**1. Read and render the text into Kazakh/Russian:**

**2. Write an essay on the given topic: “**Computer technology and software”

**Types of information systems**

Information systems support operations, knowledge work, and management in organizations. (The overall structure of organizational information systems is shown in the figure.) Functional information systems that support a specific organizational function, such as marketing or production, have been supplanted in many cases by cross-functional systems built to support complete business processes, such as order processing or employee management. Such systems can be more effective in the development and delivery of the firm’s products and can be evaluated more closely with respect to the business outcomes. The information-system categories described here may be [implemented](https://www.merriam-webster.com/dictionary/implemented) with a great variety of application programs.

**[Structure of organizational information systems](https://cdn.britannica.com/66/65066-050-DA47C86B/support-information-systems-Information-layers-Structure-Support.jpg)**

Information systems consist of three layers: operational support, support of knowledge work, and management support. Operational support forms the base of an information system and contains various transaction processing systems for designing, marketing, producing, and delivering products and services. Support of knowledge work forms the middle layer; it contains subsystems for sharing information within an organization. Management support, forming the top layer, contains subsystems for managing and evaluating an organization's resources and goals.

**Operational support and enterprise systems**

[Transaction processing](https://www.britannica.com/technology/transaction-processing) systems support the operations through which products are designed, marketed, produced, and delivered. In larger organizations, transaction processing is frequently accomplished with large [integrated](https://www.merriam-webster.com/dictionary/integrated) systems known as enterprise systems. In this case, the information systems that support various functional units—sales and marketing, production, finance, and human resources—are integrated into an enterprise resource planning (ERP) system, the principal kind of enterprise system. ERP systems support the value chain—that is, the entire sequence of activities or processes through which a firm adds value to its products. For example, an individual or another business may submit a custom order over the [Web](https://www.britannica.com/topic/World-Wide-Web) that automatically initiates just-in-time production to the customer’s specifications through an approach known as mass customization. This involves sending orders from the customers to the firm’s warehouses and perhaps to suppliers to deliver input materials just in time for a batched custom production run. Financial accounts are updated accordingly, and delivery [logistics](https://www.merriam-webster.com/dictionary/logistics) and billing are initiated.

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**Support of knowledge work**

A large proportion of work in an information society involves manipulating abstract information and knowledge (understood in this [context](https://www.merriam-webster.com/dictionary/context) as an organized and [comprehensive](https://www.merriam-webster.com/dictionary/comprehensive) structure of facts, relationships, theories, and insights) rather than directly processing, manufacturing, or delivering [tangible](https://www.merriam-webster.com/dictionary/tangible) materials. Such work is called [knowledge work](https://www.britannica.com/topic/knowledge-work). Three general categories of information systems support such knowledge work: professional support systems, collaboration systems, and knowledge management systems.

**Professional support systems**

Professional support systems offer the facilities needed to perform tasks specific to a given profession. For example, automotive engineers use [computer-aided engineering](https://www.britannica.com/technology/computer-aided-engineering) (CAE) software together with [virtual reality](https://www.britannica.com/technology/virtual-reality) systems to design and test new models as electronic [prototypes](https://www.merriam-webster.com/dictionary/prototypes) for fuel [efficiency](https://www.merriam-webster.com/dictionary/efficiency), handling, and passenger protection before producing physical prototypes, and later they use CAE in the design and analysis of physical tests. Biochemists use specialized three-dimensional modeling software to visualize the molecular structure and probable effect of new drugs before investing in lengthy clinical tests. Investment bankers often employ financial software to calculate the expected rewards and potential risks of various investment strategies. Indeed, specialized support systems are now available for most professions.

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**Collaboration systems**

The main objectives of collaboration systems are to [facilitate](https://www.merriam-webster.com/dictionary/facilitate) [communication](https://www.britannica.com/topic/communication) and teamwork among the members of an organization and across organizations. One type of collaboration system, known as a workflow system, is used to route relevant documents automatically to all appropriate individuals for their contributions.

