** Point-to-point – connected directly.

**Types of inet connection**:

**Dial-up** – Inet connection that uses a voiceband modem and telephone lines to transport data between ur computer and ur ISP, slow speed.

**DSL** – uses nowadays – fast, broadband inet connection. **Cable** – uses cable TV conn,

fast, broadband inet conn**.** 3G/4G – wireless inet conn used by smartphones**.**

**Technologies** of the

Web: browser, URL (uniform resource location), HTTP, HTML (hypertext markup language – set of elements that author uses to mark up the document)**.**

**IoT** – physical digital devices, share data with other devices, makes analytics and decisions**.**

**IoT elements**: chips, platforms, analytics, sensors, gateway, apps**.**

**IoT apps**: smart home, industry energy production, medicine**.**

**Benefits** of IoT: enterprises benefit from using IoT when a component is likely to fail and to swap it out before it causes damage, make life smarter, more comfortable and easier (routine tasks)**.**IoT **challenges**:Lack of regulations ( government regulation often takes a long time to catch up with current state of technology**.**

Understanding IoT ( how to use it?)**.** Challenges with compatibility (not all devices can be connected with other)**.** Cloud attacks (cybercriminal, cloud servers can be attacked by hackers)**.**

Limited AI (people can’t use AI how they need, most of the current AI offerings on the market have substantial limits) (6)

**7. Information systems** are

combinations of hard, software and t

**elecommunication**s netws built to collect,

store and process data. There’re various types of inf syss: transaction processing syss,

**management** **inf** syss,

**decision-support** syss and

**executive support** syss. An inf sys

progresses through several phases as it’s developed, used, and finally retired. These phases encompass a **System**

**Development Life Cycle** (**SDLC).**

**1 Planning**. Assemble the project team, justify the project, choose the development methodology, develop a project schedule, produce a project development plan.

**2 Analysis**. Activities for anal. ph.:

study the current sys, determine the sys requirements and

write **requirements report***.* The project team

**determines** requirements by

**interviewing** users and studying successful inf syss that solve similar problems. Another way to determine requirements is to construct a prototype.

**3** **Design**. The project team must figure out how the new sys will fulfill the requirements specified in the

**Sys Requirements Report**. The project team chooses

**a solution**, **selects hard and software**, and designs

**detailed application specifications**.

**4 Implementation**. The project team supervises the tasks necessary to construct the new inf sys. The tasks of the impl. ph.: buy and install hard and/or software, create apps, test apps, finalize documentation, train users, convert data, convert to new sys.

**5 Maintenance**. The Maint. ph. is the last and the longest SDLC ph. and it lasts until the sys is retired. It involves day-to-day operation of the

sys, making modifications

to improve performance, and correcting problems. 3 key concepts ensure

good quality of maint. service:

*reliability, availability* and *serviceability*. Common

**threats** to corporate inf. syss: natural disasters, power outages, equipment failures, human errors, software failures, security breaches, acts of war and malware. When a company’s brand is used without authorization, the company has become a victim of

**identity theft.** Corporate identity attacks can undermine customer confidence,

overwhelm customer service, generate bad publicity and result in lost revenues. To help minimize risks the hard and software for most corporate inf syss are housed in

**data centers**.

A **d.c.** is a specialized facility designed to hold and protect computer syss and data. Most d.c. limit physical access using password protection and fingerprint identification syss. Several

**proactive measures** can protect inf syss from threats: deterrents, preventive countermeasures, corrective procedures and detection activities.

**Deterrents** reduce the likelihood of

deliberate attack. Both

**physical deterrents**, such as

**limiting access** to critical servers, and

common deterrents, such as

**multi-level authentication,**

**password protection, and**

**biometric identification** fall under this category.

**Preventive countermeasures** shield

**vulnerabilities** to render an attack unsuccessful or reduce its impact.

**Firewalls that prevent unauthorized access** to a system and encryption that makes stolen data

i**ndecipherable** are examples of preventive countermeasures.

**Corrective procedures** reduce the effect of an attack. Data backups, disaster recovery plans, and the availability of redundant hardware devices: examples of corrective procedures.

**Detection activities** recognize attacks and trigger preventive countermeasures or corrective procedures. Antivirus software

detects viruses entering a sys and can be configured to perform corrective procedures such as removing the virus and quarantining infected files.(7)

**8.** **Programming.** Computer programming – process of writing a source code**.**

Prog. languages - set of rules that are necessary to write a source code.Comp program – set of functions**.** The most popular prog ls today are python, java, javascript, c++, c#**.**

Statement – single line of code

that perform a specific task.

With prog we are giving directions to the comp.

**Prog paradigm** refers to a way

of conceptualizing and structuring the tasks a comp performs.

