***1. Explain the subject of information security. Identify information security problems.***

The information security is the security of information and supporting infrastructure from accidental or intentional exposure of natural or artificial origin which could harm the subjects of information relations, including the owners and users of the information and supporting infrastructure.

Information Security Risk, Privacy Violation Threats, Data Corruption Threats, Malicious Software

***2. Describe the concept of information security. Specify the categories of information security techniques and information theft. Explain how to monitor and control access by the operating system.***

The concept of cyber security is considered as a synonym to safety. It is a set of measures aimed at ensuring information security.

Access control allows controlling those actions which subjects have the right to execute over information objects.

Traditional problem definition is in existence of a set of Si-subjects and a set of Oj-objects.

The task of logical control is to define a set of admissible operations and to control execution of the established order for each couple (Si, Oj).

The "object-subject” relationship can be presented as a matrix in which access subjects are in lines, and access objects are in columns. Cells at the intersection of lines and columns set conditions and access rights.

As such matrix is often rarefied, access rights lists, i.e. columns of this matrix are used. Monitoring of access rights is made by special components of the software environment – operating system kernel, security services, a database management system, software modules of the interfacial layer.

In case of aсcess permit, the analysis of the following information is done:

- The subject's identifier – discretionary (arbitrary) access;

- Attributes of the subject (a security tag, a user group)

– mandatory (forced) access.

***3. Define the e-RSA signature protocol. Explain the concepts of differentiation and control of access to information.***

RSA encoding algorithm (proposed R. Rivestom, E. Shamirom and L. Adlmanom)

In asymmetrical encoding algorithms, the encoding and decryption keys are always different (though related to each other). The key to encrypt is unclassified (open), the decryption key is kept secret.

Two primes p and q and let n = pq Let a, j (n) = (p-1) (q-1). Let the number e be such that the numbers e and j (the n) are relatively prime, and d is multiplicatively inverse to it, that is ed ° mod j (the n). The numbers e and d are called open and closed figures, respectively. The public key is the pair (n, e) the private key is d. The factors p and q must be kept secret. Thus, the security of the RSA system is based on the difficulty of the task factorization.

Access control allows controlling those actions which subjects have the right to execute over information objects

***4. Identify categories of information security. Specify the concept of information theft and major information security threats.***

• technical means – various electric, electronic and computer devices; • physical means – means, which are implemented in the form of selfcontained units and systems; • software means –software intended for accomplishment of information security functions; • cryptographic means –mathematical algorithms providing transformation of data for the solution of information security issues; • organizational means – a set of technical-organizational and legalorganizational measures; • moral and ethical means – means, which are implemented in the form of the regulations developed in the process of distributing the COMPUTER and information technologies; • legislative means – a set of the legal acts regulating the use of IS, handling and transfer of information.

***5. Specify the methods of information protection in the BIOS. What are the threats to information security.***

Information Security Threat (IS) is a potential event, action, process or phenomenon that can cause damage to anyone's interests.

Information Security Threats:

Information Security Risk (IS) is a potential event, action, process or phenomenon that can cause damage to anyone's interests.

An attempt of threatening activities is called an attack.

Classification of IS threats can be made according to several criteria:

- by the information security aspect (availability, integrity, confidentiality);

- by the IS components at which threats are aimed (data, software, equipment, supporting infrastructure);

- by the implementation method (accidental or intentional action of natural or artificial origin);

- by location of the threat source (inside or outside of the IS). Regardless of the specific threat types, an information system must possess the basic properties of information and its processing systems:

- availability - the ability to get information or information services in a reasonable time;

- integrity - the relevance of the property and the consistency of the information, its protection from destruction and unauthorized changes;

- confidentiality - protection against unauthorized access to information.

***6. Define the basics of cryptology and cryptography. Explain the concept of cryptography****.*

Cryptography is a method of protecting information and communications through the use of codes, so that only those for whom the information is intended can read and process it. The prefix "crypt-" means "hidden" or "vault" -- and the suffix "-graphy" stands for "writing." In computer science, cryptography refers to secure information and communication techniques derived from mathematical concepts and a set of rule-based calculations called algorithms, to transform messages in ways that are hard to decipher. These deterministic algorithms are used for cryptographic key generation, digital signing, verification to protect data privacy, web browsing on the internet, and confidential communications such as credit card transactions and email. Cryptography is closely related to the disciplines of [cryptology](https://searchsecurity.techtarget.com/definition/cryptology) and [cryptanalysis](https://searchsecurity.techtarget.com/definition/cryptanalysis). It includes techniques such as microdots, merging words with images, and other ways to hide information in storage or transit. However, in today's computer-centric world, cryptography is most often associated with scrambling [plaintext](https://searchsecurity.techtarget.com/definition/plaintext) (ordinary text, sometimes referred to as cleartext) into [ciphertext](https://whatis.techtarget.com/definition/ciphertext) (a process called [encryption](https://searchsecurity.techtarget.com/definition/encryption)), then back again (known as decryption). Individuals who practice this field are known as cryptographers.

***7. Give an example of modern symmetric cryptosystems. Determine the classification of modern symmetric cryptosystems.***

**Symmetric-key algorithms**[[a]](https://en.wikipedia.org/wiki/Symmetric-key_algorithm#cite_note-1) are [algorithms](https://en.wikipedia.org/wiki/Algorithm) for [cryptography](https://en.wikipedia.org/wiki/Cryptography) that use the same [cryptographic keys](https://en.wikipedia.org/wiki/Key_(cryptography)) for both encryption of [plaintext](https://en.wikipedia.org/wiki/Plaintext) and decryption of [ciphertext](https://en.wikipedia.org/wiki/Ciphertext). The keys may be identical or there may be a simple transformation to go between the two keys.[[1]](https://en.wikipedia.org/wiki/Symmetric-key_algorithm#cite_note-2) The keys, in practice, represent a [shared secret](https://en.wikipedia.org/wiki/Shared_secret) between two or more parties that can be used to maintain a private information link.[[2]](https://en.wikipedia.org/wiki/Symmetric-key_algorithm#cite_note-3) This requirement that both parties have access to the secret key is one of the main drawbacks of symmetric key encryption, in comparison to [public-key encryption](https://en.wikipedia.org/wiki/Public_key_encryption)(also known as asymmetric key encryption).[[3]](https://en.wikipedia.org/wiki/Symmetric-key_algorithm#cite_note-4)[[4]](https://en.wikipedia.org/wiki/Symmetric-key_algorithm#cite_note-5)

Symmetric-key encryption can use either [stream ciphers](https://en.wikipedia.org/wiki/Stream_cipher) or [block ciphers](https://en.wikipedia.org/wiki/Block_cipher).[[5]](https://en.wikipedia.org/wiki/Symmetric-key_algorithm#cite_note-6)

Stream ciphers encrypt the digits (typically bytes), or letters (in substitution ciphers) of a message one at a time. An example is the [Vigenère Cipher](https://en.wikipedia.org/wiki/Vigen%C3%A8re_Cipher).

Block ciphers take a number of bits and encrypt them as a single unit, padding the plaintext so that it is a multiple of the block size. Blocks of 64 bits were commonly used. The [Advanced Encryption Standard](https://en.wikipedia.org/wiki/Advanced_Encryption_Standard) (AES) algorithm approved by [NIST](https://en.wikipedia.org/wiki/NIST) in December 2001, and the [GCM](https://en.wikipedia.org/wiki/Galois/Counter_Mode) block cipher mode of operation use 128-bit blocks.

***8. Give asymmetric encoding algorithms. Explain the RSA cryptosystem.***

**RSA** (**Rivest–Shamir–Adleman**) is one of the first [public-key cryptosystems](https://en.wikipedia.org/wiki/Public-key_cryptography) and is widely used for secure data transmission. In such a [cryptosystem](https://en.wikipedia.org/wiki/Cryptosystem), the [encryption key](https://en.wikipedia.org/wiki/Encryption_key) is public and distinct from the [decryption key](https://en.wikipedia.org/wiki/Decryption_key) which is kept secret (private). In RSA, this asymmetry is based on the practical difficulty of [factoring](https://en.wikipedia.org/wiki/Factorization) the product of two large [prime numbers](https://en.wikipedia.org/wiki/Prime_number), the "[factoring problem](https://en.wikipedia.org/wiki/Factoring_problem)".

**Asymmetric algorithms**. **Asymmetric cryptography** is a branch of **cryptography**where a secret key can be divided into two parts, a **public key** and a private key. The **public key** can be given to anyone, trusted or not, while the private key must be kept secret (just like the key in **symmetric cryptography**). An example aassymetric method is the RSA algorithm, which uses some lovely tricks of number theory and the fact that it's hard to factorise large composite numbers with few prime factors. The public key is based on the private key, but is very hard to trace back to the private key. The public key is used for encoding, and the private key for decoding.

***9. Specify legislative measures to protect information in the Republic of Kazakhstan. Explain the law on digital signatures.***

The Law of the Republic of Kazakhstan On Electronic Document and Electronic Digital Signature (E-Signature Law) and the Code of Civil Procedures of the Republic of Kazakhstan specifically confirm that electronic documents authenticated by “electronic digital signatures” compliant with the E-Signature Law, which are similar to a QES[1], are equal to handwritten documents. Accordingly, such contracts cannot be denied enforceability merely because they are concluded electronically, by electronic digital signature. To prove a valid contract, parties sometimes have to present evidence in court. Leading digital transaction management solutions can provide electronic records, that are admissible in evidence, under Kazakhstan law, to support the existence, authenticity and valid acceptance of a contract. Further, the Kazakhstani Civil Code (Article 152.3) expressly permits parties to conclude agreements using various means of communications, such as telegrams, faxes, electronic documents, electronic messages or other documents which can identify parties to the transaction and their respective intents. The Civil Code does not expressly require the electronic signature in this context to be an "electronic digital signature" compliant with the E-Signature Law (ie., a QES). Thus, any form of electronic signature satisfying these Civil Code requirements, should be enforceable as a handwritten signature. But this will ultimately be left to the assessment of the court, on a case-by-case basis.

***10. Describe the management of cryptographic keys. Explain the difference between the concepts of generation, storage and distribution of keys.***

**Key management** refers to management of [cryptographic keys](https://en.wikipedia.org/wiki/Key_(cryptography)) in a [cryptosystem](https://en.wikipedia.org/wiki/Cryptosystem). This includes dealing with the generation, exchange, storage, use, [crypto-shredding](https://en.wikipedia.org/wiki/Crypto-shredding) (destruction) and replacement of keys. It includes [cryptographic protocol](https://en.wikipedia.org/wiki/Cryptographic_protocol) design, [key servers](https://en.wikipedia.org/wiki/Key_server_(cryptographic)), user procedures, and other relevant protocols.[[1]](https://en.wikipedia.org/wiki/Key_management#cite_note-Turner-What-is-key-management-1)

Key management concerns keys at the user level, either between users or systems. This is in contrast to [key scheduling](https://en.wikipedia.org/wiki/Key_scheduling), which typically refers to the internal handling of keys within the operation of a cipher.

Successful key management is critical to the security of a cryptosystem. It is the more challenging side of [cryptography](https://en.wikipedia.org/wiki/Cryptography) in a sense that it involves aspects of social engineering such as system policy, user training, organizational and departmental interactions, and coordination between all of these elements, in contrast to pure mathematical practices that can be automated.

The encryption key life-cycle, defined by [NIST](https://csrc.nist.gov/groups/ST/toolkit/documents/kms/lifecycle%20slides%20(b-w).pdf) as having a pre-operational, operational, post-operational, and deletion stages, requires that, among other things, a operational crypto period be defined for each key. A [crypto period](https://csrc.nist.gov/publications/nistpubs/800-57/sp800-57-Part1-revised2_Mar08-2007.pdf) is the "time span during which a specific key is authorized for use" and in Section 5.3 of [NIST's Guide](https://csrc.nist.gov/publications/nistpubs/800-57/sp800-57-Part1-revised2_Mar08-2007.pdf), the crypto period is determined (for example, with a symmetric key) by combining the estimated time during which encryption will be applied to data (the O*riginator Usage Period (OUP)*) and the time when it will be decrypted for use (the R*ecipient Usage Period (RUP)*).

Key distribution is an important issue in wireless sensor network (WSN) design. There are many key distribution schemes in the literature that are designed to maintain an easy and at the same time secure communication among sensor nodes. The most accepted method of key distribution in WSNs is key predistribution, where secret keys are placed in sensor nodes before deployment. When the nodes are deployed over the target area, the secret keys are used to create the network.[[1]](https://en.wikipedia.org/wiki/Key_distribution#cite_note-1) For more info see: [key distribution in wireless sensor networks](https://en.wikipedia.org/wiki/Key_distribution_in_wireless_sensor_networks).

Key distribution and key storage are more problematic in the cloud due to the transitory nature of the agents on it.[[2]](https://en.wikipedia.org/wiki/Key_distribution#cite_note-2) [Secret sharing](https://en.wikipedia.org/wiki/Secret_sharing) can be used to store keys at many different servers on the [cloud](https://en.wikipedia.org/wiki/Cloud).[[3]](https://en.wikipedia.org/wiki/Key_distribution#cite_note-3) In secret sharing, a secret is used as a seed to generate a number of distinct secrets, and the pieces are distributed so that some subset of the recipients can jointly authenticate themselves and use the secret information without learning what it is. But rather than store files on different servers, the key is parceled out and its secret shares stored at multiple locations in a manner that a subset of the shares can regenerate the key.

[Secret sharing](https://en.wikipedia.org/wiki/Shamir%27s_Secret_Sharing) is used in cases where one wishes to distribute a secret among *N shares* so that *M* < *N* of them (*M* of *N*) can regenerate the original secret, but no smaller group up to *M* − 1 can do so.[[4]](https://en.wikipedia.org/wiki/Key_distribution#cite_note-4)[[5]](https://en.wikipedia.org/wiki/Key_distribution#cite_note-5)

**Key generation** is the process of generating [keys](https://en.wikipedia.org/wiki/Key_(cryptography)) in [cryptography](https://en.wikipedia.org/wiki/Cryptography). A key is used to [encrypt](https://en.wikipedia.org/wiki/Encryption) and decrypt whatever data is being encrypted/decrypted.

A device or program used to generate keys is called a [key generator](https://en.wikipedia.org/wiki/Key_generator) or [keygen](https://en.wikipedia.org/wiki/Keygen).

***11. Define the term object identification, authentication mechanisms and user confirmation.***

**Authentication Mechanism** is hardware-or software-based mechanisms that force users to prove their identity before accessing data on a device.

**Verification** is confirmation, through the provision of objective evidence, that specified requirements have been fulfilled (e.g., an entity’s requirements have been correctly defined, or an entity’s attributes have been correctly presented; or a procedure or function performs as intended and leads to the expected outcome)

***12. Explain data protection in electronic payment systems. Define the principles of operation. Describe the principle of electronic cards operation.***

Electronic payment systems are mechanisms for the implementation of remote transactions including banking and non-banking payment terminals and remote financial services.

the specifics of data protection and security of information in the ICT framework, the concept of identification, authentication, access control, logging and auditing, encryption, and integrity monitoring;

1890 – Electronic punched card tabulating device Herman Hollerith designed an electronic punched card tabulating device that enabled the U.S. Census Bureau to tabulate the 1890 census in six months, which would have otherwise taken more than 7 years. Hollerith’s machine used punched cards to store data instead of instruction routines

***13. Describe methods of network systems security. Identify network security and messaging protection methods and databases on local networks.***

The worldwide system of computer networks is the Internet. Via the Internet computers on the network can access other computers. The Internet allows data to be moved from one computer to another. The network systems manages the way data is transferred from one computer to another and work of different components of a network system.

Local network is a network in which the computers are located within a room, building or nearby building.

***14. Describe the protection of local networks with the central database. Assess the reliability of protection mechanisms.***

Moreover, we will not deal with a very important aspect of the design - the definition of integrity constraints (except for the primary key constraint). The fact is that when using a database with developed mechanisms of constraints (e.g., SQL-based systems), it is difficult to recommend a general approach to the definition of integrity constraints.

The requirement for protection against illegal access to the cryptography

means is a part of information systems

The following security mechanisms should be provided in automated

information systems in which implemented program or information security

cryptography hardware means are realized in case of information storage and

processing:

- identification and authentication of users and subjects of access;

- access control;

- integrity support;

- registration and account

***15. Give an example of a hardware data protection. Explain the concept of 50 security audit.***

Data Protection is a set of measures aimed at ensuring information security. The continuity of data protection throughout the cycle of its storage and processing is an important aspect. Accessible storage of data backup can be considered as an example of a violation.

Functional Requirements. Functional requirements are grouped into general

criteria on the basis of performing a certain role. In total, the general criteria defind

11 functional classes, 66 families and 135 components. Classes of functional

requirements:

 identification and authentication;

 user data protection;

 protection of the safety functions (related to the integrity and control of

service and security mechanisms);

 security management (related to to the attributes of management and security

settings requirements);

 security audits;

 access to the evaluation object;

 privacy (user protection against disclosure and use of his identity);

 resource utilization (demand access to information);

 cryptographic support;

 communications (authentication of the parties in the exchange of data);

 trusted path / channel (for communication with the security services).

**16*. Expand the classification of information security. Name the information protection services: ensuring the authenticity of the subjects of information exchange, access control, ensuring privacy and confidentiality of information, ensuring data integrity.***

Legislative measures provide a level of legal support of information security measures. There are two groups of measures:

 Measures aimed at creating and maintaining a negative social attitude toward violations and violators of information security;

 Directed and coordinated measures that improve the level of knowledge in the field of information security, to help in the development and distribution of security products.

Security Policy

*  Requirement 1. The security policy. The system should strictly comply with the security policy. The subjects’ ability to access objects is defined based on their identifiers and access management requirements.
*  Requirement 2. Tags. Objects must be associated with security criteria, used as the initial information for access control procedures. The system should provide the ability to assign each criterion that defines the degree of confidentiality and modes of access to the object. Accountability
*  Requirement 3: Identification and authentication. All businesses should have a universal identifier. Access control is based on the identification of subjects and objects and differentiation rules. Identification and authentication tools must be protected from unauthorized access.
*  Requirement 4. The requirement for registration and control. For the determination of the responsibility of users, all occurring events in the system, significant for safety must be monitored and registered at a secure protocol.
*  Guarantees (correctness)
*  Requirement 5. Control of accuracy of security tools. Security tools should include independent hardware or software components that provide performance of security features. The basic principle of accuracy control is that the means of control are independent from the security tools.
*  Requirement 6. Protection sustainability. All tools must be protected from tampering or disabling. This requirement must be observed in any mode of operation of the security system and the computer system in whole.