Development, pricing, and approval of a commercial insurance policy is a process that can benefit from such a system. Another category of collaboration systems allows different individuals to work simultaneously on a shared project. Known as [groupware](https://www.britannica.com/technology/collaborative-software), such systems accomplish this by allowing controlled shared access, often over an intranet, to the work objects, such as business proposals, new designs, or digital products in progress. The collaborators can be located anywhere in the world, and, in some multinational companies, work on a project continues 24 hours a day.

Other types of collaboration systems include [enhanced](https://www.merriam-webster.com/dictionary/enhanced) e-mail and videoconferencing systems, sometimes with telepresence using avatars of the participants. Yet another type of collaboration software, known as [wiki](https://www.britannica.com/topic/wiki), enables multiple participants to add and edit content. (Some online encyclopaedias are produced on such platforms.) Collaboration systems can also be established on [social network](https://www.britannica.com/technology/social-network) platforms or virtual life systems. In the open [innovation](https://www.merriam-webster.com/dictionary/innovation) [initiative](https://www.merriam-webster.com/dictionary/initiative), members of the public, as well as existing and potential customers, can be drawn in, if desired, to enable the cocreation of new products or projection of future outcomes.

**Knowledge management systems**

Knowledge management systems provide a means to assemble and act on the knowledge accumulated throughout an organization. Such knowledge may include the texts and images contained in patents, design methods, best practices, competitor intelligence, and similar sources, with the elaboration and commentary included. Placing the organization’s documents and communications in an indexed and cross-referenced form enables rich search capabilities. Numerous application programs, such as [Microsoft](https://www.britannica.com/topic/Microsoft-Corporation)’s SharePoint, exist to facilitate the implementation of such systems. Organizational knowledge is often tacit, rather than explicit, so these systems must also direct users to members of the organization with special expertise.

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**Management support**

A large category of information systems [comprises](https://www.merriam-webster.com/dictionary/comprises) those designed to support the [management](https://www.britannica.com/topic/management) of an organization. These systems rely on the data obtained by transaction processing systems, as well as on data and information acquired outside the organization (on the [Web](https://www.britannica.com/topic/World-Wide-Web), for example) and provided by business partners, suppliers, and customers.

**Management reporting systems**

Information systems support all levels of management, from those in charge of short-term schedules and budgets for small work groups to those concerned with long-term plans and budgets for the entire organization. Management reporting systems provide routine, detailed, and voluminous information reports specific to each manager’s areas of responsibility. These systems are typically used by first-level supervisors. Generally, such reports focus on past and present activities, rather than projecting future performance. To prevent information overload, reports may be automatically sent only under exceptional circumstances or at the specific request of a manager.

**Managing information systems**

For an organization to use its information services to support its operations or to innovate by launching a new [initiative](https://www.merriam-webster.com/dictionary/initiative), those services have to be part of a well-planned infrastructure of core resources. The specific systems ought to be configured into a coherent architecture to deliver the necessary information services. Many organizations rely on outside firms—that is, specialized IT companies—to deliver some, or even all, of their information services. If located in-house, the management of information systems can be decentralized to a certain degree to correspond to the organization’s overall structure.

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**Acquiring information systems and services**

Information systems are a major corporate asset, with respect both to the benefits they provide and to their high costs. Therefore, organizations have to plan for the long term when acquiring information systems and services that will support business [initiatives](https://www.merriam-webster.com/dictionary/initiatives). At the same time, firms have to be responsive to emerging opportunities. On the basis of long-term corporate plans and the requirements of various individuals from data workers to top management, essential applications are identified and project priorities are set. For example, certain projects may have to be carried out immediately to satisfy a new government reporting regulation or to interact with a new customer’s information system. Other projects may be given a higher priority because of their strategic role or greater expected benefits.

Once the need for a specific information system has been established, the system has to be acquired. This is generally done in the [context](https://www.merriam-webster.com/dictionary/context) of the already existing information systems architecture of the firm. The acquisition of information systems can either involve external sourcing or rely on internal development or modification. With today’s highly developed IT industry, companies tend to acquire information systems and services from specialized vendors. The principal tasks of information systems specialists involve modifying the applications for their employer’s needs and [integrating](https://www.merriam-webster.com/dictionary/integrating) the applications to create a [coherent](https://www.merriam-webster.com/dictionary/coherent) systems architecture for the firm. Generally, only smaller applications are developed internally. Certain applications of a more personal nature may be developed by the end users themselves.

