

IT (Information Technology)

*Khatam Institute of higher Education
Session# 5*



Course Description (Continued..)

- *Contents:*
- *The role of managers in Information Technology (IT)* (3 sessions)
- *Organizational Issues* (3 sessions)
- *Information Technology* (9 sessions)
- *Operational and enterprises systems* (4 sessions)
- *Exciting directions in systems* (3 sessions)
- *E-Business and E-Commerce* (3 sessions)
- *Issues for senior management* (2 sessions)

Course Description (Continued..)

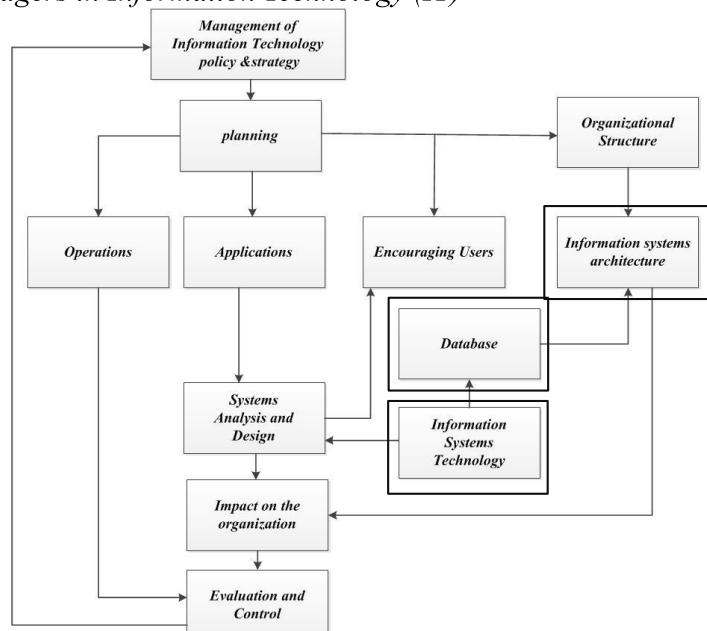
▪ Contents:

- *Information Technology* (9 sessions)
 - *Fundamentals*
 - *The components of a personal computer*
 - *Software*
 - *Managerial concerns*
 - *The Contribution of Higher-Level languages*
 - *The Web Browser and Internet standards*
 - *The operating system*
 - *Database management*
 - *File elements*
 - *Enter database management software*
 - *Database in systems design*
 - *Data Warehouses, Data Marts, and Data Centers*
 - *Enterprise Content Management*

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The role of managers in Information Technology (IT)



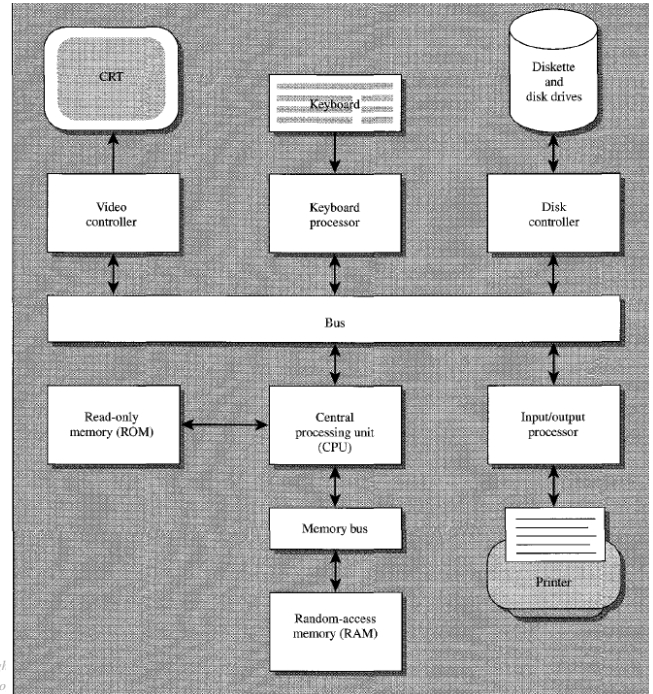
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Information Technology

▪ Fundamentals

- *The components of a personal computer*
 - *The heart of the computer is the central processing unit or CPU, which contains the logic that controls the calculations done by the computer.*
- *The Bus is a communications device, really a connection among various parts of the computer*