***17. How was the Internet created?***

The Internet was originally planned by the Advanced Research Project Agency (ARPA) of the U.S. government in the 1960s.

***18. Is it possible that the Internet has no central governing body? Is it true?***

There is no central authority that controls the Internet; different organizations own different pieces of it.

***19. How does DNS organize the Internet?***

As a general rule, in accordance with the agreement, the host names usually begin with a site "www", although they may as well start with something else - for example, "server", in "server.iitu.kz." The last node of this symbolic name, "kz", adheres to the Domain Name System (DNS) - Agreement on the identification of a resource, located on the territory of the Republic of Kazakhstan with the suffix "kz".

***20. What is the difference between the IP address and the domain name?***

A domain name is a name for an IP address of a website. Since IP addresses consist of a combination of numbers, domain names are a way for people to remember where a website can be found without having to memorize combinations of numbers and periods.

***21. How is correlation of the network clients executed?***

If earlier, a computer network was used only as a transmission medium of files and e-mail messages, then more complex problems of distributed access to resources are solved today. This access assumes separation of the server (from English – to serve, service), a powerful computer as a control unit servicing a network access to information arrays of the computer network and computers of clients of the computer network, users of information arrays.

The technology of the distributed access is also called the client server technology.  
In the client-server configuration, the application client requests information from the application server or asks the server to carry out some task. If you launch a web browser on the computer and you use this browser to view web pages from other computers, your browser is considered the client. When the user requests some information from other websites using a browser, the website which provides information is known as a server.

Server applications, as a rule, are launched on powerful computers as they should be able to serve parallel queries from many clients. On the other hand, the clients’ applications are mostly executed on less powerful computers, such as PCs or workstations.

To publish a web site, either a static or a dynamic Web server is necessary.

***22. What is web structure?***

Web browsers allow us to view a Web page, which is, as you know, what you are currently reading. A Web page is "written" in a formatting language called HTML. When we view a Web page, we normally do not see the elements of this language. The HTML code is written in a text document. HTML consists of special formatting constructs called tags that tell the browser how to display the contents of a web page. Some of these tags can create connections with other computers on which information (such as the text or images) for display on your computer can be transferred.The web page consists of three parts: the title which specifies the version of HTML, the title which contains the technical information, and a web page body.

***23. What is the difference between a static and a dynamic Web server?***

**The static Web server** consists of the computer (hardware) with the HTTP (software) server. It is called static because the server sends the files placed on it to the browser "as it is".

**The dynamic Web server** consists of a static Web server and an additional software, most often, application servers and databases. It is called dynamic because the application server changes source files before sending them to your browser on HTTP.  
  
***24. List the main HTML components.***

The characters that we add to the text in order to specify to web browsers on how to display this or that text are called tags. There are many types of tags. Each tag consists of a couple of angle brackets (<and>, also known as mathematical operators "it is less than" and "it is more than"). Some tags represent a couple of opening and closing parts which follow the <tagname> and </tagname> syntax with the ending tag which is distinguished by a forward slash (/) after the open angle bracket (<).

An HTML document should begin and end with the following tag pair: immediately after the <html> tag there should be the tag pair to denote the document header:

<head>

</head>

In between, the <head> </head> pair there should be the <title> </title> tags. The title of the document is specified within them. This title will be displayed in the title bar of the Web page.For example:

<html>

<head><title>My first web</title></head>

<body></body>  
Almost all of the Web page's content will come between the beginning and ending BODY tags ("<body>" and "</body>").  
There is also a tag type such as "comment". If, for example, we create a web page and want to put something (note, note, etc.) in the content of the page, but we DO NOT want this to be displayed by the browser, we can achieve this by placing comment tags inside a pair. Comment tags consist of a start and end character sequence ("").For example: <!-- This is a comment. -->.

***25. What types of the URL links do you know?***

A Uniform Resource Locator which is more commonly called as "URL" (pronounced "U-R-L"), is the address of a specific Web resource,and, typically, a URL has three elements.  
The first of these elements consists of an identifier that identifies the communication protocol to be used to access the resource of the URL addresses, and this identifier is followed by a colon (:) and two slashes (//).The most common protocol identifier found in URLs is "http" (which stands for Hypertext Transfer Protocol); therefore, a large percentage of the URLs you will encounter begins with http://. Other common protocol identifiers you will come across are "file" and "ftp", such as in file:// and ftp://.  
The second element of a URL is the name of the machine hosting the resource, for example, “www.iitu.kz”. It is a symbolic name given in the computer of the IITU (International University of Information Technologies). This computer is the web server of University and a computer that stores information about the university. As a general rule, in accordance with the agreement, the host names usually begin with a site "www", although they may as well start with something else - for example, "server", in "server.iitu.kz." The last node of this symbolic name, "kz", adheres to the Domain Name System (DNS) - Agreement on the identification of a resource, located on the territory of the Republic of Kazakhstan with the suffix "kz". Below you will see some other DNS agreements which show the suffixes and types of objects that are used. These suffixes are:1)com - commercial organizations, such as Ford or IBM;2) edu - educational facilities;3) gov - Government agencies;4) net - Network Service Provider;5) org - non-profit organizations such as PBS or the Red Cross. In addition, URLs typically include a third element, which is the name of the resource addressed by the URL. This name is specified in terms of a path, such as /courses.html. Thus, a complete three-element URL might look as this: http://www.dl.iitu.kz /courses.html. And, as such, the URL might be interpreted this way: using hypertext transfer protocol, retrieve the file on www. dl. iitu.kz /courses.html.

***26. What are the web standards?***

Web standards are rules and guidelines established by the World Wide Web Consortium ( W3C ) developed to promote consistency in the design code which makes up a web page.

***27. What types of attacks at Web servers do you know?***

- SQL-Injection;

- Harmful advertizing;

- Method of readdressing the results of operation of the search server; - Through the virtual hosting companies;

- Through vulnerabilities of the program servicing forums;

- Cross-site scripting.

***28. What influenced the emergence of cloud computing concepts?***

Initially, the cloud computing concept was greatly influenced by the technology of distributed computing (grid computing).

***29. What are the main characteristics of cloud computing?***

* Self-service on demand;
* Universal access network;
* Resource pooling;
* Elasticity;
* Accounting for consumption.

***30. What trends in the development of infrastructure solutions have led to the concept of cloud computing?***

* computers productivity growth;
* invention of multi-core and multi-processor computer systems, the development of blade systems;
* development of systems and storage area networks;
* infrastructural consolidation.

Currently, there are four major categories in the IT-industry – cloud computing, users’ mobility, big data and social systems. The concept of cloud computing is the result of evolutionary development of information technology over the past few decades and the answer to the challenges of modern business. Analysts from Gartner Group (Gartner Group) have referred to cloud computing as the most promising strategic technology of the future, predicting the transfer of information technology into the “cloud” in the next 5-7 years. Cloud computing is a service that provides a remote user with an access to hardware capacity or software. Cloud computing is a sort of analogue to email services such as Gmail or Hotmail, where every user can store all the e-mails, personal data, files and software on their servers. The following infrastructure solutions have heavily contributed to the emergence of a cloud computing concept: -computers productivity growth; - invention of multi-core and multi-processor computer systems, the development of blade systems; -development of systems and storage area networks; -infrastructural consolidation;

***31. List the stages of the development of cloud computing.***

1. Mainframe is a host computer center with large internal and external memory or mainframe. It is an all-purpose, high-performance, fault-tolerant server with significant input-output resources, large volume of operational and external memory for the use in the mission-critical systems with intensive packet and operational transaction treatment.

2.The new type of a server of the XXI century was created to solve these problems, a modular server which is often called Blade-server or Blade. According to the definition given by the analysts from IDC, Blade-server or blade is a modular single-board computer system that includes a processor and memory. The blades are inserted into a special chassis with a backplane providing them a network connection and power supply.

3. Another feature of the current development of computer systems is the development of specialized systems and Storage Area Networks (SAN). Today, storage systems are one of the key elements on which the business continuity of a company depends on. In current corporate IT infrastructure data storage systems are usually separated from the main computing servers adapted and configured for a variety of specialized tasks. Storage systems implement a variety of functions and play an important role in building the operational backup and data recovery, failover clustering, issues of high availability, and virtualization.

4. Consolidation is the first step to the “cloud”. One of the characteristics that describes cloud computing is a general infrastructure. In order to start to use “cloud” technology the companies first of all have to solve the problem of their non-consolidated IT infrastructure. It is clear that without consolidation it is impossible to build an effective process-oriented management.

***32. What is meant by virtualization?***

The process of virtualization is based on the possibility of one computer to do task of multiple computers by distributing its resources across multiple environments. Moreover, virtualization makes possible to host multiple operating systems using virtual servers, virtual desktops and multiple applications at a single location. Virtualization means running multiple/virtual computers on one physical computer. Virtual Machine is a fully isolated software container that works with its own operating system and applications like a physical computer. The virtual machine acts just like a physical computer and contains its own virtual (i.e., software) RAM, hard drive and network adapter. The main features of virtual machines are:

- Compatibility. - Encapsulation. - Hardware independence - Isolation.

***33. What are the main varieties of virtualization?***

The main varieties of virtualization are: - server virtualization (paravirtualization and full virtualization);Server virtualization is becoming the most popular solution in the IT market. Server virtualization means running multiple virtual servers on a single physical server. Virtual computers are servers or applications running on the host operating system that emulates the physical server device.

- virtualization at the level of operating systems; Virtualization at the level of OS kernel (operating system-level virtualization) involves the use of the host OS kernel for the creation of independent concurrent operating system environments. For the guest software it is its own network and hardware environment.

-application virtualization;The virtualization of application involves the use of a model in which each virtualized instance of the application is used: files (including system), registers, fonts, INI-files, service of COM-objects. This application works independently without making any changes to the operating system being executed without installation of procedures in the traditional sense and can be run directly from the removable media (such as flash memory cards or network folders). This technology can be used on one computer in the same operating system running several incompatible applications at the same time

-presentation virtualization;The way of virtualization is understood as emulation of a user’s interface, i.e. a user sees the application and works with it on his/her device, although in fact the application runs on a remote server transmitting a picture of the remote application. Depending on the mode the user can view the remote desktop and application running on it or only the application window itself

***34. What are the ways to provide services?***

Cloud computing represents a system of software and hardware services available to users via the Internet or a local area network in a user-friendly interface for remote access to selected resources.Cloud computing offers the following web services: - Infrastructure as a service (IaaS); - Platform as a service (Paas); -Software as a service (SaaS); -Hardware as a Service (HaaS); - Workplace as a Service (WaaS); -Data as a Service (DaaS); - Security as a Service (SECaaS).

***35. List the advantages of cloud computing.***

One of the key ideas of cloud computing is to give customers flexibility to move data between own and rented IT infrastructure. Currently, cloud infrastructure is mainly deployed on servers and data centers where using virtualization technology actually allows any customer to use the computing power absolutely without thinking about technological aspects. Thus, a “cloud” is understood as a single point of access to the calculations of the user. Cloud computing includes cloud service and deployment models for cloud systems. Cloud computing represents a system of software and hardware services available to users via the Internet or a local area network in a user-friendly interface for remote access to selected resources.

--- Shared infrastructure is an ability of virtualization technology to restructure

physical environment. Such connectivity provides less computational

resources and server components, thereby making the solution is more

flexible.

--- Dynamic resource allocation (scalability) is an ability to automatically

allocate additional resources or reduce resources available on request.

--- Network availability is an ability to connect to the external resources.

--- Managed account is an ability to track and manage the consumption of

resources, optimize the use of resources.

Cloud computing involves pooling a large number of computers in a single

computing resource using virtualization technologies through a single computer or

a system of multiple virtual devices used by different users. Thus, the clouds form

a pool of configurable computing resources

**36)** ***What Web services does cloud computing provide?***

According to Figure 3.11 cloud computing offers the following web services: − Infrastructure as a service (IaaS); − Platform as a service (Paas); − Software as a service (SaaS); − Hardware as a Service (HaaS); − Workplace as a Service (WaaS); − Data as a Service (DaaS); − Security as a Service (SECaaS)

***37) What levels of components are provided by IaaS?***

IaaS providers supply the components of the following levels: • virtualization platform for running virtual machines; • hardware (usually grid with a massive horizontal scalability); • computer network (including routers, firewalls, load balancing, etc.); Instead of buying space, servers, software, network equipment, etc. in data centers IaaS customers essentially rent the resources of the IaaS service providers

***38) How many cloud deployment models do you know? List them.***

In addition to various ways of providing cloud services, there are several models of deployment of cloud-based systems to provide cloud resources:

• Private cloud;

• Public cloud;

• Mixed (hybrid) cloud.

Depending on the type of a cloud models can own and manage a service provider and the user or both (Fig. 3.13). In this case the rights of an access to resources may also vary.

• Public cloud – an access to resources is performed by any user with a subscription, from any location, with the Internet access.

• Private cloud - resources are only available to a limited number of users (e.g. employees of a company).

• Public cloud - resources are available to multiple organizations with similar needs in terms of information resources.

• Hybrid cloud – a cloud consisting of two or more different types of a cloud, for example, public and private.

***39) Why is a private cloud used?***

Private cloud infrastructure is intended for the use by a single organization. Private cloud covers the needs of the company’s IT services, its subsidiaries or departments, and/or customers, contractors and others. Private cloud is usually owned, managed and operated by an organization-holder (Fig. 3.14). Private cloud has the flexibility to reallocate available computing power and load data in a shared infrastructure according to the needs to ensure optimal performance and reliability required.

Private clouds are a viable option when: • The entire business is built on the applications and data, the level of data protection requirements is critically high. • A business belongs to one of the sectors such as military industry or public sector where security and privacy requirements are historically very high. • The company is large enough to create its own modern data center and be profitable.

***40) What are the four main types of cloud services provided by Windows Azure?***

Windows Azure cloud services provide companies with four basic types:

• computing services;

• network services;

• data processing services;

• application services.

Microsoft Azure is Microsoft's cloud platform. Provides the ability to develop, run applications, and store data on servers located in distributed data centers. There are four main types of cloud services provided by Windows Azure.

1) Cloud computing and its services: Cloud computing and its services (for example, computing power or storage) can be compared to utilities. Just as water and electricity consumption changes in hot or cold weather, so the consumption of services provided by "cloud" platforms can increase or decrease depending on the increase or decrease in loads.

2) Software as a service: the software as a Service (SaaS) model provides the ability to lease applications. Software as a service includes platform as a service and infrastructure as a service. An example of an application as a service is the Business Productivity Online Suite.

3) Platform as a service: the Platform as a Service (PaaS) model provides the ability to lease a platform that usually includes an operating system and application services. The platform as a service facilitates the development, testing, deployment, and maintenance of applications without the need for investment in infrastructure and software environment. The platform as a service also includes infrastructure as a service. An example of a platform as a service is Windows Azure.

4) Infrastructure as a service: Model for providing infrastructure (hardware resources) Infrastructure as a Service (IaaS) provides the ability to lease infrastructure resources such as servers, storage devices, and network equipment. The entire infrastructure is managed by the service provider, and the consumer only manages the operating system and installed applications. These services are usually paid for based on their actual usage and allow the user to increase or decrease the amount of infrastructure used through special portals provided by service providers.

***41. Describe the procedure and terms of the transfer of the system to the cloud***

The way of virtualization is understood as emulation of a user’s interface,i.e. a user sees the application and works with it on his/her device, although in fact the application runs on a remote server transmitting a picture of the remote application. Depending on the mode the user can view the remote desktop and application running on it or only the application window itself.Business needs are changing our understanding of the workflow. Real user tool is software that is tied to a PC and makes it an intermediary for the corporate information system. As a result, cloud computing is developing successfully, where users have an access to their own data, but do not run and think about the infrastructure, operating system and proprietary software with which they work.

***42.What is the purpose of the Data Centers?***

- The main task of data centers is to provide a guaranteed uptime of the enterprise information system with the specified levels of availability, reliability, security and manageability. Experience of data center creation allows backup headquarters of enterprises maintaining the possible highest functionality of the information system while emergency. To maximize business efficiency, the executives know that it is better to spend a little more money to modernize the processes than to lose a huge amount in case of unexpected circumstances.

Therefore, a data center should solve a number of basic tasks:

- storing and analyzing large amounts of information;

- ensuring security of IT-systems;

- maximazing data availability;

-testing the reliability of the systems;

- ensuring the integration of distributed systems;

-ensuring the smooth operation.

***43.What is meant by mobile technology?***

-Speaking about mobile technologies, generally all kinds of gadgets, applications, processors, displays, batteries are involved. It is difficult to assess the impact of mobile technology in our daily lives. They penetrated into all spheres of our life, and their role is growing. The availability of all kinds of smart phones, tablets, e-readers, smart watches and glasses contributes to their rapid spread around the world and all the billions of mobile devices have a major impact on quality of our life. In a short period of time the development of the first mobile phones has undergone significant changes. The first mobile systems were based on the principle of analog communication systems. The first cell phones were used only as an alternative to the usual analog terminals. The first "handsets" steel cordless phones are so-called the first generation of 1G cellular. 1991 is the birth of generation of 2G cellular communication. 3G standard was developed and began to be implemented in 2000, and by 2008 4G format had been developed.

***44. List generation mobile technologies and overview the history of the development of generations.***

**-** The history of the development of wireless mobile technology began since the introduction of several innovative network technologies in the 1980s: AMPS in the United States and the combination of TACS and NMT in Europe. Although several generations of mobile services existed before, AMPS triple, TACS and NMT are considered the first generation - «1G», because these technologies have allowed mobile phones to become a mass product. In the generation of mobile technologies the letter «G» means the generation, 1G - analog cellular, 2G -DIGITAL cellular communications, digital 3G- widely way cellular communications, switched multi-purpose computer networks, including the Internet), 4G - wireless high-speed data network of new generation.

***45.What services are provided by mobile technology of 3rd generation?***

The primary task of the third generation network was to improve the quality of the second-generation networks adding a variety of new services.

The third-generation technology (3G - wideband digital cellular) provides high-quality sound transmission (speech), images, multimedia content; the transmission rate has been increased from 9.6 kbit / s to 2 Mbit / s. In addition, 3G meant Internet access and data exchange between the PC and mobile phone. CDMA2000 standard is the third generation of cellular standards (3G).