Today’s most common prog paradigms are:

**Event-driven** - focuses on choosing user interface elements and defining event-handling routines that are triggered by various mouse or keyboard activities. *Visual Basic, C#***.**

**Procedural -** focuses on linear steps that provide the computer with instructions on how to solve a problem or carry out a task. *BASIC, Ada, Pascal, Fortran, COBOL***.**

**Object-oriented -** describes programs as a series of objects and methods that interact to perform a specific task. *Smalltalk, C++, Java, Scratch***.**

**Declarative -** describes aspects of a problem that lead to a solution and help to solve problems for non-numeric data, including

words and concepts. *Prolog.* The prog l that uses just 0s and 1s is called a machine (low-lvl)*.* The prog l utilizing simple English words is called source(high lvl)*.*

A compiler/interpreter is a program that converts a high-lvl l into machine code.

A program written in one of high-lvl prog ls if often called a source program.There are some types of errors in programs:

**syntax error** - occurs when an instruction doesn’t follow the syntax rules, or grammar, of the prog l. **runtime er -** occurs when a program runs.

**logic er** – occurs when there is logic or design problem, such as using the wrong formula. There are 2 main **development methodologies:**

**A predictive**- focuses on rigorous development. Almost doesn’t change during the project. Used for large software development projects.

**An agile -** focuses on flexible developmen, that evolve as a project progresses. Programmers produce a subset of the project, show it to users, and then plan the next phase of development.

**Object-Oriented Prog –** it’s one of the main prog methodologies, which is based on the idea that a program is a set of objects, each belonging to a certain class and the classes build up an inheritance hierarchy. **Object** - is a data field that has unique attributes and behaviour.

**Class** - is a template for a group of objects with common characteristics.  
**Method** - is a segment of code that defines an action. **Message** - activates Method. The set of superclasses and subclasses that are related to each other is referred to as a **class hierarchy.**

**Pillars of OOP:** Encapsulation – break connection between objects. Inheritance – for using in future, avoid the repetitive coding work. Polymorphism – ability of object to take different forms. Abstraction – shows only necessary information (attributes).

**Artificial Intelligence (AI)** - is a method of prog a comp, robot, or other objects to think like a smart human. It’s becoming important in today’s world because it can efficiently solve problems in a variety of areas, including healthcare, entertainment, banking, education**.**

**AI vs ML**: AI broader concept, while ML is the most common application of AI(apps: Spotify, Apple Mus). In future AI will outperform humans in relatively simple tasks such as translating, driving car etc.

**AI + /-:** + efficiency, accuracy, cost-saving. - high cost of creation, upgrade; making human lazy, unemployment, lacking out of the box thinking.

**VR** and **AR** are the two sides of the same coin.

**AR** simulates artificial objects in the real environment; **VR** creates an immersive artificial environment. (8)

**+/-**: + can be used for training, education; in game industry; train for real-life situations; automate many task. - they require expensive hw and sw to create and use; disconnecting from the real world.

**Game progg** – process of creating video game.

**Genres:** simulation (copy different activities from real life); strategy (focused on skillful thinking and planning to achieve victory); role-playing (players assume the roles of character); adventure; puzzle.

**Components**; art, characters, lvls, audio, lighting, story. **Ls**: С++, C# , Python, Java, JavaScript, Swift.

**Robotics** –it’s the science and study of robots**.**

**Robot** – computer-controlled machine that is programmed to move, manipulate objects, perform work. **Types of robots:** *Virtual robots* – don’t exist in real life, they’re just programs. *Rolling robots* – have wheels, only flat areas. *Stationary robots* – stand at one place, has some settings. *Autonomous robots* – self-supporting *. Walking robots* – have legs, not only flat areas. *Remote-control robots* – guided by a person (drones). (8)  
**Components of robots:** Motor of some sort, Sensory system, Movable physical structure (end-effectors), Power supply, Program,

Computer “brain” (CPU). **+:** life easier, Saves people from difficult work, Boost productivity. **-:** Increasing unemployment and e-waste, May have failures, Always in need of service and energy.

**9. Digital security. A user ID** is a series of characters – letters, numbers or special symbols – that becomes a person’s unique identifier.

**A password** -//- that verifies a user ID and guarantees that you are the person you claim to be. The term **authentication protocol** to refer to any method that confirms a person’s identity using something the person knows, something the person possesses, or something the person is. A person can also be identified by biometrics, such as a fingerprint, facial features, or a retinal pattern. When someone gains unauthorized access to your personal data and uses it illegally, it’s called **identity theft**. Ways to steal a password:

**The brute force attack** exhausts all possible combinations of letters to decrypt a password.

**Sniffing** intercepts information sent out over computer networks. **phishing**, in which a hacker poses as a legitimate representative of an official organization such as ur ISP in order to persuade you to disclose highly confidential information.