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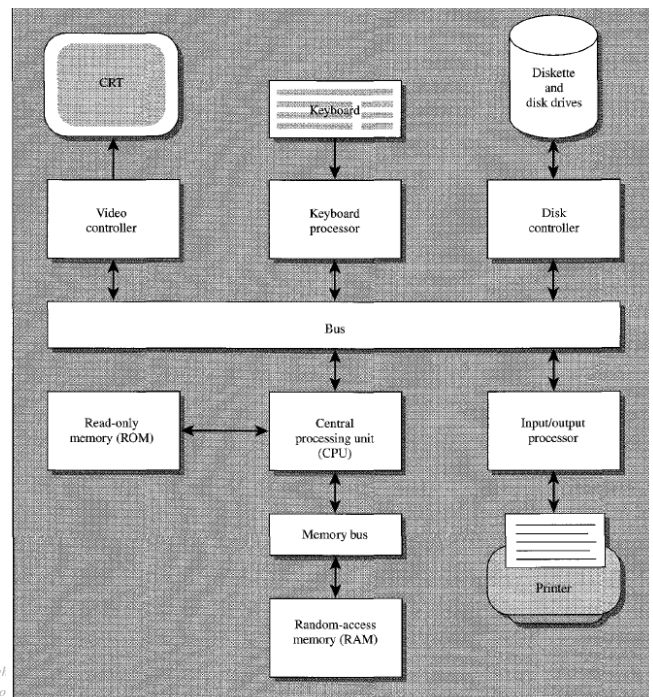


Information Technology

▪ Fundamentals

- *The components of a personal computer*
 - *Primary memory of the computer holds two kinds of information.*
- *We have an input-output (I/O) processor, which is dedicated to controlling devices such as printers*
- *Read-only memory stores instructions used by the computer*

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Information Technology

▪ Fundamentals

▪ CPU

- The control unit manages the CPU
- The Bus interfaces the cache memory on the chip with random access memory chips (RAM).
- The code cache is a portion of very fast memory on the CPU chip.
- The data cache is also fast memory for keeping small amounts of data for faster access than is available from RAM memory chips.
- The instruction location counter always points to the next instruction in a program to be executed

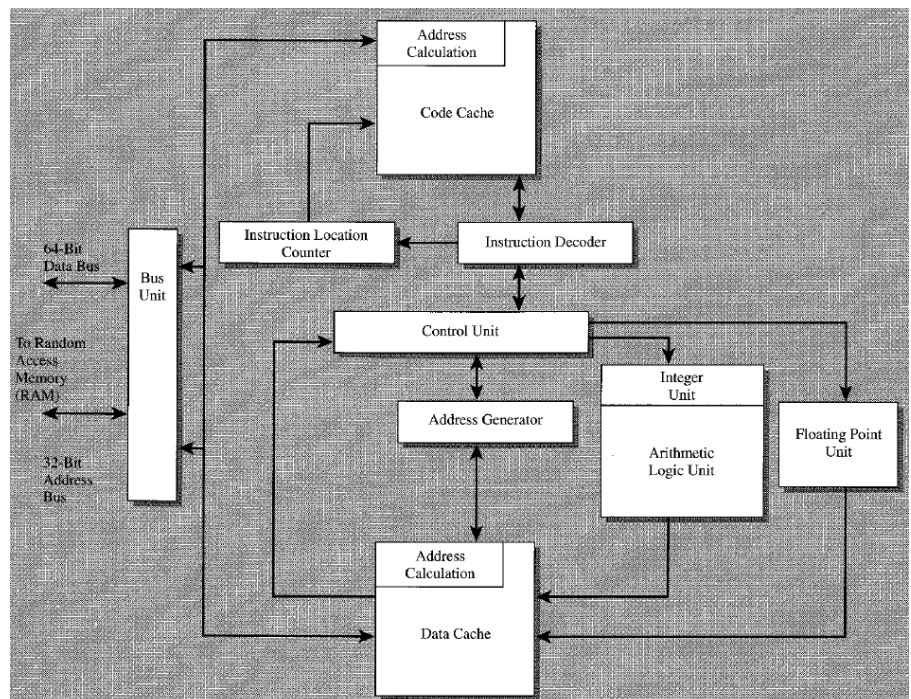
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Information Technology

▪ Fundamentals

▪ CPU



Information Technology

- *Fundamentals*
 - *CPU*
 - *The instruction decoder determines what each instruction means*
 - *The address generator computes the address in memory for these data.*
 - *The integer unit performs integer arithmetic, and the floating-point unit performs floating-point arithmetic.*
 - *The arithmetic and logic unit (ALU) performs logical operations such as comparisons between two numbers.*