***46.What functions can 3G mobile generation technology perform?***

The simplest 3G phones will be used primarily for telephone calls saving all the information on the network, more complex models will be able to support video streams, providing the user with news and online content, information centers, which will allow you to download information from the internet and save it to the device. A wireless keyboard, replacing the cutting-edge electronic organizers, will manage the most complex devices. Experts call all the possible new functions of the new 3G mobile applications, up to voice control, not to mention the transmission of streaming video at high speed. The most used feature in all usual cell phone was and still is the possibility of sending SMS. Features of new generation of 3G phones are not limited to sending a text message longer than 160 characters. Sophisticated mobile applications allow users not only to write about favorite team goal, but also to send a postcard-picture, as well as an audio file, where the winning roar from the crowd will be recorded. The latest 3G phones will be able to be controlled via the network, so mobile operators can provide their customers with a wider range of mobile applications.

***47.What is soft for mobile and the parts of soft?***

Software for mobile is software designed to be installed on the mobile phone, smart phone, to expand and complement its functionality. Any device without software is a meaningless piece of iron.

Software connects wires and chips in a single well-functioning system.

The basic software for mobile:

* OS;
* office programs;
* anti-virus software;
* graphic editor;
* games in Java and so on.

Mobile operating system is a system that allows the All-phone to do a full PC.

Operating systems are installed on smartphones and communicators to ensure quality of work. In recent years, the mobile market has been flooded with software solutions running on Windows, Android and Bada. Choice of a mobile phone depends on the operating system installed on it.

The main operating systems for mobile phones are:

* Android - mobile OS developed on the Linux kernel by Android Inc., which is currently absorbed by Google.
* Bada — platform developed on Samsung Hand-Held Platform by Samsung. It should be noted that Bada is still not operating, but more open-platform
* Maemo is based on Debian Linux. It is a platform for mobile devices, which is more commonly used in tablets and communicators Nokia. At the heart of Maemo is Gnome components, including the graphics library gtk. Applications for Maemo are often free of charge
* Palm webOS — exotic mobile operating system of Palm, which was created for the smartphone Pre and Pixi. Palm web OS platform is optimized for touch screen devices
* Apple iOS (iPhone OS) is an operating system for mobile devices based on Apple's Mac OS X. It is installed on the iPhone, iPod Touch and iPad. Apple iOS is created on the Darwin kernel, which in its turn is based on the Mach microkernel.
* Windows Mobile is a mobile operating system running on a number of devices, which include Pocket PC, namely smartphones and communicators.

Office applications allow you to work with text, tables, facilitate record keeping, systematize data, provide a comfortable transfer of information, etc. Antivirus protects your device from malware. Graphic programs offer the opportunity to work with photos, create images and graphics regardless the level of complexity. The most common mobile software is games, players and browsers.

***48.What are the main OS of mobile phones of 3rd generation?***

The third-generation technology (3G - wideband digital cellular) provides high-quality sound transmission (speech), images, multimedia content; the transmission rate has been increased from 9.6 kbit / s to 2 Mbit / s. In addition, 3G meant Internet access and data exchange between the PC and mobile phone.

***49. List the basic functionality of modern smartphones.***

The third generation of mobile technology includes:

* IP-telephony;
* voice calls;
* video telephony;
* audio / video streams (video filming, photography, television);
* mobile office;
* Web browsing;
* services associated with the subscriber's location (navigation in an unfamiliar place), guides and maps, security);
* games;
* Mobile e-commerce (search and selection of products, services, products payment).

The third-generation standards enable to provide a wide range of multimedia services and support data rates up to 14Mbit / sec.

***50.What application is used for the development of functionality of mobile phones and games*?**

Flash for mobile and Java applications for mobile

***51.What functions can flash for mobile perform?***

 View flash – with this function it is possible not only to get, send flesh cards, but also to play videos, watch cartoons;

 design the appearance of the phone – in this case, it is necessary to use the flash screensavers, screen servers, menus, etc.

 games in flash which are gaining more and more popularity;

 mobile encyclopedias and dictionaries developed in flash.

 Programs for training on the basis of mobile devices;

 Dynamic sited in flash which allows you to implement a dymanic polling remote server. These features allow you to actively interact with the web services.

***52. What does the term "multimedia" mean?***

Multimedia is a modern computer information technology which allows combining text, sound, video, graphics and animation in a computer system.

Today, multimedia are multiple information mediums: interfaces providing input/output information of various types into the computer, computer creation, processing and display of information of different levels and structures for the perception by various organs of human senses simultaneously.

***53. What are the main components of the multimedia application? Is it necessary to have all the components?***

Main media:

- Binary media including processor instructions, a binary code and data files;

- Contact media comprising tactile, strain gauge, electric contact, capacitive

and other touch media serving to enter the mechanical code and a space-dependent

information;

- Text media which are text data for people, software texts for interpreters,

other textual information;

- Audio streams representing audio files, digital audio series, sets of musical

audio and other types of digital audio;

- Graphical media which are drawing files, photos, and other two-dimensional

graphic information;

- Video streams representing video and dynamic series of graphic

information;

- Virtual reality which is an interactive 3D-video stream.

***54. What is the difference between preparation of materials for printing for the Internet and for multimedia applications?***

There is no difference in the quality of the resulting images on the screen or

on paper when printing. JPG format compresses the file almost 5 times compared

to the extended format of BMP. TIF format retains not only the integral image but

also layers (parts) and channels which were previously used.

***55. Can the web-site be considered as a multimedia application?***

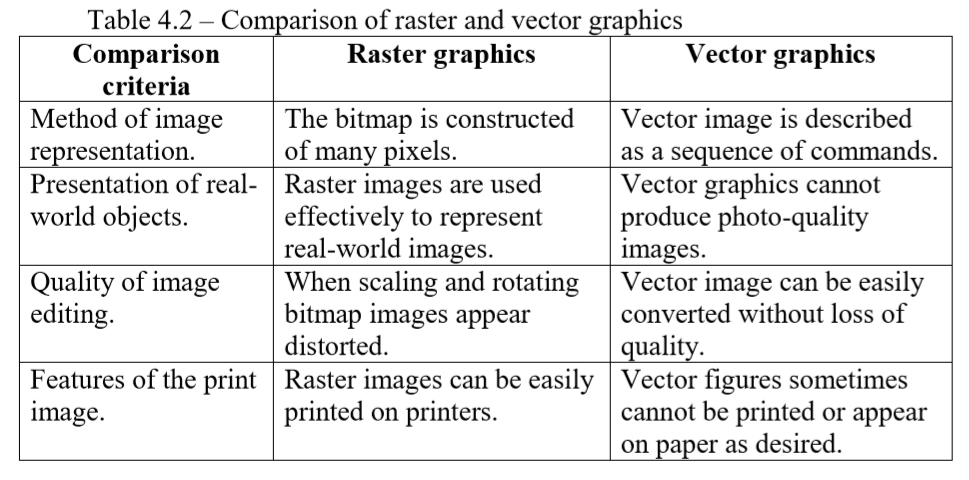
- multimedia presentations (held on the stage or via the Internet through the use of webinar service for online broadcasting and Power Point program, for example, to create a slide show);

- multimedia Internet resources (Internet resources that contain information presented through multimedia technology. For example, YouTube service enables users to upload their own videos which will be available for viewing and downloading to other users of the service).

***56. What are the main differences between raster and vector graphics? What are the most common formats of vector and raster graphics?***

Computer graphics is divided into vector, raster, 3D-graphics and fractal graphics. Vector Graphics is intended to create decoration and drawings, and to a lesser extent, for their processing. In the vector graphics the main point is the form of the object. Design possibilities based on the use of fonts and simple geometric forms (lines) by means of vector graphics are much less. The quality of vector images when magnified is not changed. Vector graphics is widely used, for example, in mapping where it is required to enlarge individual parts by many times without losing quality. Here, the image is made up of lines and curves which are called vectors and have such properties as color and location coordinates. Vector image is not dependent on the resolution

Raster graphics is used in processing publications and printing. The smallest element is a dot on paper or pixel on the screen. However, the disadvantage is its deterioration with the increase - there appears a "grain" on the image - the effect of pixilation. Raster graphics always operates a two-dimensional array (matrix) of pixels. Each pixel is mapped to a value - brightness, color, transparency or a combination of these values. Raster image has a certain number of rows and columns.



**Review questions**

**Part 5**

1. **What is meant by the database? What is the difference between a database and a simple set of data?**

There are various definitions of the database (DB). Most often, the database refers to a named set of structured data related to a certain subject area.

There are three features which distinguish the database from a simple set of

data:

- The DB is stored and processed on a computer system.

- The data in the database is well structured, i.e. it highlights the main

elements of the types and relationships between the elements, as well as the

restrictions on the permitted operations.

- It provides data search and data processing.

1. **What is the database system? What are its components?**

The Database System is a computerized system of structured data. Its main purpose is to store information and provide it on demand.

There is a single-user and a multi-user system. A single-user system is a system, in which the database can be accessed by only one user at a time.

A multi-user system is a system, in which the database can be accessed by multiple users at a time. The main objective of such a system is to allow the user to work with the database as a stand-alone.

**3. What are the main elements of the database?**

Typically, the database system is divided into four main elements:

• Data.

• Hardware.

• Software.

• Users.

**• Data** Data in the database can be described as integrated and shared. Integrated data can be represented as the union of some separate files, totally or partially nonoverlapping. Certain data sections of a general database may be accessible to several different users.

**• Hardware** This includes: - a storage facility for storing information together with I/O devices; - a processor with the main memory, which is used to support the operation of the system software.

**• Software** The main part of the software is a database management system (DBMS). The main function of the database is providing the user with an opportunity to work with the database without going into detail into the hardware issues. The DBMS supports a high level of user operations. These operations include operations that are performed using an SQL (Structured Query Language), which is a special database language. The main database is the main but not the only component of the system software, referred to others can be utilities, application development tools, reporting tools, etc.

**• Users** There are three groups of database system users: - Application programmers. For the application development purposes that use the database, they apply a variety of languages and programming environments: Visual Basic, C ++, Java, C # and others. Applications programmers have an access to the database by issuing an appropriate request to the database (usually, SQL operators).

**4. What is the data model? What are the main components of the data model?**

**Data model:** The core of any database is the data model, which is a set of data structures and their processing operations.

Consequently, the **major components** of the data model are: data structures, operations on the data, and constraints.

**Data structures.** Structuring of data is based on the use of concepts such as "aggregation" and "generalization". Let’s consider the file systems that implement the "flat file" model with the conceptual basis of the four basic types of logical data structures: a) a field is the smallest named set of data, b) a record is a named set of fields, c) a file is a named set of records of the same type, d) a set of files or a library is a named collection of files that are processed in the system.

**The basic operations on the data.** The dynamic properties of the data model are expressed by a variety of operations that define allowable actions on the contents of the database to convert it from one state to another. This set of operations is related to the language of data manipulation.

**Constraints.** Logical constraints that are imposed on the data are called integrity constraints. DBMS must ensure the consistency of the data by the specified limitation in case of transfer from one state to another.

**5. Name the existing data models. What are the differences between them?**

*The hierarchical data model*

The basic concepts of a hierarchical data model are: the level, the node (or the element) and communication.

*Network data model*

The elements of this model are level, node and connection.

*Relational data model*

The relational data model is a way of presenting the data in a tabular form.

**6. What are the levels of the database architecture? Give definition of each level.**

There are three main levels of the DB architecture:

- *Inner layer (also called natural)*, storage means are associated with the information on the physical devices. The internal rate shows the physical elements for storing information.

- *Exterior layer (also called the user)* associated with the methods of presenting the data for individual users (the application programmer or the end user).

- *Conceptual level (also called logical)*, an ‘intermediate’ level between the first two. It views all database information in a more abstract form. At this level the actual data is stored regardless of its presentation.

**7. Name the main levels of the database design. What problems are solved when designing databases?**

During the database design two major problems are solved: - How to display the domain objects in an abstract data model when the objects on this map do not contradict the semantics of the subject area and are the best possible (efficient, convenient, etc.) This problem is often called the problem of logical database design. - How to ensure the effectiveness of a query to the database, bearing in mind its specific features, by placing the data in the external memory, creating any additional structures (e.g. index), etc.? This problem is called the problem of physical database design.

**8. What is a normalization? How many normal forms are there?**

In the theory of relational databases the following sequence of normal forms is recommended:

- First Normal Form (1NF);

- Second Normal Form (2NF);

-Third Normal Form (3NF);

- Normal Form Boyce-Codd (BCNF);

- Fourth Normal Form (4NF);

-Fifth Normal Form or Normal Form of projection connection (5NF or PJ / NF).

The basic properties of normal forms:3

**9. What stages of work with database technologies are there?**

Techniques of working with databases involve several steps:

- Construction of an Infological base model;

- Creation of the structure of database tables;

- Processing data contained in the tables;

-Display of information from the database.

**10. What is the SQL language? What is the basic structure of the SQL language?**

The SQL (Structured Query Language) is a standard query language for working with relational databases. The SQL language appeared after the relational algebra, and its prototype was developed in the late 70s at IBM Research Company. It was implemented in the first prototype of a relational DBMS by the IBM System R. company. Further it was used by many commercial database systems and due to its wide use it gradually became a ‘de facto’ standard for the languages to manipulate data in relational database languages.

Unlike relational algebra, where operations were only queries to the database, the SQL is a complete language. It contains not only query operations, but also the operators corresponding to Data Definition Language (DDL), which is a data description language. In addition, the language contains operators for managing (administration of) the database.

**11. What are the basic SQL operators?**

CREATE TABLE, DROP TABLE , ALTER TABLE, CREATE VIEW, ALTER VIEW, DROP VIEW, CREATE INDEX, DROP INDEX ,DELETE ,INSERT, UPDATE, SELECT ,OPEN, FETCH, CLOSE ,PREPARE, EXECUTE

**Review questions**

**Part 6**

1. **What is a Data Mining? What is the significance of DM application in some modern fields of science and business dealing with large Databases (Big Data).**

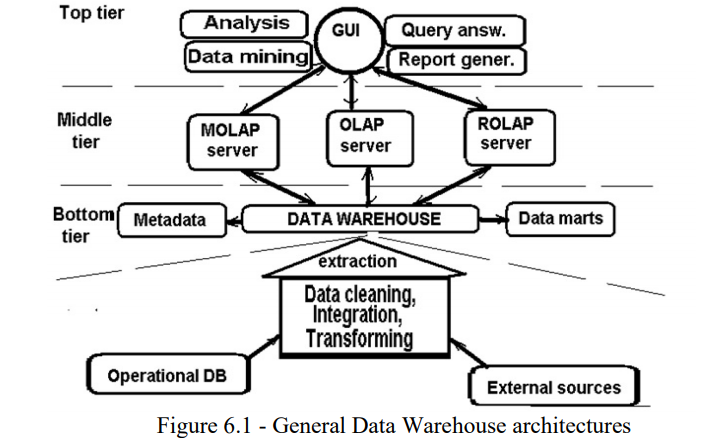
Data mining is a process of performing automated extraction and generating predictive information from large data banks. DM includes analysis of (often large) observational data sets to find unsuspected, previously unknown relationships and summarize the data in new ways that are both understandable and useful for the data owner.

Relationships and summaries derived through a data mining are often referred to as models or patterns. Examples include linear equations, rules, clusters, graphs, tree structures, and recurrent patterns in time series. It should be noted that the discipline typically deals with data that have already been collected for some purpose other than the data mining analysis (for example, they may have been Collected in order to maintain up-to-date record of all transactions in a bank). This means that the objectives of the data mining usually play no role in the data collection strategy. This is one of the ways in which it differs from many statistics in which data are often collected by using efficient strategies to answer specific questions.

1. **Give the main differences between Date Warehouse and conventional Database System.**

DM, popularly referred to Knowledge Discovery in Databases (KDD), is the automated or convenient extraction of patterns representing knowledge implicitly stored or captured in large databases which can contain millions of rows related to Database subject, Data Warehouses, Web, other massive information repositories or data streams.

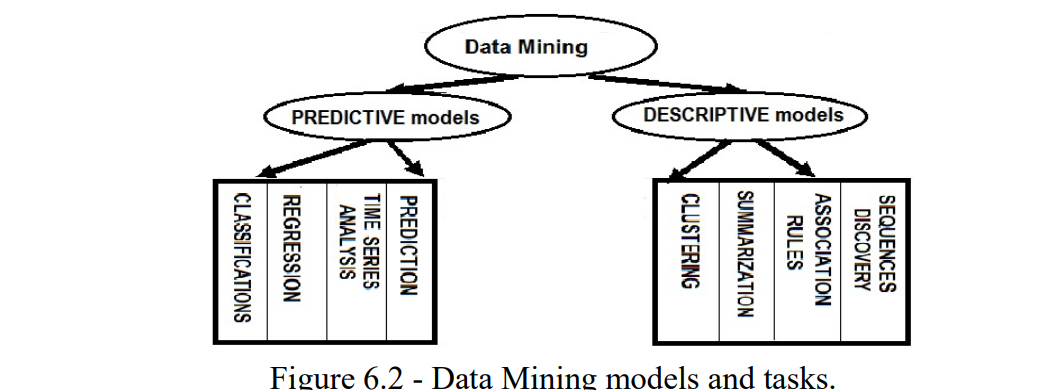
For example, Figure 6.1 illustrates the place of DM in the Data Warehouses (DWH) architectures.

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So, readers (who we suppose know about Database system structure) can recognize main differences between conventional Database System and DWH which include Data Mining, Analysis (as parts of knowledge discovery in databases),OLAP Engine (Online Analytics Processes instead of or additionally to Online Transaction Processes) DW/Marts servers (set of servers for different departments of enterprises), Back Ground process/preprocessing (e.g. Cleaning – solving problem with missing data, noise data) and etc.

1. **Define and explain the typical DM tasks.**

DM involves many different algorithms to accomplish different task. All these algorithms attempt to fit a model to the data. The model that is created can be either predictive or descriptive in nature. Figure 6.2 represents the main DM tasks used by that type of model.

****

Predictive model enables to predict the values of data by using known results from different sets of sample data.

• Classification enables to classify data from a large data bank into predefined set of classes. The classes are defined before studying or examining data in the data bank. Classification tasks enable not only to study and examine the existing sample data but also to predict the future behavior of that sample data. For example, the fraud detection in credit card related transaction to prevent material losses; estimation of the probability of an employee to leave an organization before project’s end are some of the tasks that you determine by applying the technique of classification.

Essence of a descriptive models is determination of the pattern and relationships in a sample data:

•Clustering is a data processing in some sense opposite to classifications which enables you to create new groups and classes based on the study of patterns and relationship between values of data in a data bank. It is similar to classification but does not require predefining the groups or classes. Clustering technique is otherwise known as unsupervised learning or segmentation. All these data items that resemble more closely with each other are clubbed together in a single group, also known as clusters. Examples include groups of companies producing similar products, or soils having the same properties (eg, black soil), a group of people with the same habits, etc.