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**Acquisition from external sources**

There are several principal ways to acquire an information system from outside the organization. Many firms have resorted to [outsourcing](https://www.britannica.com/topic/outsourcing) their information systems. Outsourcing entails transferring the major components of the firm’s systems and operations—such as data centres, telecommunications, and [software](https://www.britannica.com/technology/software) development and maintenance—to a specialized company that provides its services under long-term contracts specifying the service levels (that is, the scope and the quality of service to be provided). In some cases the outsourcing entails moving the services abroad—i.e., [offshoring](https://www.britannica.com/topic/offshoring) in pursuit of the cost or expertise advantages. Responsibility for the acquisition of new applications then falls to the outside company. In other cases the company may outsource just the development or maintenance of their information systems, with the outside company being a systems developer.

[Cloud computing](https://www.britannica.com/technology/cloud-computing) is increasingly being adopted as a source of information services. It offers on-demand access via the [Internet](https://www.britannica.com/technology/Internet) to services furnished by a provider that runs data centres with the necessary software and other resources. The services can be provided at one of three levels: as the [infrastructure](https://www.merriam-webster.com/dictionary/infrastructure) for running existing applications, as the platform for developing new applications, or as [software-as-a-service](https://www.britannica.com/technology/software-as-a-service) (SaaS) to be used by the firm over the network. In particular, SaaS has become a cost-effective way to use enterprise systems. Generally, cloud computing is provided by external vendors, although some firms [implement](https://www.merriam-webster.com/dictionary/implement) their own private clouds in order to share resources that employees can access over the network from a variety of devices, often including smartphones. Scalability and avoidance of capital expenditures are notable advantages of public clouds; the partial loss of control is a drawback.

Companies may choose to acquire an application by leasing a [proprietary](https://www.merriam-webster.com/dictionary/proprietary) package from a vendor under a license and having the software customized internally or externally by the vendor or another outside contractor. Enterprise systems are generally leased in this way. An [alternative](https://www.merriam-webster.com/dictionary/alternative) is to [deploy](https://www.merriam-webster.com/dictionary/deploy) an [open-source](https://www.britannica.com/topic/open-source) application, whose program code is free and open for all to modify under a different type of license that enforces the openness of the application in perpetuity. Generally, the costs of the use of open-source software include the technical support from specialized vendors.

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**Internal information systems development**

When an information system is developed internally by an organization, one of two broad methods is used: life-cycle development or rapid application development (RAD).

The same methods are used by software vendors, which need to provide more general, customizable systems. Large organizational systems, such as enterprise systems, are generally developed and maintained through a systematic process, known as a [system life cycle](https://www.britannica.com/topic/system-life-cycle), which consists of six stages: feasibility study, system analysis, system design, programming and testing, installation, and operation and maintenance. The first five stages are system development proper, and the last stage is the long-term exploitation. Following a period of use (with maintenance as needed), the information system may be either phased out or upgraded. In the case of a major upgrade, the system enters another development life cycle.

Industrial methods of software production and reuse have been [implemented](https://www.merriam-webster.com/dictionary/implemented) in systems development. Thus, reusable software components are developed, tested, and catalogued to be [deployed](https://www.merriam-webster.com/dictionary/deployed) as parts of future information systems. A particularly important method of component-based development is the use of Web services, which are software objects that deliver a specific function (such as looking up a customer’s order in a [database](https://www.britannica.com/technology/database)) and can be stitched together into interorganizational information systems enabling business partners to cooperate.

After an installed system is handed over to its users and operations personnel, it will almost invariably be modified extensively over its useful life in a process known as system maintenance. A large system will typically be used and maintained for some 5 to 10 years or even longer. Most maintenance is to adjust the system to the organization’s changing needs and to new equipment and other software, but inevitably some maintenance involves correcting design errors and exterminating software “bugs” as they are discovered.