Information Technology

- *Fundamentals*
 - *What makes a chip perform*
 - *Clock speed*
 - *Data path*
 - *Computation*
 - *Memory size*
 - *Floating-point arithmetic*
 - *Number of transistors per chip*
 - *Pipe lined execution*

Information Technology

- *Fundamentals*
 - *What Techniques Increase Speed*
 - *Cache memory*
 - *When the computer reads from the disk, the cache memory is filled with the data requested and with extra data nearby.*
 - *A pipelined computer breaks down instructions into many small steps like an assembly line. Each of these steps or stages is handled by a separate circuit.*
 - *The Pentium chip features two integer execution units, each fed by its own instruction pipeline, also called superscalar architecture*

Information Technology

- *Fundamentals*
 - *What Techniques Increase Speed*
 - *Many of today' s PC applications depend on graphic features, so manufacturers have turned their attention to the video controller and its role in the computer.*
 - *Graphics accelerator cards are video controllers that actually have a processor chip and a large amount of memory (say, a megabyte or more) to offload the display task from the CPU*

Information Technology

- *Fundamentals*
 - *Input/output*

POPULAR INPUT-OUTPUT DEVICES

Both input and output	Input devices	Output devices
PC Terminal	Keyboard Mouse Scanning Image Optical Character Recognition Bar code Touch screen Voice	Printers Laser Inkjet Voice Graphics

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Information Technology

- *Fundamentals*
 - *Input/output*
 - *Barcoding*
 - *Bar coding is an extremely popular way of entering data into a computer. We encounter a form of bar coding in grocery stores equipped with checkout scanners. These devices use a laser to read the universal product code (UPC)*
 - *Other types of bar codes are used extensively in the manufacturing industry.*
 - *In a highly automated factory, parts are marked with bar codes. The codes direct the flow of the part through the factory and may even indicate to a machine what operations to perform on it.*



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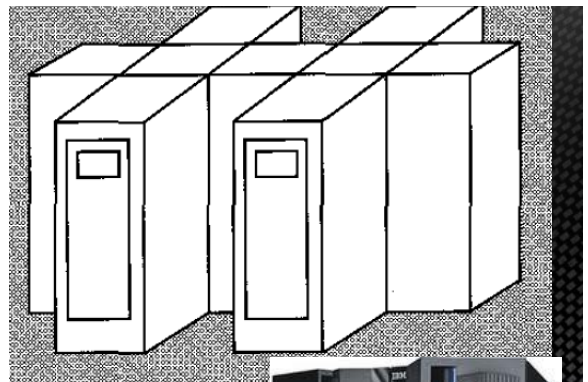
- *Fundamentals*
 - *Input/output*
 - *Optical character recognition (OCR)*
 - *An OCR software package reads the image and converts the characters in the image to ASCII.*
 - *To recognize letters or characters, the OCR software compares the input with a series of stored characters attempting to find the best match.*

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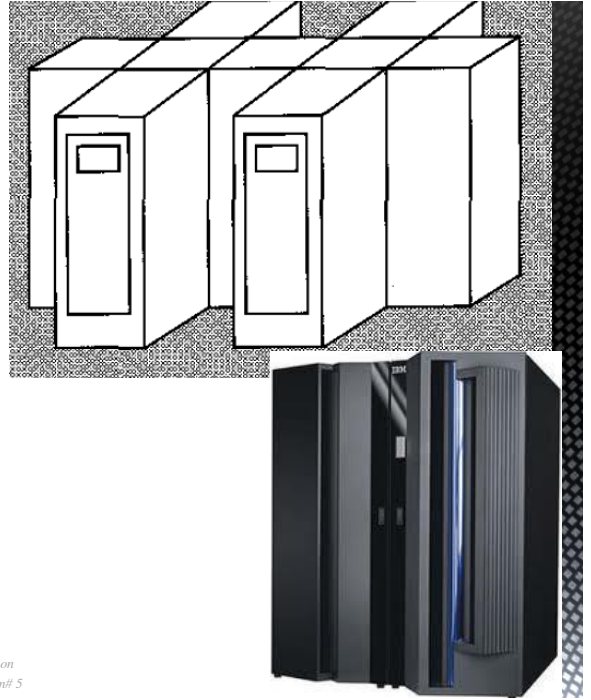
- *The today's computers*
 - *The first computers developed were mainframes, which are large general-purpose machines.*
 - *Today this type of machine is likely to support a number of terminals and personal computers interacting with huge databases containing billions of characters of data.*
 - *Mainframe computers are used extensively to process transactions and maintain vital data for access by various users.*