**4. Explain several often used DM techniques.**

1. **Statistics** is one of largest branches of mathematics which deals with the collection and analysis of numerical data by using various methods and techniques.
2. **Point estimation**: a process of calculating a single value from a given sample data using statistical techniques such as mean, variance, media and so on.
3. **Data summarization**: a process of providing summary information from a large data bank without studying and analyzing and every data elements in the data bank.
4. **Testing a hypothesis**: a technique of applying sample data to a hypothesis in order to prove or disprove the hypothesis.
5. **Correlation**: a technique of determining the relationship between two or more different sets of data variables by measuring their values.

**5. Explain the 5A process model.**

The 5A begins first by assessing the problem followed by access or accumulation of data related to the problem. Then, it analyses the data using various DM techniques, extracts neccessary information and implements (Act) the results of solving the problem. Eventually, it tries to automate the process of data mining by building proper software.

**6. Explain the CRISP-DM process model.**

CRISP-DM (Cross-Industry Standard Process model for Data Mining proposed by a multinational group of vendors (Denmark, Germany, UK, Netherlands ):

The CRISP-DM process model consists of the following steps (Figure 6.4.):

* understand and collect the objectives and requirements to generate DM definition for the business problem.
* analyze the data collected in the first phase, matching patterns to propose a models for solving the problem.
* create final sets of needful data that are input for various modeling tools. The data are first transformed and cleaned to generate Database.
* select and apply different modeling techniques of DM using the Databases from the previous phase and analyze the generated output.
* evaluate models that you generate in the previous phase for better analysis of the refined data.
* deployment: organize and implement the gained knowledge for the end users.

We will list two other process models without detailed description of their items.

**7. Describe some DM applications for customer services.**

DM applications can be found in various fields in our life. It is useful for small, middle and large organizations that generate large amount of data per day. We will list some examples of DM applications, main goal of which is analysis and management of correspondent activities.

some DM applications for customer services:

* Business
* Electronic (and traditional) commerce
* Computer security Data mining
* Banking and financial processing
* Bioinformatics, Medicine, Health care
* News and entertainment data

**8. Describe DM application in computer security analysis and management.**

- Computer security Data mining enables network administrators and computer security experts to combine their analytical techniques with business knowledge to identify probable cases of fraud and abuse that compromise the security of a computer or a network.

**9. How are classifications used and applied?**

Classification is, perhaps, the most familiar and popular data mining technique with big number of applications including image and pattern recognizing, medical diagnosis, loan approval, detecting crime patterns, financial tendencies. A lot of researches suppose that Estimation and Prediction may be considered as types of classification as well.

Classification algorithms require the classes to be defined based on data attribute values. The classification process is divided into two steps:

* Developing model for evaluating and training data
* Classifying tuples (rows) from target Database.

According to R.L. Kennedy, Yu. Lee, B.V. Roy (1998) there are three basic methods to solve the classification problem:

*  Specifying boundaries: in this method classification is carried out by dividing input database into categories. Each of these categories is associated with one class.
* Using probability distribution: in this method, probability definition of a class at a particular point determined. Consider a class j C , the probability definition at one point i t is ( | ) ji P t C . Here each tuple is considered to have a single value and not multiple values. If the probability of the class is known to be as () j PC then the probability that ti is in the class j C is determined by the formula ( )\* ( | ) jj i P C P t C :
* Using posterior probability: You would like to determine the probability that i t is in a class j C , where i t is a data value. In this method for classification, the posterior probability for each class is computed and then ti is assigned to the class with highest probability. The formula for posterior probability is denoted as ( | ) j i P C t .

**57) what programs are used for working with bitmap graphics?**

Raster graphics-used in the development of printed publications and their processing. The smallest element is a dot on paper or a pixel on the screen. The most famous raster programs are GIMP 2.2.8; Adobe Photoshop Microsoft Paint;

**58) what are the main parameters for digitizing the footage?**

Digital video has five main characteristics: resolution, frame rate, color depth, bitrate (video stream width), and image quality.

**59) . What are the known digital video formats?**

VHS (Video Home System – - analog video format, 240 240 TV lines.

DV (digital video) - digital format, 500 500 lines. The video image and audio in DV format are written separately.

Advanced advanced system Format (ASF) Is the preferred Windows Media file format.

Audio-video interleaving (AVI) is a special type of resource exchange file format. The AVI format was developed by Microsoft.

Quick QuickTime (mov) - Apple Apple for creating ,editing, VIEWING, and PUBLISHING MULTIMEDIA FILES

FLV (Flash Video) - RT RTMP connections.

UVI and many others. SWF (Shockwave Flash) - Adobe Adobe Flash, Flash Flash.

M2TS files are a Blu-ray video file used for the format container and Blu-ray Audio-Video disc (bdav formats) of the MPEG-2 transport stream. It.

M4V files are a video file downloaded from Apple's iTunes store that includes TV shows, full-length movies, music, and videos.

3GPP (third-generation partner project) is a format developed for using video on mobile phones, in third-generation cellular communications as a format for multimedia files.

**60) What programs are used for assembling and installation of multimedia applications?**

When developing a multimedia application, it is necessary to take into account that objects depicted in different colors and against a different background are perceived differently by a person.

An important role in organizing visual information is played by the contrast of objects with respect to the background. There are two types of contrast: forward and reverse. With direct contrast, objects and their images are darker, and with the opposite - lighter than the background. In multimedia applications, both types are usually used, both separately in different frames, and together, within the same picture. In most cases, the opposite contrast dominates.

Preferred is the work of multimedia applications in direct contrast. Under these conditions, an increase in brightness leads to improved visibility, and if it is reversed, it worsens, but the numbers, letters and signs presented in reverse contrast are recognized more accurately and faster than in direct contrast, even at smaller sizes. The larger the relative sizes of the parts of the image and the higher its brightness, the smaller the contrast should be, the better the visibility. The comfort of perceiving information from the monitor screen is achieved with a uniform distribution of brightness in the field of view.

**61) What is the «shockwave»? What are the areas and features of the application?**

SWF (Shockwave Flash) is extension of animation created with Adobe Flash and video in flash format. It is played by browsers using Flash Player. Flash videos are also widely disseminated on the Internet.

**62) How is synchronization of video and audio in the project implemented?**

This feature simplifies the process of synchronizing audio and video recorded separately for users (this process is sometimes called dual-system recording). Using the Combine Clips command, you can select a video clip and synchronize up to 16 audio channels with it. The clips that make up the merged clip are called “component clips”.

Clips can be combined into groups by selecting them either in the Project panel or in the Timeline panel. The “Combine Clips” command can be executed either using the “Clip” menu or from the context menu. This command depends on the context, so you need to select several clips to make it available.

You can combine one or more sound clips with one video clip or AV clip. The total number of audio tracks allowed in the combined clip is 16, including any combination of monaural clips, stereo clips, or 5.1 surround clips. One monaural clip will be counted as one track, one stereo clip as 2 tracks, and 5.1 surround clips as 6 tracks.

***63. What parameter characterizes the degree of compression of the audio stream?***

Stream speed (bitrate) – the number of bits used to store one second of multimedia content. It characterizes the compression rate of the stream, the bitrate is used to estimate the stream transfer rate in bits or kilobits per second, typical values are 64 kbps, 128 kbps,..., 320 kbps. For Audio DVD, the bitrate can reach 6912 kbps.

***64. What is a codec?***

There are dozens of different formats of audio files. Many manufacturers of digital recording devices develop their own formats for storing audio data. Codecs are installed in computers so that digital processing programs could “understand” new formats.

***65. What are the main characteristics of the video?***

Digital video has five main characteristics: resolution, frame rate, color depth, bitrate (video stream width), and image quality.

**66. List the major video file formats.**

VHS(video home system) is an analog video format. The features pf which wre limited to resolution of 240 TV lines.

DV (Digital video) is a digital format which provides a resolution of 500 lines. Video and audio in DV format are written separately. This gives a possibility to add sound after the completion of recording or video editing, and also to rerecord the sound. The DV format offers the highest quality photo and video shooting and allows you to save all the data in digital form on tape, memory card or computer hard drive

Advanced Systems Format (ASF) is the preferred Windows Media file format. If you have appropriate codecs installed on your computer, by using Windows Media Player you can play video, audio and mixed recordings compressed using these codecs and stored in the ASF file

Audio Video Interleave (AVI) is a special kind of Resource Interchange File Format. AVI format was developed by Microsoft. AVI format is the most common format for presenting video and audio data to the computer.

QuickTime (MOV) is developed by Apple Inc. for creating, editing, viewing and publishing multimedia files. The files in QuickTime format can contain video, audio, animation, graphics, three-dimensional objects, and objects of virtual reality.

FLV (Flash Video) is a video format for distribution and transmission on the Internet through RTMP-connection. It is used by such host sites like YouTube, RuTube, Tube.BY, Google Video, Movie and etc.

SWF (Shockwave Flash) is extension of animation created with Adobe Flash and video in flash format. It is played by browsers using Flash Player. Flash videos are also widely disseminated on the Internet.

M2TS is a video file of Blu-ray format used for the format container Blu-ray Disc Audio-Video (BDAV) MPEG-2 Transport Stream. Its operation is based on the use of the transport stream MPEG-2 container. The main purpose is storing video on Blu-ray discs.

M4V is a video file downloaded from the Apple Itunes store that includes TV shows, feature films, music, and videos. It looks like a MP4 file but may be copyprotected using FairPlay DRM from Apple.

3GPP (Third Generation Partnership Project) is a format designed for video on mobile phones in the third generation of mobile communications as a format for multimedia files.

**67. What is the difference between linear and non-linear video editing?**

Linear editing involves overwriting footage from two (or more) video sources on the video recorder with cutting out unnecessary and "gluing" the desired video scenes and adding effects. The main drawback is quality loss, high labor intensity and a large number of video equipment.

Nonlinear editing is carried out on the basis of computer systems. In this procedure original video materials are inputted into the computer, and then they are edited. There is no loss of quality during multiple "movements" of videos that can be considered as an advantage and with significant savings of video equipment. Disadvantages are that it is not real time operation, much video processing time, high labor intensity. It has limited amount of recorded video to input into the computer.

**68. Where are multimedia used?**

Multimedia finds its application in various fields including advertising, art, education, entertainment, engineering, medicine, mathematics, business, scientific research, space-time applications, and other information processes involving people

Education. In education multimedia is used to create computer-based training courses and reference books, such as encyclopedias and collections. Training courses allow the user to go through a series of presentations, name of the text and associated illustrations in various presentation formats.

Equipment. Software developers can use multimedia in any computer simulations from entertainment to training, such as military or industrial training. Multimedia for software interfaces are often created as collaboration between creative professionals and software developers.

Industry. In the industrial sector multimedia are used as a way of presenting information to the shareholders, management and colleagues. Multimedia are also helpful in organization of staff training, advertising and sales of the product worldwide through virtually unlimited web-based technology.

Mathematical and scientific research. In mathematical and scientific research multimedia are mainly used for modeling and simulation.

Medicine. Doctors may also practice through virtual surgeries or simulations of the human body affected by a disease, thus, trying to develop techniques to prevent it. Multimedia graphic tools combined with the tomographic technique can effectively study the human body and its organs.

**69. What are the main trends in the development of multimedia technologies?**

Multimedia finds its application in various fields including advertising, art, education, entertainment, engineering, medicine, mathematics, business, scientific research, space-time applications, and other information processes involving people.

Education. Equipment. Industry. Mathematical and scientific research.

**70.What is the basis of smart technologies?**

There is basic intelligence in the form of certain pre-programmed algorithm services and a collection of different databases in the SCP (Service Control Point) of Service Management. SSP (Service Switching Point) detects the call from the common network to the intellectual network and sends them to the SCP for processing, being the interface to an intelligent network platform. The intelligent network platform may comprise multiple SCP and SSP. Service Management System SMS (Service Management System) can introduce new services, modify old ones and it stores information about all provided services, about subscribers and their admission to certain services, as well as the originals of all service programs. Surely, the smart network can be created not only in the telephone network, but it will be discussed later on.

71. What opportunities can an intelligent network provide?

Intellectual networks Figure 5.1 – Intellectual network

There is basic intelligence in the form of certain pre-programmed algorithm services and a collection of different databases in the SCP (Service Control Point) of Service Management. SSP (Service Switching Point) detects the call from the common network to the intellectual network and sends them to the SCP for processing, being the interface to an intelligent network platform. The intelligent network platform may comprise multiple SCP and SSP. Service Management System SMS (Service Management System) can introduce new services, modify old ones and it stores information about all provided services, about subscribers and their admission to certain services, as well as the originals of all service programs. Surely, the smart network can be created not only in the telephone network, but it will be discussed later on.

**72. What is the advantage of smart grids?**

the Smart Grid includes many smart things, such as a smart phone, or a smart vacuum cleaner, or even a smart home. There are two things that are important for a Smart Grid: the network manages users and network elements, and a Smart grid cannot exist without a smart meter. Smart meters transmit current information about consumption to power sources, and on the other hand, they receive data about tariffs. This is often done via the cellular interface, but you can also imagine using the existing Internet infrastructure via a VPN or data transfer over the power network

**73. What is a distributed network?**

a Distributed network is a distributed computing network system in which program components and data depend on multiple sources.

**74. What is the Smart Grid concept?**

Smart grid Concepts - Smart home, smart phone, smart vacuum cleaner, smart refrigerator, smart bus.

**75**. **What directions are identified by the "Smart City"?**

At the United Nations General Assembly on Environment in Nairobi, 23-27 June 2014, regarding the "smart cities" it was noted that the digital age allows you to build a "smart city", where information technology is used for coordination and dissemination of data in order to obtain a single view of the entire system that provides a comprehensive picture of decision-making and provides information in real-time to both suppliers and users to improve water supply, transport and energy

**Conception** of the «smart city», including 3 levels of «smart» products and technology. Level 1: Basic Sensing Mechanism, Level 2: Basic Sensing Mechanism + One Way Data Communication. Level 3: Sensing Mechanism + Two way Flow of Data

**76.** **How does the use of ICT promote energy conservation?**

In this regard information technology connected with the use of the modern tools of collection and data transfer allows new opportunities in the case of solution of issues of energy saving. The computerization of solving problems of technological processes optimization and minimization of losses are directly connected with saving energy resources. The centralized monitoring of technical condition of energetic units and the other equipment, observation of rules of industrial safety are indispensable conditions of stable operation of thermal power plants and hydroelectric power stations. Creation of such centralized monitoring systems is possible thanks to the modern data exchange protocols allowing to connect territory remote monitoring systems to the head Data Processing Center (DPC). Further development and the growth of power of servers together with the use of virtualization technology will allow to solve important information problems of processing and reliable data storage in the central DPC. Considering specifics of the energetic branch it is pertinent to mark that in the power industry along with high speeds of computation, reliability and fail safety of server and network equipment are important. Monitoring the aggregated conditions, energetic logistics, supply of the fuel and energy production are the processes proceeding continuously. The use of the blade servers, the newest faulttolerant data storage systems and systems of backup of data, technologies of clustering (creation of clusters from servers) will allow to reduce quantity of failure points, duplicate and reserve the main parts of DPC to support the maximum fail safety.

**77.** **How many directions does the "Smart City" Astana project have?**

The positive experience of "smart cities" was the foundation of SmartAstana project. The Head of the State noted that until 2017 this project should run in full and the infrastructure construction of EXPO-2017 should use the principles of the "smart city." SmartAstana is based on the experience of European countries. In world practice, the SmartCity concept has already proven itself by showing its efficiency in terms of energy savings, cost of maintenance of utilities and reduction of accidents on the roads. Consultants assure that the project will cover infrastructure, social sector, intellectual, innovative part of the environment, ICT, culture and recreation, and participation in political life. Today, the project developers have begun to implement its two directions: Security city and Intelligent Transportation System (ITS). By the end of 2017 in Astana, 42 "smart" traffics will operate on six streets: Saryarka, Turan, Kunaeva, Dostyk, Sarayshyk and Syganak. Traffic lights will be able to distribute the traffic flow while avoiding congestion on city roads. Experts estimate that the capital's residents will be able to significantly reduce the time they spend on the road, for example, to get from home to work. ITS project is implemented by the Spanish company Typsa, which has experience in more than 60 countries. Implementation of ITS is particularly relevant for Astana, where about 400 thousand cars daily pass its streets. The main objectives of the project are adaptive management of traffic, priority to public transport in front of private, road safety, reduced harmful emissions, increase of speed and elimination of congestion. It is planned that the project will cover 69 schools, 72 kindergartens, 18 health centres and 11 hospitals, as well as places of mass gathering of people, more than 50 commercial, entertainment and business centres. The introduction of new technologies into the daily life of the city will improve the performance indicators and the SmartCity will allow Astana to enter the Top 50 "smart cities" of the world

**78. What is the purpose of ITS in the "Smart City" Astana project?**

Intelligent Transport System (ITS). The main objectives of the project are adaptive traffic management, the priority of public transport over private, road safety, reducing harmful emissions, increasing speed and eliminating traffic jams. As part of the direction

**79. What is e-commerce?**

Electronic business (commerce) is a form of business transaction in which the parties interact electronically: using computer networks, exchanging electronic documents.

**80. What are the main models of interaction between subjects of e-commerce?**

The basic models of interaction between the subjects of e-commerce are:

- **B2B** - Business-to-Business focused on the business partner;

- **B2C** - Business-to-Consumer focused on the end-user;

- **C2C** - Consumer-to-Consumer focused on the end-user.

B2B is a business model in which the interaction between the companies is done via computer networks. The basis of the B2C business model is retail trade, i.e. interaction between companies and consumers on the Internet.

C2C is a model of selling goods and services by one consumer to other consumers, i.e. consumers’ interaction with other consumers on the Internet.

In addition, there are a number of business models (B2A - Business-to-Administration, involving the interaction of companies with administrative authorities; C2A - Consumer-to-Administration, involving the interaction of consumers with the administration, etc.).

**81. What is a reverse auction?**

Reverse Auctions there is only one buyer and several sellers. All the auctions of government procurement work using this structure. Auctions implement natural pricing schemes, they are therefore used for the study of market opportunities.