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**Information system infrastructure and architecture**

A well-designed information system rests on a [coherent](https://www.merriam-webster.com/dictionary/coherent) foundation that supports responsive change—and, thus, the organization’s agility—as new business or administrative [initiatives](https://www.merriam-webster.com/dictionary/initiatives) arise. Known as the information system [infrastructure](https://www.merriam-webster.com/dictionary/infrastructure), the foundation consists of core [telecommunications networks](https://www.britannica.com/technology/telecommunications-network), [databases](https://www.britannica.com/technology/database) and data warehouses, [software](https://www.britannica.com/technology/software), [hardware](https://www.britannica.com/technology/hardware-computing), and procedures managed by various specialists. With business [globalization](https://www.merriam-webster.com/dictionary/globalization), an organization’s infrastructure often crosses many national boundaries. Establishing and maintaining such a complex infrastructure requires extensive planning and consistent implementation to handle strategic corporate initiatives, transformations, mergers, and acquisitions. Information system infrastructure should be established in order to create meaningful options for future corporate development.

When organized into a coherent whole, the specific information systems that support operations, management, and knowledge work [constitute](https://www.merriam-webster.com/dictionary/constitute) the system architecture of an organization. Clearly, an organization’s long-term general strategic plans must be considered when designing an information system infrastructure and architecture.

**Organization of information services**

Information services of an organization are delivered by an outside firm, by an internal unit, or by a combination of the two. Outsourcing of information services helps with such objectives as cost savings, access to superior personnel, and focusing on core [competencies](https://www.merriam-webster.com/dictionary/competencies).

An information services unit is typically in charge of an organization’s information systems. When the systems are largely outsourced, this unit is of a limited size and concentrates on aligning the systems with the corporate competitive strategy and on supervising the outside company’s services. When information services are provided in-house and centralized, this unit is responsible for planning, acquiring, operating, and maintaining information systems for the entire organization. In decentralized structures, however, the central unit is responsible only for planning and maintaining the infrastructure, while business and administrative specialists supervise systems and services for their own units. A variety of intermediate organizational forms are possible.

In many organizations, information systems are headed by a chief information officer (CIO) or a chief [technology](https://www.britannica.com/technology/technology) officer (CTO). The activities of information services are usually supervised by a steering committee consisting of the executives representing various functional units of the organization. Steering committees set the priorities for the development of future systems. In the organizations where information systems play a strategic role, boards of directors need to be involved in their governance. As described below, a vital responsibility of an information services unit is to ensure uninterrupted service and [integrity](https://www.merriam-webster.com/dictionary/integrity) of the systems and information in the face of many security threats.

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**Information systems security and control**

With the opening of information systems to the global [Internet](https://www.britannica.com/technology/Internet) and with their thorough infusion into the operation and management of business and government organizations and into the infrastructure of daily life across the world, information security issues have moved to the forefront of concerns about global well-being.

**Information systems security**

Information systems [security](https://www.britannica.com/technology/security-and-protection-system) is responsible for the integrity and safety of system resources and activities. Most organizations in developed countries are dependent on the secure operation of their information systems. In fact, the very fabric of societies often depends on this security. Multiple infrastructural grids—including power, [water supply](https://www.britannica.com/science/water-supply), and health care—rely on it. Information systems are at the heart of intensive care units and [air traffic control](https://www.britannica.com/technology/air-traffic-control) systems. Financial institutions could not survive a total failure of their information systems for longer than a day or two. Electronic funds transfer systems (EFTS) handle immense amounts of money that exist only as electronic signals sent over the networks or as spots on storage disks. Information systems are [vulnerable](https://www.merriam-webster.com/dictionary/vulnerable) to a number of threats and require strict controls, such as continuing countermeasures and regular audits to ensure that the system remains secure. (The relationship among security measures is shown in the figure.)

**Information systems controls**

To ensure secure and efficient operation of information systems, an organization institutes a set of procedures and technological measures called controls. Information systems are safeguarded through a combination of general and application controls.

General controls apply to information system activities throughout an organization. The most important general controls are the measures that control access to computer systems and the information stored there or transmitted over telecommunications networks. General controls include administrative measures that restrict employees’ access to only those processes directly relevant to their duties. As a result, these controls limit the damage that any individual employee or employee impersonator can do. Fault-tolerant computer systems installed in critical [environments](https://www.merriam-webster.com/dictionary/environments), such as in hospital information systems or securities marketplaces, are designed to control and isolate problems so that the system can continue to function. Backup systems, often in remote locations, may be activated in the case of failure of the primary information system.