A **key logger** is sw that secretly records a user’s keystrokes and sends the inf to a hacker. A key logger is a form of malicious code called a Trojan.  
**Trojans** are computer programs that seem to perform 1 function while actually doing something else.

A **password manager** stores user IDs with their corresponding passwords and automatically fills in login forms. tips for

**protection your portable computer from theft**: Never leave ur portable comp unattended; If u have to leave ur portable comp in ur car, never

leave it in plain view. Lock it up in the trunk or cover it up;

Carry ur portable comp in an inconspicuous carrying case; Consider securing ur portable comp with an anti-theft device.

**A good computer maintenance routine:** Back up ur files regularly, particularly those that are most important to u; Run utilities that ensure peak performance for ur hard disk drive; Delete ur browser’s

history and cache files on a monthly basis in order to free up space for your temporary files; Apply the latest operating sys, driver, and security updates; Scan your computer for viruses and spyware 1s a week.

**Security sw** is designed to protect computers from various forms of destructive sw and unauthorized intrusions. Security sw: antivirus, antispyware, anti-spam, and firewalls.  
The terms **malicious sw** refer to any comp program designed to surreptitiously enter secretly a comp, gain unauthorized access to data, or disrupt normal processing operations. Malware includes viruses, worms, Trojans, bots, and spyware.

A **comp virus** is a set of program instructions that attaches itself to a file, reproduces itself, and spreads to other files. Any code that is designed to hide the existence of processes and privileges is referred to as a

**rootkit**.

A **comp worm** is a small self-replicating, self-distributing program designed to carry out un authorized activity on a victim's device.

A **dropper** is designed to deliver or "drop" malicious code into a device.

A **security suite** integrates several security modules to protect against the most common types of mw, unauthorized access, and spam.

**Antivirus software** is a type of utility sw that looks for and eradicates viruses, Trojan horses, worms, and bots. In the context of cyber security,

**social engineering (SE)** is a deceptive practice that exploits human psychology by inducing victims to interact with a digital device in a way that is not in their best interest The target of a social engineering exploit is an individual or organization that may be tricked into participating in the scam.

Social engineering attacks prey on human vulnerabilities, such as gullibility, ignorance, curiosity, greed, courtesy, indifference, and carelessness.

To prepare for a possible

**ransomware** exploit, be sure to maintain current backups of your important data and disconnect the backup device when backups are not in progress.

**10.** **JOB HUNTING.** Job hunting involves more than searching for open positions and sending your resume to employers. U also need to make sure u’re a good fit for the job, can catch the hiring manager’s attention and are well-prepared to answer interview questions.

**Build ur professional brand.** Create profiles on networking sites. A strong personal brand that portrays you in a professional light will provide recruiters, employers, and contacts with a strong positive impression of u as a candidate they should be interested in.

**Create ur resume/CV and Cover Letter**. It’s important to take the time to write targeted résumés and cover letters that specifically link ur qualifications to the hiring criteria for the jobs u’re applying for.

**Connect with everyone u know**, because u never know which contact may be able to help u with ur job search or put u in touch with someone who can.

**Keep ur job search focused**. Use the job search engines to find jobs by using keywords that match ur interests and the location where u want to work. . It’s a good idea to research company information and

**create a list of companies** to target in ur job search. u can do some special outreach to get ur app noticed and get email notifications for new job openings immediately after they are posted.

**Be clear and simple**

**when describing the job you want**.

**A resume or CV (Curriculum vitae)** is a brief document that summarizes you as a job candidate. Most resumes include educational history, applicable skills (hard and soft skills) and summary of qualifications (official certifications or workplace achievements). **A cover letter** is a detailed document that shows hiring managers ur desire for a particular job. It is an opportunity to demonstrate more of ur personality than you can on your resume. Throughout the letter, you can discuss specific items listed in the job description and how your skills and experience match those requirements. You should **adapt your resume to each job you apply for**. Study the job description to determine why you are a great fit. Add ur skills, experience and measurable achievements that are relevant to that position. **Hiring managers** who look through many resumes should be able to read urs and quickly know that u have the skills for the position. **Professional ethics** encompass the personal and corporate standards of behavior expected by profess-s. There are some **universal ethical principles** that apply across all professions: honesty, trustworthiness, loyalty, respect for others, avoiding harm to others, accountability. **The job interview** is ur best chance to show the a hiring manager that u’re the best person for their job. Preparing for an interview primarily means taking time to thoughtfully consider ur goals and qualifications relative to the position and employer. Before ur interview, u should have **a good understanding of why you want the job** and why you’re qualified. Modern companies usually have **social media accounts and blogs** that discuss their company culture and industry. This information can give you an impression of the tone and personality of the company, as well as what they value. (10)