Bidding at auctions is conducted under the following schemes:

1) standard or English auction – there are used open format offers when all customers are aware of each other's offers. The seller assigns the starting price and the buyers indicate the price of a 3% more;

2) the Dutch auction - it starts with obviously inflated prices, also uses an open form of proposals and continues until one of the buyers accepts it;

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3) simultaneous auction offers - all buyers set their prices at the same time and the winner is the buyer who offers the biggest price;

4) double auction - when the proposal comes from the seller and the buyer at the same time. As a result, the equilibrium price is set - electronic exchanges operate on the principle of the electronic auction;

5) the auction of closed offers - when the buyer and seller do closed (secret) proposals within a fixed time span. The winner buys the goods at the previous maximal price.

**82. List all types of e-business.**

E-business is represented by a big number of various companies that have moved to the Internet and now work there. A company is regarded as a type of ebusiness not due to the technology used, but because of the specifics of the company activity. Over time, many more companies will switch to the electronic format, though today it seems unthinkable. As technology is improving rapidly, what is hard to imagine today will be possible in the future. The activities listed below are selected because of their proven viability. There are also other types, but in order to succeed, they must interact with the mentioned ones. For example, commerce does not make sense without marketing and information exchange. These phenomena must go hand in hand in both online and traditional forms of business.

**83. Specify the features of electronic banking.**

E-banking is one of the most prosperous electronic ventures. E-banking allows customers to access accounts and perform various financial transactions using a simple website. No special program is required, just a Web-browser; in many banks these services are provided for free. E-banking saves time and money of individual clients and companies. Electronic bank transfers a part of responsibilities to the consumers and provides clients with self-service opportunities. This online service allows users to have full information about their accounts, including history (record of all the receipts), to transfer money and order checks, to pay bills and contact the Customer Service Department if necessary. The only operation unavailable on the Internet is getting cash, but banks are already working on a solution to this problem. To become a client of a virtual bank, the consumer must have a computer or other device with an Internet connection and browser. Depending on the e-bank safety strategy, one will need to install an additional software module or Java support. A plug-in or a Java applet is used to increase the level of encoding to ensure the security of financial transactions. More advanced systems use smart cards to provide customers with secure access. Another way to improve security is to use, along with the ID and login, a list of transaction numbers (TAN) that is a set of one-time passwords. Many people use special computer programs like Quicken as systems for personal financial management. The main difference between personal finance management and electronic banking is that the former is the program installed on the user’s computer to manage financial affairs and all transactions are carried out through the mediation of a third party, reducing the security level of electronic banks. Electronic banking is one of the digital services which allows users to perform the same bank functions as Quicken, with one difference: users can access their accounts directly via the Internet.

**84. What are the advantages of e-learning over the traditional one?**

In some cases, distance learning can help. And sometimes-harm. Among the advantages and main advantages of such training is its versatility. At any time, a school student or a student will be able to do their own education. The student is not bound by a time frame, and can allocate time as required for himself. After all, the main thing in modern education is the result. The development of the material can take place in different periods: from a few hours to several days.

Feedback from teachers and students indicates that self-education plays a huge role in this form of education. That is, no teachers behind your back, no pressure and mentoring tone. This is a plus — you can learn how to use time efficiently, better assimilate the material. There are some people who find it easier to learn when no one is monitoring the process.

**85. What are the main legal documents in e-commerce?**

The store on the Internet is not limited in space and time. The range of products that the store offers is also unlimited. For example, Amazon.com it offers over 4.7 million books. Imagine that imagine a store with so much literature stored in its warehouse! Really, this not exactly a good comparison, because Amazon.com does not store books on warehouse, and orders them as needed. But Amazon.com provides information about each individual book.

Retailers (sometimes referred to as e-sellers) also offer more products than traditional sellers, as well a wider range of services for each product. Online books, CDs and tickets sell better than in retail establishments, 453 since the consumer value of these products is their content, not design. The appearance of the plane ticket does not have for example, the buyer is interested in the price and level of service on the plane. New technologies also make the Internet a great place to sell products that are purchased based on emotions, due to their appearance type, not content (so-called spontaneous purchases).

**86. What is an electronic textbook?**

An electronic textbook is not only a comprehensive, but also a complete didactic, methodical and interactive software system. Didactic aspects concerning the most General regularities the training process, and methodological aspects determined by the specifics teaching specific subjects or groups of subjects, they are closely interlinked with each other and with issues of program implementation electronic textbook. It is not possible to consider any one of these without taking into account other aspects.

**87. In what way is the training system different from the electronic textbook?**

An electronic textbook used in laboratory classes, should contain automations in training, access to work, performance of experiments, processing of experimental data, presentation of results of laboratory work. Such electronic textbooks should include modeling components creating a virtual laboratory, allowing to study various phenomena or processes at an accelerated or slowed down time.

The history of computer-based training development dictates the need to distinguish between two types of training systems - traditional and intelligent. The main features of intelligent tutoring systems are the management of educational activities at all stages of learning and doing cognitive tasks, starting from setting principles and searching for solutions and ending with evaluation of optimal solutions; providing a dialogue interaction in a language close to natural. Discussed in a dialogue may be not only the correctness of certain student actions, but also the search for solutions, action planning, monitoring techniques, etc. In such systems, individual training is based on a dynamic model of the learner. Systems of this type provide the distribution of control functions between the computer and the students, enriching the latter, in with new independent learning features, thereby ensuring optimal transition to the doctrine of self-learning. An intelligent system can improve its training strategy by increasing the data storage capacity

**89.** **What are the advantages of information technologies in training?**

E-government is the governance system, the system of interaction between the authorities themselves, with citizens and enterprises using information technologies (which should reduce red tape and increase the transparency of government activity). Effective IT training includes giving in-house workshops or training sessions, many schools and universities also organize such workshops to teach pupils the best information technology skills. Information Technology training means helping supervisors and firms adapt to different business processes and changing conditions. Such training concentrates on the ways that emerging new technologies influence how business is conducted on a high level or large scale. IT training classes help provide knowledge and information concerning the use of technology in various IT areas, which leads to making rapid informed decisions, yield gain for your organization, enhanced customer satisfaction and ensures success of your organization within this enhanced competitive world. Some of the roles that professional are interested in the area of IT in acquiring training are mainly

**90. What is e-government?**

**E-government** is the use of technological communications devices, such as [computers](https://en.wikipedia.org/wiki/Computer) and the [Internet](https://en.wikipedia.org/wiki/Internet) to provide public services to citizens and other persons in a country or region. E-government offers new opportunities for more direct and convenient citizen access to government, and for government provision of services directly to citizens.

**91.What kind of e-government services do you know?**

Utilities, various certificates (certificate from the narcological organization), records, etc.

**92. What is a digital signature?**

Documents which are circulating in the information society, ought to ensure not only the presentation of data in digital form for transmission over the network, but also ought to have certain validity. The paper documents for this purpose use personal signature and stamp, which is a legal guarantee of the authorship of the it’s a digital signature

**93. Where and for what purposes are digital signatures used?**

Digital signatures are a standard element of most cryptographic protocol suites, and are commonly used for software distribution, financial transactions, contract management software, and in other cases where it is important to detect forgery or tampering.You can use Digital Signature Certificates for the following: For sending and receiving digitally signed and encrypted emails. For carrying out secure web-based transactions, or to identify other participants of web-based transactions.

**94. List the conditions required for the implementation of e-government.**

In pursuit of the development goals of Singapore's e-Government, it was decided to develop the government's action plan, which includes strategic objectives and strategic program of e-government. Nowadays there were identified six strategic programs to achieve the above strategic objectives of Singapore: 1) Knowledge-based working environment: public servants at all levels must be technically literate and have to use the benefits of ICT to improve work processes, service delivery and teamwork; 2) Electronic services: all government services, which technically can be provided in the electronic form, should be provided in the electronic form; 3) Technological experiments: they will contribute to a more rapid adaptation of public bodies to rapidly changing technical conditions and will aim to reduce the likelihood of a large investment into wrong decisions; 4) Improvement of operational efficiency: computer equipment must be modern; 5) Adaptable, but robust IT-infrastructure: rapid convergence of telecommunications, radio technology and information technology has opened the possibility for the use of government network at a lower cost. A sophisticated, well-developed, robust and expandable infrastructure is an essential element to support e-government initiatives;

6) Education in the field of ICT: educational programs in ICT provide knowledge not only in the study of computer systems and applications, but also in the use of ICT to improve business processes and in the provision of public services.

**95. Give an explanation of unified e-government architecture.**

Unified architecture of e-government (hereinafter UA) is a structure that reflects the relationship between all elements of the e-government, and should allow to identify and systematize existing needs of the ICT use in various ministries and departments, as well as opportunities to reduce the existing redundancy, and to identify areas, in which they have homogeneous requests for ICT investments.

**96. What is the essence of the electronic digital signature method?**

Like a written signature, the purpose of a digital signature is to guarantee that the individual sending the message really is who he or she claims to be. Digital signatures are especially important for electronic commerce and are a key component of most authentication schemes.

**97. What are the differences between e-government formats of other countries?**

Three main architectural models practiced in America, Europe and Asia. Conventionally, they can be called like this: the American model, which reflects the specifics of its formation in the United States; the European model, used in the development of e- government structures in most countries in Western, Central and Eastern Europe; the Asian model which is implemented with great success in Singapore and South Korea.

The European model is characterized by the presence of supranational institutions. This model is focused primarily on the alignment conditions and coordination of e-government activities across all European Union countries.

The American model of e-government was developed in the US and Canada. The program of its creation in the United States, first of all, aims to simplify and reduce the cost of interaction of citizens and business representatives with government agencies, as well as to make possible their direct communication.

The Asian model is based on a particular management style, an Asian type of corporate culture and multi-layered system of governance, organized as a hierarchical pyramid.

**98. What types of special purpose application software do you know?**

Types of application software for specific purpose: desktop publishing systems, Electronic encyclopedias, textbooks, dictionaries, reference manuals, Machine translation systems (CAT software), Server DBMS (client-server), Video editors, Audio Editors, Musical editors and etc.

**99. How is the search work in the Internet conducted?**

Search is a process in which, in one way or another, the sequence is compared with each object that is being searched for, stored in the array. The purpose of any search is the need, need or desire to find different types of information needed information, knowledge, etc. to improve their own professional, cultural or other level of the person conducting the search; \* new information and formation of new knowledge; making managerial decisions solutions, etc. Number of users working on the Internet in online mode, constantly grow. This makes it difficult to organize an operational search and finding the necessary information for a large number of users. Problems arise due to a variety of opportunities (types) of information search, various ways of their implementation in information search systems (IPS), different levels of knowledge users about the capabilities of such systems, especially in the field of generating queries and processing data obtained as a result execution of these requests, etc.

**100. What is special about the automated retrieval system?**

The number of users who work online is growing. This makes it difficult to organize operational search and find the desired information for a large number of users. There are problems caused by a variety of features (types) of information retrieval, different ways of their realization in the information retrieval system (IRS), users’ various levels of knowledge about the possibilities of such systems, especially in the area of query and data obtained as a result of these requests, etc.

**101. To what extent does our country participate in international cooperation to address the problem of abuse in the Internet?**

In recent years our country has implemented a set of measures to improve information security. The legal base of information security has been formed, issues of hardware and software information security have successfully been resolved, the situation in the staffing of the information technology industry has been improved, and etc. However, looking at this or that aspect of information security, and in particular, at the ICT market, one can not bypass its economic aspects

**102.** **Describe the rules to enhance or promote the development of e-commerce in our country. If there are no such regulations, list down relevant rules which could contribute to the development and dissemination of e-commerce in the country.**

Develop reasonable laws and sound policies. The information society poses many new challenges for legislators: identification of citizens, privacy and data protection, questions regarding jurisdiction in cyberspace, e-commerce taxation, as well as cyber-crime and cyber-terrorism. The state should be flexible during the creation of a new legislation, by generating trust to all types of electronic transactions and keeping a balance between the need for economic development and ensuring the confidentiality of information. Private companies engaged in e-commerce, can not only take advantage of its proximity, for example, to local consumers, but also to grow and expand into new global markets. It also helps to increase the level of training and the level of local employment

**103. What are the prospects of development of the IT market in the field of free software?**

Free software is software released under the free license agreement, which gives the user the right to use the software for any purpose (not prohibited by law), access to the source code of the program to display, adaptation, processing, distribution programs (for free or for a charge), modify, and distribute processed versions of the program with the requirements of the possible inheritance of the license. In contrast, proprietary (non-free) software belongs to a specific company (developer). The copyright holder retains the right to use, copy, and modify information in whole or in part. There is also the concept of open source software (OSS). Unlike free software, its license agreement may allow you to research the source code of a product without modification and / or distribution of copies of it. Free software

**104. What is a startup company?**

A **startup** or **start-up** is a company started by an entrepreneur to seek, [effectively develop, and validate](https://en.wikipedia.org/wiki/Lean_startup) a scalable [business model](https://en.wikipedia.org/wiki/Business_model). While [entrepreneurship](https://en.wikipedia.org/wiki/Entrepreneurship) refers to all new businesses, including self-employment and businesses that never intend to become registered, startups refer to the new businesses that intend to grow large beyond the solo founder. Startups face high uncertainty and have high rates of failure, but a minority of them do go on to be successful and influential.Some startups become [unicorns](https://en.wikipedia.org/wiki/Unicorn_(finance)), i.e. privately held startup companies valued at over US$1 billion.

**105. What are the technological parks?**

Software technology park are the places where that IT sector is very developing and there are major industry of the IT sectors .  
the rule is to contribute towards economy of the IT sector.

Technology parks are models to capitalize on knowledge in national and regional development, are effective instruments in the transfer of technology, creation and attraction of companies with high added value

**106. What is the purpose of creating a business incubator?**

**Business incubators** are programs of assistance to businesses that provide entrepreneurs with necessary support and consulting. Typically, business incubators are located in special rooms where a few start-ups are located. They share not only the space and equipment but they also have equal access to all services provided by the business incubator including consulting on various business areas. The cost of some services may be included in the rental price, and other types of provided services are at a quite low price

**107)What are the prospects for electronic payment systems?**

Prospects for the development of electronic payment systems in modern Russia. The state of the payment systems market today can be described as “at the beginning of rapid development”. Electronic payments are a natural stage in the development of telecommunications. Electronic payments are needed primarily for the purchase of services and intangible goods “shipped” via the Internet, as well as payment for utilities and other services. Just as e-mail eliminates the need to go to e-mail to send letters, so electronic payments save time and effort. Obviously, the spread of electronic payments depends not only on the development of electronic payment systems themselves, but also on the expansion of public access to the Internet and the literacy of citizens in the survey on electronic payments.

**108) list modern electronic stores, electronic auctions, and electronic payment systems**

Moodle, green stone (GNU GNU GPL) in Kazakh and Russian),

startup training programs: StartUp.kz, iStartUpSchool, Atameken startup, electronic payments via PayPal, Yandex Money, and so on.

**109. What are the main trends of media development?**

Main trends in the development of multimedia technologies: 1. mobile phone Content 2. Augmented reality 3. Virtual reality 4. user interface.

**110. What are the prospects for the development of E-technologies?**

New ICTs bring about changes in the life of Kazakhstan’s society: they expand cable-satellite broadcasting, mobile Internet, mobile communication, digital broadcasting, gradually introduce elements of interactive TV and increase confidence in electronic means of mass communication as an important source of information about events in the country and the world.

The potential of ICT is already ranked among the state priorities. There is an increase in output of information products and services in the country. In the twenty-first century the business of information technology has become one of the most prosperous. Every year information technology industry is growing at 13-18% in Kazakhstan. Changes in the life of Kazakhstan’s society caused by the spread of ICT are economical, social, political and cultural.

**111. How do you understand the possibilities of ICT?**

The force and possibilities of ICT consist in connecting different parts within an integral and integrating network by communications. The telecommunication network which includes fixed telephone lines, transmitters to lines of direct visibility, wireless networks, satellite and optical fiber cables, is a part of extensive system. The same list includes:

- intelligent sensor telecommunication networks;

- the Internet of things, the built-in technologies for interaction;

- "smart" dust – networks of neurochips;

- high speed multimedia;

- next generations of information systems

**112) what types of ICT do you know?**

ICTs can be broadly classified into digital and analog, synchronous and asynchronous.

Synchronous ICT involves the interaction of communication participants in real time, for example, in online chats.

ICTs are used in modern automobiles to control the efficient operation of the vehicle's engine and fuel systems.

According to the forms of ICT application in the educational process.

By type of information.

**Review questions**

**Part 6**

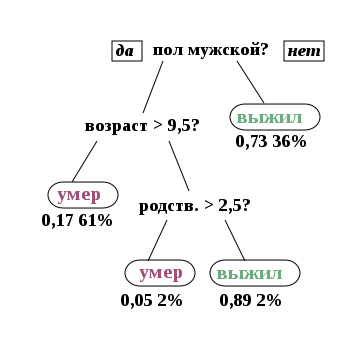
**10. What is the Decision Tree? Give the example of how it can be embedded in Decision Support Systems.**

Decision Support Systems.

The decision tree (DT) or classification Tree is a tree graph associated with D (a database containing tuples 1 {,...,} n tt and attributes 1 {,...,} n AA) that has properties. With this, we can study and calculate the weight classification using formulas .

**11. What is the main difference between algorithms of building Decision Tree?**

The decision tree (also called the classification tree or regression tree) is a decision support tool used in machine learning, data analysis, and statistics. The structure of the tree consists of “leaves” and “branches”. The edges (“branches”) of the decision tree contain the attributes that the objective function depends on, the values ​​of the objective function are written in the “leaves”, and the attributes that distinguish cases are written in the other nodes. To classify a new case, you need to go down the tree to the leaf and issue the corresponding value. Similar decision trees are widely used in data mining. The goal is to create a model that predicts the value of the target variable based on several input variables.

****

**12. Classify tuple t9 (0, 0, 1, 1, 1, 1, 1, 1) using DT in Figure 6.7.**

Example of regressions. Given X1,X2,Y and calculated Y1,Y2,Yr , using regression equations; Deviations: Di = ( Y- Yi ) / Y, % , ( i= 1, 2, r )

Thus, some popular “classical” methods of classifications are explained. There are other more complex techniques of classifications such as Discriminant Analyses, Genetic Algorithms, Information gain, Neural Network solutions and different hybrid approaches which are subjects of separate or advanced Data Mining courses.