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**Securing information**

Controlling access to information systems became profoundly more difficult with the spread of wide area networks (WANs) and, in particular, the Internet. Users, as well as interlopers, may access systems from any unattended computer within an organization or from virtually anywhere over the Internet. As a security measure, each legitimate user has a unique name and a regularly changed password. Another security measure is to require some form of physical authentication, such as an object (a physical token or a smart card) or a personal characteristic (fingerprint, retinal pattern, hand geometry, or signature). Many systems combine these types of measures—such as automatic teller machines, which rely on a combination of a personal identification number (PIN) and an identification card. Security measures placed between an organization’s internal networks and the Internet are known as [firewalls](https://www.britannica.com/technology/firewall). These combinations of hardware and software continually filter the incoming, and often outgoing, data traffic.

A different way to prohibit access to information is via [data encryption](https://www.britannica.com/technology/data-encryption), which has gained particular importance in [electronic commerce](https://www.britannica.com/technology/e-commerce). [Public key encryption](https://www.britannica.com/topic/public-key-cryptography) is used widely in such commerce. To ensure confidentiality, only the intended addressee has the private key needed to decrypt messages that have been encrypted with the addressee’s public key. Furthermore, authentication of both parties in an electronic transaction is possible through the digital certificates issued to both parties by a trusted third party and the use of digital signatures—an additional code attached to the message to verify its origin. A type of antitampering code can also be attached to a message to detect corruption. Similar means are available to ensure that parties to an electronic transaction cannot later [repudiate](https://www.merriam-webster.com/dictionary/repudiate) their participation. Some messages require additional attributes. For example, a payment in electronic cash is a type of message, with encryption used to ensure the purchaser’s anonymity, that acts like physical cash.

To continually monitor information systems, intrusion detection systems are used. They detect anomalous events and log the information necessary to produce reports and to establish the source and the nature of the possible intrusion. More active systems also attempt to prevent the intrusion upon detection in real time.

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**Organizational impacts of information systems**

Essential organizational capabilities are enabled or [enhanced](https://www.merriam-webster.com/dictionary/enhanced) by information systems. These systems provide support for business operations; for individual and group decision making; for [innovation](https://www.merriam-webster.com/dictionary/innovation) through new product and process development; for relationships with customers, suppliers, and partners; for pursuit of competitive advantage; and, in some cases, for the business model itself (e.g., [Google](https://www.britannica.com/topic/Google-Inc)). Information systems bring new options to the way companies interact and compete, the way organizations are structured, and the way [workplaces](https://www.britannica.com/topic/work-economics) are designed. In general, use of Web-based information systems can significantly lower the costs of [communication](https://www.britannica.com/topic/communication) among workers and firms and cost-effectively [enhance](https://www.merriam-webster.com/dictionary/enhance) the coordination of supply chains or webs. This has led many organizations to concentrate on their core [competencies](https://www.merriam-webster.com/dictionary/competencies) and to outsource other parts of their value chain to specialized companies. The capability to communicate information efficiently within a firm has led to the deployment of flatter organizational structures with fewer hierarchical layers.

Nevertheless, information systems do not uniformly lead to higher profits. Success depends both on the skill with which information systems are [deployed](https://www.merriam-webster.com/dictionary/deployed) and on their use being combined with other resources of the firm, such as relationships with business partners or superior knowledge in the industrial segment.

The use of information systems has enabled new organizational structures. In particular, so-called virtual organizations have emerged that do not rely on physical offices and standard organizational charts. Two notable forms of virtual organizations are the network organization and the cluster organization.

In a network organization, long-term corporate partners supply goods and services through a central hub firm. Together, a network of relatively small companies can present the appearance of a large corporation. Indeed, at the core of such an organization may be nothing more than a single [entrepreneur](https://www.merriam-webster.com/dictionary/entrepreneur) supported by only a few employees. Thus, network organization forms a flexible [ecosystem](https://www.britannica.com/science/ecosystem) of companies, whose formation and work is organized around Web-based information systems.