**13. How can set of logical rules for classification using Decision Tree be created?**

Decision tree (DT)-based algorithms: The DT algorithms are the most useful in classification problems. Using this technique a tree is constructed to model the classification process. Once the tree is built it is applied to each tuple in the database and results in classifications for that tuple. Definition: Decision Tree (DT) or Classification Tree is a tree associated with D (D is data base contains tuples {t1,..., tn} and attributes {A1, ... , An} ) that has the following properties: - Each internal node (vertex) is labeled with Ai attribute; - Each arc (edge) is labeled with a predicate that can be applied to the attribute associated with the parent node; - Each leaf node is labeled with a Cj class. Solving the classification problem using DT is a two steps process: 1. Decision tree induction: construction of DT and using training data 2. Application of DT for each ti in D, to determinate its class. Let’s consider a simple DT to understand this definition. There is a known rule to determine body weight of adult person (at age after 20-25): Firstly, let’s determine parameter DW = 100\*(W/(H-100) -1) ,% , where W is a weight of a person, kg; H is a height of a person, cm. Dimensionless values of these attributes are used to calculate DW. The following approximate information has been obtained using statistical data of medical observations (Table 6.2):

Table 6.2 - Data (Gender and Interval of DW) and classification of weight Gender Interval of DW Classification M DW ≤ -20% U (under weight) M -20% ≤DW ≤20% N (normal weight) M 20% ≤DW O (over weight) F DW ≤ -15% U (under weight) F -15% ≤DW ≤25% N (normal weight) F 25% ≤DW O (over weight)

In accordance with the above definition of the structure of DT, we can create proper DT based on classification in this table.

**14. Create Rule-based algorithm for “Traditional Marks” classes from Table 6.1 based on the values of attribute “%points”.**

**Rule-based algorithms**

Another way to construct classification for tuples in Database (or for some interrelated objects in data set) is to create a set of logical rules which enable to put each tuple (or object) into one of predefined classes. There are several known techniques to provide these rules.

**Generating rules from DT**

For example, we can transform the result of DT solution into form of Rule-based algorithm describing each path from root to leaf of DT in the form of logical predicate:

**IF** (predicate 1) ∩(predicate 2) ∩....(predicate N) **THEN** B

For instance (tree in Figure 6.7b.):

**IF** (X4=1) ∩ (X3=1) **THEN** Class II;

**IF** (X4=1) ∩ (X3=0) **THEN** Class I.

**15. What is an idea of KNN method of classifications?**

K Nearest Neighbors (KNN) algorithm. Let’s take K=3. Using calculated distances from previous example we find three smallest distances which are: d(t1, t9)=1 ; d(t6, t9)=2 ; d(t4, t9)=3; Major number of these tuples i.e.( t1, t4) belongs to Class I, therefore t9 belongs to Class I as well. From these examples we can notice that the Simple approach method is just particular case of KNN method with K=1, and then - it is better take K as odd number to avoid possible uncertainness when equal numbers of the smallest distances belong to different classes (fifty-fifty result).

**16. What is the difference between KNN and Simple approach algorithm?**

**KNN algorithm** is one **of** the simplest classification **algorithm**. ... **KNN algorithm** can also be used **for** regression problems. The only **difference** from the discussed methodology will be using averages **of** nearest neighbors rather than voting from nearest neighbors.

**17. Why is it better to use odd number of neighbors in KNN method?**

The method is labor intensive when given large training sets. It did not gain popularity until the 1960s when increased computing power became available. It has since been widely used in the area of pattern recognition.

When a classification is made for a new ***t****x*, its distance to each item in a set with known classification must be determined. Only the *K* closest (with shortest distances) entries are considered further. The new ***t****x* is then placed in the class that contains the most items from this set of *K* closest items.

**18. Give any example of Fuzzy Sets application of classifications problem.**

Fuzzy Sets and Fuzzy Logic In described methods of classification above we have supposed that each given object belongs exactly to one class. Nevertheless there are situations when this constraint doesn’t hold. You can see in the Figure 6.8. one simple example of such situation. Income which is “low” in some cities (or even in one region of city) 168 is rather “medium” in other places. So, it is impossible to provide exact boundary between Low, Medium and High classes of income. To describe these overlapping classes so-called Fuzzy set can be used. Definition 1: A Fuzzy Set (Class) is a set, let it be F, in which a set (or class) membership function f(X), is a real valued (as opposite to Boolean for conventional classification) function with output in the range [0,1]. Definition 2: An element X belongs to F with probability f(X) and simultaneously is in ⌐F (NOT F) with probability 1- f(X). Actually, f(X) is not true probability, but rather degree of truth associated with the statement: “X belongs to F”.

В описанных выше методах классификации предполагалось, что каждый данный объект принадлежит только одному классу. Тем не менее, бывают ситуации, когда это ограничение не имеет места. Один такой пример можно видеть на рисунке 8. Доход, который является "низким" в каком-то городе (или даже в одном районе города) может быть вполне «средним» в другом месте. То есть, невозможно определить точную границу между классами населения с низким, средним и высоким уровнями доходов. Для описания таких перекрывающихся классов можно использовать так называемые нечеткие множества.

Example:

Пример :



**19. Briefly describe the idea of using LSM for linear regression problems.**

Initially, regression was investigated as statistical approach connected with correlation of random variables, but then it was proved (Legendre in 1805, Gauss in 1809) that the same results can be obtained using methods of minimization, in particular, Least Squares Method (LSM). This technique became more popular due to uniform approach to constructing regression equations for multivariate regression, and it is implemented in the numbers of statistics softwares. Now, the idea of this approach will be described.

**20. Give definition and describe some of the main applications of clustering.**

Clustering is a data processing in some sense opposite to classifications which enables you to create new groups and classes based on the study of patterns and relationship between values of data in a data bank. It is similar to classification but does not require predefining the groups or classes. Clustering technique is otherwise known as unsupervised learning or segmentation. All these data items that resemble more closely with each other are clubbed together in a single group, also known as clusters. Examples include groups of companies producing similar products, or soils having the same properties (eg, black soil), a group of people with the same habits, etc.

**21. Briefly describe various types of clustering techniques.**

Types of clustering techniques are: **Partitioning methods, Hierarchical clustering and Density-Based Clustering.**  
**Partitioning algorithms** are clustering techniques that subdivide the data sets into a set of k groups, where k is the number of groups pre-specified by the analyst.

There are different types of partitioning clustering methods. The most popular is the [K-means clustering](https://www.datanovia.com/?p=7674) (MacQueen 1967), in which, each cluster is represented by the center or means of the data points belonging to the cluster. The K-means method is sensitive to outliers.

**Hierarchical clustering** is an alternative approach to partitioning clustering for identifying groups in the dataset. It does not require to pre-specify the number of clusters to be generated.

The result of hierarchical clustering is a tree-based representation of the objects, which is also known as dendrogram. Observations can be subdivided into groups by cutting the dendrogram at a desired similarity level.  
**DBSCAN** (**Density-Based Spatial Clustering and Application with Noise**), is a **density-based clusering** algorithm (Ester et al. 1996), which can be used to identify clusters of any shape in a data set containing noise and outliers.

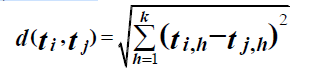
The basic idea behind the density-based clustering approach is derived from a human intuitive clustering method. For instance, by looking at the figure below, one can easily identify four clusters along with several points of noise, because of the differences in the density of points.

Clusters are dense regions in the data space, separated by regions of lower density of points. The DBSCAN algorithm is based on this intuitive notion of “clusters” and “noise”. The key idea is that for each point of a cluster, the neighborhood of a given radius has to contain at least a minimum number of points.

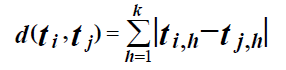
**22. Calculate the distance between 2 objects A{12, 3, 40,10} and B{15, 7, 35, 12} using: a) Euclidean distance; b) Manhattan distance.**

***ti*** = {*ti,1*; *t i,2*; *...; ti,k*} and ***tj*** = {*tj,1*; *tj,2*; : : :; t*j,k*},

Common (Euclidean) distance:



Manhattan distance is also known as "city block" or “taxicab” distance between vectors *ti* and *tj*. (Manhattan is one of New York City’s 5 boroughs in which streets map looks like rectangular grid):



??????????

**23. Give definitions of different types of Measures of distance between clasters.**

Measures for distance between clasters (or between point and clusters): Ci and Cj a)Single link (minimum distance): dmin ( tCi, tCj ) (i.e. min d(thi,tmj) for all n and m, where tni belongs to Ci, tmj belongs to Cj) b) Complete link (maximum distance): dmax(tCi, tCj) c) Centroid (mean distance): d(Mi, Mj) , where Mi – mean center (Ci), Mj – mean center (Cj). Some authors recommend to use medoids instead of centers. d) Average distance: Mean (d(thi,tmj) for all n and m, where tni belongs to Ci, tmj belongs to Cj).

i mj ij ij mj jni

avg

tCt tt i NN C

CC

It should be noted that there are other methods such as Mahalanobis distance, D2Similarity (dependences) etc.

**24. Give explanation of K-means and K-medoids algorithm.**

The k-means method is the most popular clustering method . It was invented in the 1950s . The algorithm works in such a way that it tries to minimize the total square deviation of cluster points from the centers of these clusters .

K-medoids-The idea of the method is similar in many ways to the K-means method, but instead of calculating averages, existing tuples (medoids) are used as new centers.

The solution is the scenario with the most negative increment from the original value, or (which is the same) with the minimum value of the cost function F, for example, defined above

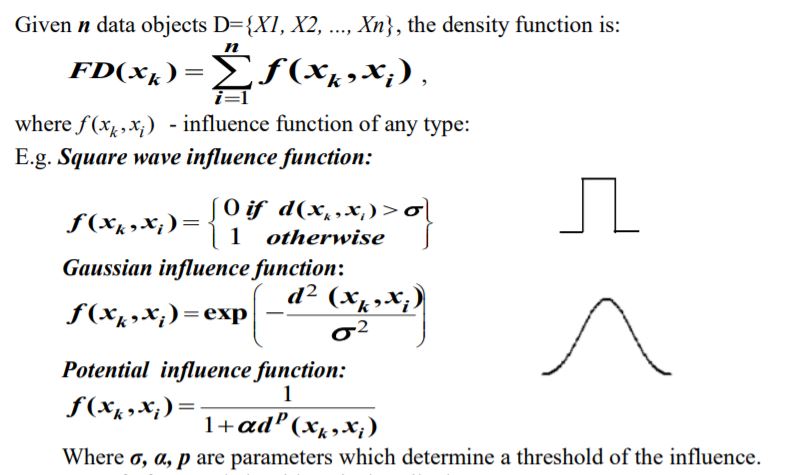
**25. Give definition and explain some agglomerative clustering algorithms.**

Recursively merges the pair of clusters that minimally increases a given linkage distance.

**26. What is the essence of Density–based methods of clustering? Give example of influence function.**

These methods deal with arbitrary shapes clusters. In the density-based clustering method, clusters are formed on the basis of the region where density (amount) of objects is high. Method is often used in geographical, soil science, agriculture, etc. mapping, Idea: The density function at an object X is defined as a sum of influence functions of all data points.

Example:



**27. How does data mining help in market-basket analysis?**

Example of Association Rules and Frequent Item Sets: the market-basket problem which assumes that we have some large number of items, e.g., "bread," "milk." In addition to the marketing application, the similar question can be applied, for example, to the following areas of activity:

Baskets = documents; items = words. Words appearing frequently together in documents may represent phrases or linked concepts, and can be used for intelligence information gathering.

Baskets = sentences, items = documents. Documents with many similar sentences could represent plagiarism or mirror sites on the Web.

**28. Describe possible analogy between market-basket problem and Web sites plagiarism.**

Customers fill their market baskets with some subset of the items, and we have to know what items people buy together, even if we don't know who they are. Marketers use this information to position items and control the way a typical customer traverses the store. In addition to the marketing application, the similar question can be applied, for example, to the following areas of activity:

Baskets = documents; items = words. Words appearing frequently together in documents may represent phrases or linked concepts, and can be used for intelligence information gathering.

Baskets = sentences, items = documents. Documents with many similar sentences could represent plagiarism or mirror sites on the Web.

**29. What are Association rules, in which fields of human activities we can apply them?**

**Association rules**(ARs) are the process to search relationships among data items in a given data set, so all the data items can be managed. Mainly association rules are used when a data set has large data items. It determines the sequential patterns that might exist in a large and unorganized data bank. These ideas have lots of application in medicine (diseases diagnostic), crime investigations, market-basket researches, etc.

Example of Association Rules and Frequent Item Sets: the ***market-basket problem*** which assumes that we have some large number of items*,* e.g., "bread," "milk." Customers fill their market baskets with some subset of the items, and we have to know what items people buy together, even if we don't know who they are. Marketers use this information to position items and control the way a typical customer traverses the store.

**113. What does the interrelation between the purposes of development and ICT consist in?**

Nowadays, any person with a small mobile phone in hand, a tablet or a personal computer (PC) has the ability to access the world of information. This is done through a seamless network of technologies, applications, services and content, interlinked through a grid of telecommunications technologies. It does not matter for the emd- user how the system works, as long as it delivers what is wanted; it broadly introduces a student or the provider of development services to the diverse technologies; unpacking or unbundling of the various terms is critical for understanding the conditions and contexts of their applications and effectiveness.

**114. What are the main stages of information development of the society?**

**1)System of communications.** The force and possibilities of ICT consist in connecting different parts within an integral and integrating network by communications. **2)Cognitive technologies and robotization.** The word "Cogito" from Latin means "to know". That is, cognitive technologies "working" with our knowledge of: evaluating our attention that tracks our state following the work of the brain and trying to "understand" human. **3)New technologies of the computer and human interface.** With the development of technologies there appear more and more opportunities for improving human-computer interaction, however one should not forget that human opportunities are not limitless, which holds true with respect to the above processes. 4)**Virtual world.** There are several definitions of the virtual world concept. According to the English-Russian dictionary by professor V. K. Müller the word ‘virtual’ means – actual (not nominal), valid, effective, possible. **5)Smart city, smart production, smart transport. S**mart city is a system of interacting systems, thus ensuring modern quality of life due to the use of innovative technologies which provide economic and eco-friendly use of urban systems.

**115. What is the best method for reducing a digital gap?**

In order to fully bridge the digital divide and realize full potential of ICTs, a requisite level of human resources and institutional capacity must first exist. Using ICT for their socio-economic development through human and institutional capacity development. APCICT’s mandate responds to the Declaration of Principles and Plan of Action of the World Summit on the Information Society (WSIS), which states that: “Each person should have an opportunity to acquire necessary skills and knowledge in order to understand, participate actively in, and benefit fully from, the Information Society and the knowledge economy.”

**116. What is the difference between "the economy of knowledge" and "the society on the basis of knowledge"?**

Plan of Action of the World Summit on the Information Society (WSIS), which states that: “Each person should have an opportunity to acquire necessary skills and knowledge in order to understand, participate actively in, and benefit fully from, the Information Society and the knowledge economy.” The economy of knowledge is part of science which discovered keeping time to determined sphere, like ICT. While society get the experience, qualifications by knowledge and they have strong relationship.

**117. What aspect of ICT will you refer the portal of the electronic government to?**

On a global scale ICT gave the population new opportunities and resources: the electronic government expanded provision of the state services; Aspect is cloud technologies, where includes the main aspect - The development of social networks and the use of ICT in social life;

**118. What are the purposes and tasks of intellectual economy?**

- ensuring the efficiency of the public administration system;

- ensuring availability of information and communication infrastructure;

- formation of the information environment for social and economic and cultural development of society;

- development of the national information space.

Tasks of improving the government administration, creating an "open" and "mobile Government", and developing the information infrastructure will be solved within these areas through the widespread introduction of ICTs.

119) and 120) Они похожи

Components of a Computer System are**:**

Hardware System.

Software System - Operating System and Application Software.

Network System.

**Network System**

The worldwide system of computer networks is the Internet. Via the Internet computers on the network can access other computers. The Internet allows data to be moved from one computer to another.

**Hardware system** The hardware system consists of external and internal physical components that enable a computer to accept input data, process and store data, and produce outputs. **Operating system software** provides instructions to hardware system components. Examples of operating systems are Microsoft Windows operating system and Macintosh operating system.

**Application software** provides instructions that enable the user to perform specific tasks such as creating presentations, document layout, and editing images.

121) A computer is an electronic machine that performs input, processing, storing, and output operations according to programmed instructions to carry out specific tasks. Formerly, computers were used primarily to do arithmetic computations.

122) Figure 2.1 - Von Neumann architecture.

There are three categories of computer architecture:

System Design: It includes all hardware components in the system including data processors aside from the CPU such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and different things like multiprocessing and virtualization.

Instruction Set Architecture (ISA): It is the embedded in programming language of the central processing unit. It defines the CPU's functions and capabilities based on programming which it can perform or process. This includes the word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.

Microarchitecture: It is known as computer organization. This type of architecture defines the data paths, data processing and storage elements, as well as the way they should be implemented in the ISA.

123) **Hardware system**

The hardware system consists of external and internal physical components that enable a computer to accept input data, process and store data, and produce outputs.

Hardware components provide physical interface in a computer system. However, the cant function without instructions. These instructions are software programs.

**124. Arrange the levels of interaction among users, application software, operating system software and hardware system.**

The operating system software serves as the interface between application software and hardware components. The application software interacts with the users of a computer system.

**Operating system software** provides instructions to hardware system components. Examples of operating systems are Microsoft Windows operating system and Macintosh operating system

**Application software** provides instructions that enable the user to perform specific tasks such as creating presentations, document layout, and editing images. Examples of application software programs are Microsoft Word and Notepad.

**The hardware system** consists of external and internal physical components that enable a computer to accept input data, process and store data, and produce outputs.

**125. What is a network system and why does it play an essential role in the operation of a computer system.**

The network systems manages the way data is transferred from one computer to another and work of different components of a network system. The worldwide system of computer networks is the Internet. Via the Internet computers on the network can access other computers. The Internet allows data to be moved from one computer to another.

**126. List the network connection components.**

A network interface card (NIC) sends data from a computer over a network, and collects incoming data sent by other computers.

A modem is a device that enables data from a computer to be transmitted via phone lines or television cable lines to reach other computers on the Internet.

The Hardware network components, a computer also needs an Internet service provider.

Application software such as Web browsers

**127. Breakdown the evolution of computer systems into periods and point out the main advancements in computing devices matched to those periods.**

1200s—Manual Calculating Devices

1600s—Mechanical Calculators

1800s—Punched Cards

1940s—Vacuum Tubes

1950s—Transistors

1960s—Integrated Circuits (IC)

1970s to Present—Microprocessor

With advancements in computing devices, computers have integrated in many aspects of our lives. Purchases are processed through computers. Products are designed using computers. Movies are made with computer simulations. The growth of the computing industry is driven by the numerous computing technologies that are used in such areas as commerce, communications, banking, and education. In the next subchapter ways of computer technology use are examined.

Stages of computer advancement in the field of computer application to solve problems of handling large amounts of data and calculations will be examined.

**128. Explain why the Moore’s law states that the growth in the number of transistors has slowed.**

As transistors become smaller, more transistors can be placed on the chip. This implies faster processing speeds and greater data storage capacity.

He predicted that the numbers of transistors put on a microchip will double every 12 months, until physical limitations are reached. This observation was termed "Moore’s Law." Now the exponential growth has slowed down to doubling every 18 months, nevertheless, the rate of growth is still exponential

**129. Classify computers by their speed and computing power.**

PC (Personal Computer) or Micro-Computers

It is a single user computer system having a moderately powerful microprocessor. It is termed as a computer that is equipped microprocessor as its CPU.

Workstation

It is also a single user computer system, similar to the personal computer, however, has a more powerful microprocessor.

Mini-Computer

It is a multi-user computer system, capable of supporting hundreds of users simultaneously

Main Frame

It is a multi-user computer system, capable of supporting hundreds of users simultaneously. Software technology is different from minicomputer.

Super-Computer

It is an extremely fast computer, which can execute hundreds of millions of instructions per second.

**130. Give examples of applications of computer systems in different spheres of human activity.**

Application software provides instructions that enable the user to perform specific tasks such as creating presentations, document layout, and editing images. Examples of application software programs are Microsoft Word and Notepad. For instance, when you open a file using Microsoft Word, first the application provides the user-interface to specify which file you want to open. Application software such as Web browsers (for example, Internet Explorer and Netscape) and electronic mail (for example, Outlook and Netscape Mail) also enhance the usefulness of a network system. Software applications are capable of keeping track of the product database, work schedule, and budget of the project to help you pinpoint potential barriers to the timely completion of the project. You can see some project management software system demos provided by Microsoft.

**131. What types of computers are possible?**

The example of a very good explanation of computer architecture is Von Neumann architecture, which is still used by the most types of computers nowadays. There are three categories of computer architecture:

System Design: It includes all hardware components in the system including data processors aside from the CPU such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and different things like multiprocessing and virtualization.

Instruction Set Architecture (ISA): It is the embedded in programming language of the central processing unit. It defines the CPU's functions and capabilities based on programming which it can perform or process. This includes the word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.

Microarchitecture: It is known as computer organization. This type of architecture defines the data paths, data processing and storage elements, as well as the way they should be implemented in the ISA.

**132. What are the components of computer systems?**

Components of a Computer System are**:**

Hardware System.

Software System - Operating System and Application Software.

Network System.

**133. What are the main computer operations?**

A computer is an electronic machine that performs input, processing, storing, and output operations according to programmed instructions to carry out specific tasks.

**134. How is it possible to connect the additional device to the computer?**

Additional devices can be internal (inserted into the system unit) or external (connected externally using connectors). External devices can connect to a computer using a telephone line, USB ports, or audio ports.

**135. What is the usefulness of connection of computers with each other?**

Via the Internet computers on the network can access other computers. The Internet allows data to be moved from one computer to another. The network systems manages the way data is transferred from one computer to another and work of different components of a network system.

136. ***Why are devices similar to monitors, printers and keyboards called peripherals?***

The hardware system consists of external and internal physical components that enable a computer to accept input data, process and store data, and produce outputs.

A computer peripheral is any external device that provides input and output for the computer. For example, a keyboard and mouse are input peripherals, while a monitor and printer are output peripherals. Computer peripherals, or peripheral devices, are sometimes called "I/O devices" because they provide input and output for the computer. Some peripherals, such as external hard drives, provide both input and output for the computer.

137. ***Explain how data is represented using binary digits.***

Computers represent data using 0's and 1's, also known as binary numbers. Each digit, whether binary or decimal, must be represented by a voltage in the computer's circuitry. It is easy to build circuits that discriminate between two voltages. We could call these voltages "on" 49 and "off." It is much harder, though not impossible, to build circuits to discriminate reliably among ten different voltages.

A piece of data, such as an alphabet letter, may be represented using a sequence of binary digits- 0's and 1's. There are several types of codes used to represent character data. Extended ASCII code uses eight bits (or one byte) to represent input characters.

138. **Distinguish the number systems by their base.**

All data, including audio, visual, and program instruction data can be represented and stored using a sequence of binary digits, or a sequence of bytes. In other words a file is a collection of data. In some files, the bits of data directly encode individual letters, numbers, and punctuation symbols that make up words 50

and sentences. In image files, the bits of data need to be computed and transformed to images that we can interpret.

Some files have a header section that indicates which format is used to encode the data in order to allow the computer to reassemble the binary data back into the human-readable form of the document.

***139. Give examples of converting numbers from decimal to binary and hexadecimal number systems***.

**Binary to Octal**

**Step 1** - Divide the binary digits into groups of three (starting from the right).

**Step 2** - Convert each group of three binary digits to one octal digit.

Decimal Number: 2110 = Binary Number: 101012

**Binary to Hexadecimal**

**Step 1** - Divide the binary digits into groups of four (starting from the right).

**Step 2** - Convert each group of four binary digits to one hexadecimal symbol.

Binary Number: 101012 = Hexadecimal Number: 1516

***140. Give a definition of computer software.***

**SOFTWARE**

Software is a set of commands that controls the computer operations. Computer software helps us in implementing computing tasks in the computer

***141. List the main functions of computer software.***

Software includes the following functions:

1. manage the computer resources of the organization;

2. provide the user with all resources necessary to solve computational tasks;

3. act as a mediator between the institutions and the stored information.

One of the key tasks of the managing personnel is selection of the appropriate software for the organization needs.

**142. What is the main difference between the operating system and applications?**

The operating system is not a separate object; it consists of many layers with their functions. The levels of the operating system and applications running by users are

considered as unique "tasks" or "processes", competing with each other for the access to the CPU and other hardware resources. The management of this competition through appropriate schedule processes is the primary responsibility of the operating system and can have a significant impact on the system performance.

**143. Classify software.**

Software is a set of commands that controls the computer operations. Computer software helps us in implementing computing tasks in the computer. Software includes the following functions:

1. manage the computer resources of the organization;

2. provide the user with all resources necessary to solve computational tasks;

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**144. Explain why the operating system (OS) plays a crucial role in interaction between users and a computer system.**

The operating system plays a very important role in the user interaction with the computer system. In this section, we will look at typical operating system functions, such as: device management, memory management, resource sharing and management processes. After analyzing the operating system, we will be able to find an apparent reason which slowdowns your computer and the steps you can take to solve these problems. We will also discuss the issues of computing environment settings in accordance with the requirements of the task at hand.

**145. List the main functions of OS performs. 95**

Operating system functions, such as: device management, memory management, resource sharing and management processes. Many aspects of the OS operation can be explained by this mechanism. In the course of explaining the distribution of work, this module covers most of the components of a computer system. The computer system distributes not only a lot of internal resources, such as the CPU time, but also external resources, such as access to the hard drive. Memory management system is an important part of the kernel work. A standard personal computer today has 1 GB or more of RAM (DRAM). A part of it is reserved for the operating system, but most of them are available for user programs.

**146. Give examples of OS.**

MS-DOS (Microsoft Disk Operating System) is a single-user, single-tasking computer operating system that uses a command line interface. Early versions of Microsoft Windows ran under MS-DOS. MS-DOS has a relatively small number of commands, and an even smaller number of commonly used ones. UNIX is an operating system which was first developed in the 1960s, and has been under constant development ever since. It is a stable, multi-user, multi-tasking system for servers, desktops and laptops. Microsoft created the Windows operating system in the mid-1980s. Windows comes pre-loaded on the most new PCs, which helps to make it the most popular operating system in the world.

Mac OS is a line of operating systems created by Apple. It comes preloaded on all new Macintosh computers or Macs.

**147. Explain the meaning of the terms of encapsulation and abstraction and their importance in software structure.**

The term “encapsulation” in programming means a data hiding algorithm and implementing details from the user or the application programmer. In this case the application programmer is provided only by specification (interface) of the object. In medicine, the term "encapsulated" means "enclosed in a capsule shell, or" in the technical sciences it means –“protected from external influences”. The term "abstraction" means the allocation of significant, important object properties for their subsequent implementation. In this context it is also interaction between software layers.

When organizing relatively independent processes in the form of levels or layers, the system can maintain better control and can achieve high efficiency. In computer science principles to ensure these benefits are called encapsulation (encapsulation) and abstraction (abstraction).

148**. List the software layers that make up the computer and explain the interaction among them**

A computer is often considered as something rather abstract, and the externally visible interface is much simpler than its internal complexity. Such complexity comes in part from the number of pieces involved. However, these pieces can be viewed in layers, where a layer only interacts with those immediately above or below.

 There is generally a main board (known as the motherboard), with one (or more) processor(s), some RAM, device controllers, and extension slots for option boards (for other device controllers). Most noteworthy among these controllers are IDE (Parallel ATA), SCSI and Serial ATA, for connecting to storage devices such as hard disks. Other controllers include USB, which is able to host a great variety of devices (ranging from webcams to thermometers, from keyboards to home automation systems) and IEEE 1394 (Firewire). These controllers often allow connecting several devices so the complete subsystem handled by a controller is therefore usually known as a “bus”. Option boards include graphics cards (into which monitor screens will be plugged), sound cards, network interface cards, and so on. Some main boards are pre-built with these features, and don't need option boards.

he BIOS/UEFI also contains a piece of software called Setup, designed to allow configuring aspects of the computer. In particular, it allows choosing which boot device is preferred (for instance, the floppy disk or CD-ROM drive), setting the system clock, and so on. Starting Setup usually involves pressing a key very soon after the computer is powered on. This key is often **Del** or **Esc**, sometimes **F2** or **F10**. Most of the time, the choice is flashed on screen while booting.

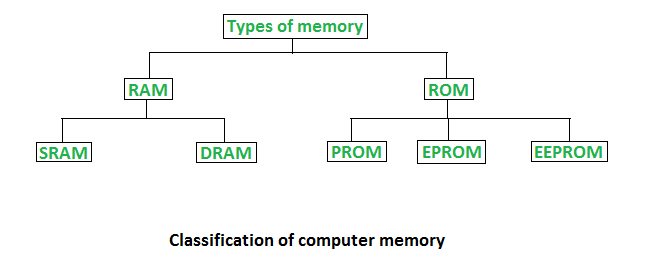
149. **Explain the role of BIOS in the work of a computer system**.

**BIOS** (basic input/output **system**) is the program a personal **computer's** microprocessor uses to get the **computer system** started after you turn it on. It also manages data flow between the **computer's** operating **system** and attached devices such as the hard disk, video adapter, keyboard, mouse and printer.

BIOS enables computers to perform certain operations as soon as they are turned on. The principal job of a computer's BIOS is to govern the early stages of the startup process, ensuring that the operating system is correctly loaded into memory. BIOS is vital to the operation of most modern computers, and knowing some facts about it could help you troubleshoot issues with your machine.

150**. List the types of computer memory.**

Memory is the most essential element of a computing system because without it computer can’t perform simple tasks. Computer memory is of two basic type – Primary memory(RAM and ROM) and Secondary memory(hard drive,CD,etc.). Random Access Memory (RAM) is primary-volatile memory and Read Only Memory (ROM) is primary-non-volatile memory.



151**Explain the role of MBR in the work of a computer system.**

The Master Boot Record (MBR) is the information in the first [sector](https://searchstorage.techtarget.com/definition/sector) of any hard disk or diskette that identifies how and where an operating system is located so that it can be [boot](https://searchwindowsserver.techtarget.com/definition/boot) (loaded) into the computer's main storage or [random access memory](https://searchstorage.techtarget.com/definition/RAM-random-access-memory). The Master Boot Record is also sometimes called the "[partition](https://searchstorage.techtarget.com/definition/partition) sector" or the "master partition table" because it includes a table that locates each partition that the hard disk has been formatted into. In addition to this table, the MBR also includes a program that reads the boot sector record of the partition containing the operating system to be booted into RAM. In turn, that record contains a program that loads the rest of the operating system into RAM.

152**Explain the role of POST in the work of a computer system.**

When power is turned on, **POST** (Power-On Self-Test) is the diagnostic testing sequence that a **computer's** basic input/output **system** (or "starting program") runs to determine if the **computer** keyboard, random access memory, disk drives, and other hardware are **working** correctly.

Short for **power-on self-test**, the **POST** is a test the computer must complete verifying all hardware is working properly before starting the remainder of the boot process. The POST process checks computer hardware, like [RAM](https://www.computerhope.com/jargon/r/ram.htm) (random access memory), [hard drive](https://www.computerhope.com/jargon/h/harddriv.htm), [CD-ROM drive](https://www.computerhope.com/jargon/c/cdrom.htm), [keyboard](https://www.computerhope.com/jargon/k/keyboard.htm), etc., to make sure all are working correctly.

153. What is a process? What does a process include? Name the possible states that a process can be in.

A process is an instance of a computer program that is executed by one or more threads. It contains program code and its activity. A process contains a program counter, stack, heap, data section and text section. Possible states of the process are: new, running, waiting, ready, and completed. This process is created while in a new state. In the run or wait state, the process is executing or waiting for the event to occur, respectively. A ready state occurs when a process is ready and waiting to be assigned to a processor, and should not be confused with the wait state mentioned earlier. After the process ends with the execution of its code, it enters the completion state.

154. What is a thread? Why are threads useful?

Thread is a virtual processor with its own set of registers, similar to the registers of a real central processor. Threads allow you to run multiple processes at the same time. By default, all actions are performed in the main thread. This causes problems, since the graphics, as a rule, must be drawn while lengthy processes occur. For example, the boot screen should be active when the underlying process is performing calculations.

155. What is a context switch? What activities are performed by the processor during a context switch?

Context switch is the process of storing the state of a process or thread, so that it can be restored and resume execution at a later point. This allows multiple processes to share a single CPU, and is an essential feature of a multitasking operating system. Your computer may do many implementations of software components and can switch from one to another. For example, your Web browser accesses the auxiliary program, when you want to run a sound file or video clip. There are several programs that can perform this function. All you need is to tell the browser which program to use. This division of functionality means that if a new program is available, it is possible to switch to it and there is no need to install a new browser.

156. Explain what is happening in terms of preemptive multitasking and what effect it has to the user.

The processor also assigns priorities to different types of interrupts. Low-speed devices like the keyboard have low priority. High-speed devices like a SCSI disk have high priority because they need a rapid response in order to function optimally. It avoids losing information.

157. An interrupt indicates that the thread is not being run and should therefore be followed by a gray gap. How does the kernel handle an interrupt?

The processor interrupts execution of the user program and provides control to the kernel. The kernel looks at certain registers of the status to clarify from where there arrived the absent pages and says "This process wants access to its virtual page seven. I will select some random access memory and I will load in it the seventh page of the program. Now I will correct the table of pages and I will give the program a chance to continue execution". Then control returns to the user program, and the program proceeds as if nothing unusual happened.

158. How does virtual memory work using a page table?

Processors that support virtual memory, such as Pentium, can operate in two modes. In the real mode addresses correspond to physical addresses of cells in a random access memory. Only the kernel has the right to work in a real mode. In the virtual mode, each address is converted to a physical address of a memory cell using a page table. For each page in the virtual address space the page table gives the actual address of the page in the random access memory. Within the scheme of virtual memory each program has its own table of pages supported by a kernel. And the physical memory distributed under programs shouldn't be continuous. The table of pages of our hypothetical program can tell: 75

159. What is the primary purpose of virtual memory?

To understand why we need virtual memory, we should consider how the older operating systems like MS-DOS worked. In those systems, all programs have worked in a real address space, yet there was no virtual address space.

Programs written in binary machine code contain instructions and data. Both instructions and data contain memory addresses.When you record a program in a machine code (or your compiler translates a high-level language into a machine code), you (or the compiler) must determine the address for each command, and each part of the data. For example, you start from scratch and keep all your commands and data sequentially. Suppose that your program takes a memory address from 0 to 8.462. Someone else writes the programs in the same way, starting from the address 0. Clearly you cannot run two programs that occupy the same memory address at the same time in this circuit. When you download the second program, it will overwrite over the first one.

160. List three advantages of using virtual memory when executing a program.

In the virtual system of memory each program works in own address space. Therefore when the program boots in memory, there is no need for any readdressing. The virtual address space may be larger or smaller than the physical memory of the processor. Besides, in order to make this scheme work, the virtual memory needs the hardware support. First, memory is divided into parts under the name of the page (pages). The page is the smallest part of memory which can be distributed under the program. On the Pentium platforms a page makes 4 Kbytes. Secondly, the processor must be able to convert virtual addresses into real.

Processors that support virtual memory, such as Pentium, can operate in two modes. In the real mode addresses correspond to physical addresses of cells in a random access memory. Only the kernel has the right to work in a real mode. In the virtual mode, each address is converted to a physical address of a memory cell using a page table. For each page in the virtual address space the page table gives the actual address of the page in the random access memory.

The user program works only with the virtual addresses; it has no idea in what part of physical memory it is executed. When the processor is in the virtual mode, the address translation happens all the time. Each link is translated. It occurs very quickly because the transfer happens directly in the microprocessor chip.

Thirdly, With small effort, with the help of technical means, we can go in this scheme one step further and completely separate the virtual memory of RAM.

161. What is included in the concept of man-machine interface?

Sometimes, human-computer interaction is called human-machine interaction and computer-human interaction. Thus human-computer interaction studies and takes into consideration both human and computer related factors. From the computer perspective it is important to consider computer graphics technology, operating systems, programming languages, development environments, engineering, and design. From the human side more attention is required to communication theory, graphic and industrial design, linguistics, sociology, cognitive psychology and human factors such as user satisfaction.

Therefore, in the design, development and use of devices and programs we should take into account the basics of physics, ergonomics, ecology, psychology, 97

chemistry, the conditions in which the interaction occurs, the purpose of the systems and much more.

Human-computer interaction is a relatively new discipline that dynamically evolves with:

- expanding the range of devices;

- expanding the scope of the interactive devices;

- increasing the number and complexity of the problems the mankind is facing today;

162. List the main means of man-machine interface.

In computer systems interaction may be at the user, hardware and software levels.

The user interface allows the user to control the program or operation of the computer system and obtain the desired results. In fact, the user interface is a channel used for the program and user interaction. The user interface implements interaction of a person working with personal computer by means of special interaction elements.

*An interaction element* is a user interface element with the help of which the user interacts directly with the program or computer system.

There are active and passive interaction elements.

A passive interaction element is an element of a user interface through which the user has no direct access to the system or software resources, i.e. cannot manage or modify its resources directly and immediately. Passive interaction elements include information messages, prompts, etc.

An active interaction element is an element of a user interface through which the user has direct access to the system and software resources with the ability to directly control and change them. Active interaction elements include system configuration and program management tools, file system commands, etc.

According to the conventional classification, the existing interfaces can be divided into the following types:

- Command line interface;

- Graphical interface;

- SILK-interface. 107

1. ***Are there any fundamentally new breakthroughs in the development of human-machine interface?***

1) **Recognition of hand movements and gestures -** can be interpreted and used in order to communicate with a computer. For example, to switch tracks in the playlist, or flip pages of a book, such gestures as scrolling in different directions could be used

2**) Face detection and special recognition -** control points on the face in order to determine the eyes, nose and mouth cold be used for many different solutions. Combination of different face parameters, voice and gestures can be used for accurate personality identification, evaluation of the behavior of different age group representatives or recognition of the emotional state of the person.

3**) Using a depth sensor** - adds new features and experience in everyday activities such as Web-conferencing and remote communication. Segmentation based on the image depth allows to split the front and rear background. For example, to add color to the virtual communication, the background can be replaced by any image, for example, a lunar landscape or a beach

Natural-intuitive interaction is based on our natural skills used in everyday life. Every day we use our hands to manipulate objects, our voice - to communicate. In a virtual environment, all these natural human capabilities will allow to forget about the rules and make the interaction easier.

Development of technologies for voice, image and video processing brings HCI to a qualitatively new stage. In recent years, the area of applying human computer interaction has expanded. The ultimate goal of modern HCI is to make relationship between humans and machines similar to the communication between man and man

1. ***Is there any effective speech recognition system available? What are the shortcomings of speech recognition systems?***

Automatic speech recognition technology can be applied to computer access by allowing the user to speak the names of the keyboard characters or key words and have these spoken utterances interpreted by the computer as if they had been typed. The software spells every word it recognizes correctly. Typically, it recognizes 5–20% words incorrectly. It cannot recognize homonyms.

SILK-interface (Speech, Image, Language, Knowledge) is an intuitive

interaction between a human and an interface in a way natural for humans. It is an evolution in the field of computer interaction. Modern devices and computers have enough computing power to recognize desires and intentions of the user. Almost everything that the user is trying to resolve with the help of a computer, can be ordered through the recognition of facial expressions, voice and gestures. it is assumed that such interfaces should include dialogue with the user in a natural language containing symbolic elements, visual information (including facial expressions), and take into account such minor things as, for example the direction of user's sight

1. ***What does ergonomics study?***

The rapid growth of the number of users in recent years shows the increasing importance of the proper working space organization while using the computer. It is evident in the increasing number of young people with musculoskeletal problems, especially those with the spine

Ergonomics - ergo (work) + nomos (law) is a scientific discipline, which studies the complex human functional capabilities in labor and domestic processes. The main objective is to identify and create optimal conditions for high life and work efficiency. Other objectives of ergonomics are design, implementation and improvement of activities, means and conditions and special ways of preparing for them. Also improving the efficiency and the quality of human activities in the system "human - machine - object of activity - environment" for maintaining the health and personal development.

1. ***What are the main causes of fatigue in the design of jobs and the posture of the working person?***

The height of the working surface above the floor, as well as its size and shape are important factors influencing human performance. Failure to comply with the working surface requirements leads to increased fatigue, physical discomfort, a range of medical problems, and as a consequence a decreased productivity. Physiological disturbances occur in the neck and shoulder area, in the area of the forearm and hand, in the lumbar spine, the hip area. These problems increase significantly in case of the following violations:

* the keyboard height above the floor is too big or too small
* the forearm and wrist have no proper support and, therefore, do not rest
* the operator's head is overtilted
* due to the lack of space for the operator’s legs the thighs are bent under the table

1. ***What are the main types of musculoskeletal disorders at work on a computer, their causes and ways of prevention?***

Sedentary work (especially long) is harmful to human, in principle: you slouch or lean forward, your spine is deformed, injuring spinal discs. You raise your shoulders and bend your arms, keeping them on their toes, and, of course, they start to hurt. Pinch blood vessels, overload the heart, the hand tendrons are stretched, leading to painful consequences, and the vision is getting worse. Pose, consequently, productivity and health depend largely on the size and design of the workplace.

A human keeps sitting on average for about 80 000 hours in his life! We sit at work, while studying, eating, in the car, on the plane, watching TV, in the theater and even during our spare time. Action is disappearing from our lives. Nature has created the human body for action, dynamics and constant motion, for which the rest state is not typical. The sitting posture puts a strain on the back muscles, and only when a person leans back, the load is somewhat reduced.

Prolonged sitting leads to pains in the spine, legs, and headaches.

***Prevention:***

The height of the chair should be adjusted to the horizontal position of the hips and vertical position of the thighs. Feet should be placed firmly on the floor. The seat adjustment range should not be less than 38-52 cm in height. It is important to provide a footrest, which should have a slight inclination (5-15 °) and be heavy enough to be firmly fixed on the floor. The surface of the seats should be at least 45 cm wide and 38-43 cm deep.

The most important aspect of the information perception from monitor is the general and local lighting. Slow performance will occur as a result of insufficient illumination and overillumination. The lack of illumination slows down manual data input and excessive light exposure - increases the rate of errors

PART 6

30-Explain terms ‘Support’ and ‘Confidence’ for ARs applications, give an example.

Association rules(ARs) are the process to search relationships among data items in a given data set, so all the data items can be managed. Mainly association rules are used when a data set has large data items. It determines the sequential patterns that might exist in a large and unorganized data bank. These ideas have lots of application in medicine (diseases diagnostic), crime investigations, marketbasket researches, etc. The basic terminologies of the association rule are: Definition: Let a data set S:{I1, I2, I3, …, In} and a database of transactions D:{t1, t2, …, tn} where ti = {Ii1, Ii , …, Iim} and IiJ ∈ S, then association rule is an implication of the form X ⇒ Y, where X, Y ⊂S are items of data called as item sets and X Y = ∅ ((i.e. trivial implications X◊ X are eliminated).

Support: Support for an association rule X ⇒ Y is a percentage of transaction in the database that consists of X U Y. It is represented by S.

Confidence: Confidence for an association rule X ⇒ Y is a ratio of the number of transactions that contains X ∩Y to the number of transaction that contains X.

PART 7

1. What is computer network?

Computer network is a distributed computing system, which includes set of:

- computer facilities and network devices;

- communication channels;

- software (it controls the information interaction of computers in the

network).

Why are computers joined to a network? The network allows users of

different computers to exchange information and access remote resources.

Therefore, the computer is joined to the network to exchange information and

share computer resources (in the time-sharing mode). For example, together use

one printer, plotter, fax-modem, disk storage, etc. Each year the list of new

opportunities to use information resources is expanding.

2-What are the structure and the purpose of a computer network?

Computer network is a distributed computing system, which includes set of:

computer facilities and network devices; communication channels; software (it controls the information interaction of computers in the network).

3 What are the advantages of joining computers in a computer network?

Part 7/3.The advantages of using the computer networks are the following:

- quick and timely exchange of the data;

- sharing the peripherals reduces costs;

- possibility of using standard applications;

- effective planning and use of time while working on a common project

4. How do you understand the principle of interaction between computers on a ‘client-server’ network? What are the differences between server computers and client computers?

Part7/4. Client-server. It has an allocated DB server, which in addition to the storage performs data processing. The database can be viewed as a system consisting of two parts: the server and a set of clients. The database as such is called the DB server, and clients are various applications that run on the database.

Apple Talk system has been developed as a distributed client-server network. In other words users can share network resources (such as files and printers). Computers that provide these resources are called service devices (servers); computers that use network resources of service devices are called clients (clients). Interaction with service devices is considerably transparent to the user, as the computer itself determines the location of the requested material, and refers to it without receiving the further information from the user. In addition to the ease of use, the distributed systems also have economic advantages over systems where all are equal, since important material may be placed in a few, but not in many locations.

5. What are the types of networks and data transmission methods?

Client-server. It has an allocated DB server, which in addition to the storage

Part7/5.

Types of Network Territorial feature will be taken as basic classifications. From this point, computer networks are divided into:

– LAN (LocalAreaNetwork – local CN) combines multiple computers within the building;

– CAN (CampusAreaNetwork – campus (coorporate) CN) brings together a group of closely located buildings; – MAN (MetropolitanAreaNetwork – metropolitan (district, region) CN) provides information exchange within the city (district, region);

– WAN (WideAreaNetwork – large-scale CN) combines administrative units within the state or several neighboring states;

– GAN (GlobalAreaNetwork – global CN) brings together the continents. A special place in this classification is taken by IntraNet and ExtraNet.

They may be concurrently assigned to CAN and MAN (WAN, GAN). Computer network is conventionally divided into two broad classes:

– the first class unites LAN and CAN;

– the second class unites MAN, WAN and GAN.

In the first class network, host computers are located at small distances and connected with the common bus of a particular type. In the second class network, host computers are located at a considerable distance from each other. Territorial communication networks are used for the organization of their interaction, which are based on the main channel of primary networks. Main nodes of the second class may belong to one or more organizations, but are commonly used by many organizations. Networks based on servers are widespread.

Server – a computer which controls the network and gives users access to their network resources. Client – a computer in the network which is able to work with the data and the network resource.

The most common data transmission methods in wireless local area networks are the following:

- infrared radiation;

- laser;

- broadcast in a narrow range (single-frequency transmission);

- broadcast in the scattered spectrum;

- mobile networks.

Infrared radiation. These networks use infrared rays. There is a network of direct visibility, when the transmitter and receiver are tuned to each other and network is in scattered radiation. In this case, the signal is reflected off the walls and ceiling before reaching the receiver.

Laser. Laser requires a direct sight between transmitter and receiver. Any interference to beam interrupts the transmission.

Broadcast in a narrow range. In this case, users can configure transmitters and receivers as an ordinary radio to a particular frequency.

Broadcast in the scattered spectrum. The basic difference of it is that the signals are transmitted in a frequency band, and it gives the opportunity to have a truly wireless network.

Mobile networks. In this case telephone lines, cellular networks, satellite connection are used.

6. What is the purpose of various levels of networking model?

Physical layer sends the bits into the communication channel and receives incoming bitstream. It understands only ones and zeros, but does not understand the semantics of the bitstream that it is transmitting or receiving.

Link layer operates with such concepts as data flow control, identification and correction of errors, the transfer of frames. But it does not set the transmission and reception route.

Network layer is responsible for determining the route between the transmitting and receiving open systems. It does not have any mechanisms for detecting and correcting transmission errors and simply hopes for reliable transmission service of the link level.

Transport layer as a link layer provides functions responsible for integrity of transmitting data. But in contrast to the data link layer, the authority of level extends beyond the current segment of the local network. It can detect packets that have not been correctly recognized by the router and automatically generate a request for their retransmission.

Session layer is hardly involved as many protocols transmit its function to the transport layer. Managing the flow of proprietary information during the "dialogue" between the two open systems is the duty of the session layer.

Presentation layer is responsible for data coding method and controls the presentation of information in the network. The main function of the level is syntactic and semantic analysis of the transmitted data. At this level, the data presented in the format of an open system is converted to the required standard format for transmission.

Application layer provides the interface between the user applications and network programs (protocols). The scope of this level does not apply to the applications themselves.

7. Why are protocols necessary when transferring files over a network?

Protocols in a networked environment define the rules and data transfer procedures. Data transmission in the network consists of a series of steps that must be performed in a constant manner. The sending and receiving computers use protocols to perform the following procedures:

- partitioning data into packets;

- adding the address information to the packet;

- preparation of packets to the transfer;

- receiving packets transmitted by cable;

- copying the data from a packet to build the original data blocks;

- transmission of these reconstructed blocks to the computer.

8. What is the network topology? How do the various topologies like “star”, “ring” and “bus” differ?

Network topology is a mutual arrangement of computers, physical media and other network devices.

The bus topology provides a linear diagram to connect computers to one cable. The terminal resistance - terminators are set at the end of the cable. The signal passes through a cable through all the connected computers, bouncing off the terminator. The more connected computers to the cable via T connector the slower the network would be. This is one of the factors affecting the performance of the network.

In the network of the star topology, each node is connected to a device called a Hub or Switch. The hub provides a common connection, when all nodes can communicate with each other. In the networks of this type, concentrator sends a signal from one node to the other nodes. Hubs can be both passive and active. Active hubs support a greater number of nodes and longer cables.

The network with "ring" topology is characterized by the absence of endpoint connections: a network is closed, forming an indissoluble ring. Starting the movement from one point of the ring, the data are eventually coming back to the starting point. Because of such features of the "ring" topology, the data move in one direction only. Damage of a cable segment leads to failure of the entire network. Another weak point of "ring" is that the data pass through each node, allowing the interception not intended to outsiders. Typically, such topology is not used in a "pure" form because of its unreliability.

9. What is a Fast Ethernet?

Fast Ethernet (data transmission speed of 100 Mbit/s), and the IEEE 802.3z standard was adopted in 1997 - Gigabit Ethernet on fiber optic (data transmission speed of 1 Gbit/s). IEEE 802.3ab - Gigabit Ethernet twisted-pair category 5 was adopted in autumn, 1999, as a standard

10. What are the differences between the transmission media: twisted pair, coaxial cable and fiber optic cable?

The coaxial cable and twisted pair - wires of copper or copper-base coated with an insulating layer of other materials. They both can be used in television and telephony, to transmit data in the form of electrical signals. At that time, as a fiber-optic cable can transmit the same data types with a wider bandwidth, fast speed and high frequency. It is made of very thin and flexible glass or plastic tube.

11. What are the features of wireless data transmission technologies in computer networks?

pros

One system for all types of data and applications;

Extensibility, ease reconfiguration;

The documentation for each node of the system;

The warranty on the system up to 20 years of operation;

Very high reliability

Minuses

The high cost of design and installation

12. What is the purpose of network cards? Why are repeaters necessary for data transmission?

Devices which connect the end user with the network, also referred to as terminal nodes or stations (host). An example of such device is a conventional personal computer or workstation (powerful computer, performs certain functions requiring large processing power. For example, video processing, modeling of physical processes, etc.

The purpose of using the repeater is regenerated and re-synchronization network signals at the bit level, which allows you to send them through the medium over a greater distance. The term repeater (repeater) originally meant individual port 'inlet' 'a device and a separate port on its' output'. It is now also used by repeaters with multiple ports.

**13. What is the purpose of hubs and switches? What is the difference?**

AP company Bay Networks (USA), manager of data administration, switches, hubs, routers, traffic messages is used in more than 50% of the world systems f**or the organization of the computational process in the administration** of local and global networks used.

Switches have more features than hubs, carrying, in particular, the role of routers within the network. Network topology containing switches are called switched topologies. Switch "learns" the MAC-address and stores them in an internal lookup table. The switch establishes a temporary connection between the sender and the recipient of the frame and the frame is transmitted on the temporary connection.

**14. What is the purpose of network operating system?**

**Network operating system** is an operating system oriented to computer networking, to allow shared file and printer access among multiple computers in a network, to enable the sharing of data, users, groups, security, applications, and other networking functions.

**15. What are the differences between basic approaches to network management organization: objects tables, domains and DNS service?**

The first approach is object tables (Bindery). Used in Novell NetWare network operating systems. This table is located on each file server in the network. It contains information about users, groups, and their access rights to network resources (data, services, and printing via network printer, etc.) - this organization is convenient if there is only one server in the network. In this case, you need to define and control only one information base. When you expand the network and add new servers, the volume of tasks for managing network resources increases dramatically. The system administrator has to define and control the users ' work on each network server. Network subscribers, in turn, must know exactly where certain network resources are located, and to get access to these resources, they must register on the selected server. Of course, for information systems consisting of a large number of servers, this organization of work is not suitable.

The second approach is used in LAN Server and Windows NT Server-domain structure. All network resources and users are grouped together. The domain can be considered as an analog of object tables (English, bindery), only here such a table is shared by several servers, and server resources are shared by the entire domain. Therefore, in order for a user to access the network, it is enough to connect to the domain (register). After that, all the domain resources and resources of all servers and devices that are part of the domain become available to it. However, using this approach also causes problems when building an information system with a large number of users, servers, and therefore domains, for example, a network for an enterprise or a large branched organization. Here, these problems are already related to the organization of interaction and management of multiple domains.The third approach, the directory name Services (DNS), is devoid of these disadvantages. All network resources( network printing, data storage, users, servers, etc.) are considered as separate branches or directories of the information system. Tables that define DNS are located on each server. This, firstly, increases the reliability and survivability of the system, and secondly, simplifies the user's access to network resources. By registering on a single server, the user gets access to all network resources. Managing such a system is also easier than using domains, since there is a single table that defines all network resources, while for a domain organization, you need to define resources, users, and their access rights for each domain separately.

**16.What is the IP address of a computer used for?**

**IP-address** is a unique 32-bit identifier of the IP interface on the Internet. IP-address is usually written, broken down into octets in decimal separated by a dot

IP address formats 220

|  |  |
| --- | --- |
| Binary | Decimal |
| 10100000.01010001.00000101.10000011 | 160.81.5.131 |

Each IP address in the Internet or Intranet should be unique regardless of the number of nodes in the network, weather 1000 or 1000 000 nodes. If your company network is configured to use TCP/IP and is not connected to the Internet, then assignment and the use of unduplicated address from the IP address space is not a big problem. You can choose from the entire address space those that meet your needs. However, if your organization's network must be connected to the Internet, it becomes much more difficult to make sure that the IP address is not used by anyone else.

**17. What classes of addresses are used in the TCP/IP protocol?**

A Class uses only the first octet as a network identifier and remaining three octets as the node ID.

B Class uses the first two octets for the network ID and the remaining two octets for the node identifier   
C Class uses the first three octets for the network identifier and the remaining octet for the node ID.  
D Class uses high-order bits of the first octet for broadcasting messages.  
E Class is an experimental class of the addresses reserved for future use.

**18. What is the purpose of a subnet mask?**

Subnet musk is a 32-bit address that allows you to determine how many bits in the address are used as the network ID. The network mask is constructed by the following rules: 1) at a position corresponding to the network ID, bits are set (1). 2) at a position corresponding to the node ID, the bits are released (0).

**19. In the networks of which classes the IP addresses have more than 1000 hosts? In the networks of which classes the IP addresses have only 254 hosts?**

More than 1000 hosts in the networks is: A,B classes

Only 254 is: C classes