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Information Technology

- *The today's computers*
 - *Today many mainframe applications are called "legacy systems."*
 - *These systems represent a heavy investment; they process critical transactions, and they are difficult to change.*
 - *These mainframe systems are capable of processing a huge volume of transactions given very high speed data channels*



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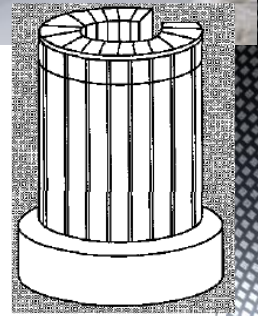
- *The today's computers*
 - *Organizations using mainframe computers generally process large amounts of data.*
 - *The computers may access databases with billions of characters of data and control networks of hundreds or thousands of terminals.*
 - *The computers need to be able to handle extensive telecommunications activities and input-output operations.*



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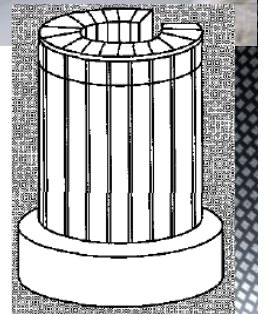
- *The today's computers*
 - *Scientists and engineers have computationally intensive problems to solve, often involving numbers with many digits of significance.*
 - *Examples include the*
 - *Simulation of airflow over an aircraft,*
 - *Weather forecasting simulations,*
 - *Analysis of geological data, and even*
 - *Predictions about the speed of a sailboat designed for the Americas Cup competition.*



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Information Technology

- *The today's computers*
 - *Supercomputers are among the fastest computers today, with speeds measured in hundreds of megaflops (a megaflop is the execution of 1 million floating-point instructions per second) to more than a gigaflop (1 billion floating-point instructions per second).*
 - *Machines have achieved teraflop speeds, executing over 1 trillion instructions per second.*



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Information Technology

- *The today's computers*
 - *Minicomputers evolved as manufacturers increased processing speeds and expanded word sizes to 32 bits.*
 - *Companies use this midrange computer for a variety of processing tasks, some of which are similar to what a mainframe did a decade ago.*
 - *Next came the PC or personal computer, which was first designed as an 8-bit computer.*
 - *Workstations use high-performance 32-bit computers for engineering and scientific work. The workstation features superior graphics and is often used for design tasks.*

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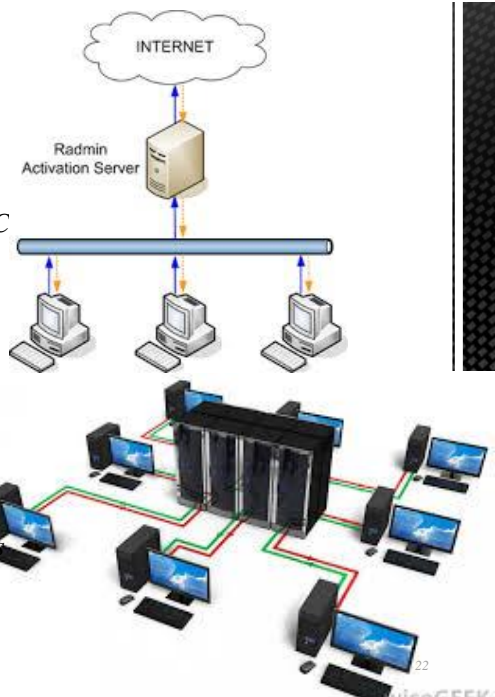
Information Technology

- *The today's computers*
 - *In the client-server model of computing, a user's client PC makes requests of a server computer that has data and possibly programs on it*
 - *The server is responsible for the database and is likely to execute transactions to update and manage it.*
 - *One Compaq server containing four Pentium processors has been clocked at 600 transactions per second with standard database software compared to 200 transactions per second for some midrange computers.*



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Information Technology

- *The today's computers*
 - *The PDA or personal digital assistant began as super calculators able to store a user's calendar and phone book.*
 - *Today these devices often weigh less than a pound and some offer handwriting and voice recognition, fax and modem communications, and even a pager.*
 - *A sales representative might use a small PDA that has information on contracts. A longshoreman uses a PDA that has a bar-code reader and scanner to record the location of containers.*



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The role of managers in Information Technology (IT)

- *HW#07*
 - *Simon Marshall Associates*
 - *Study your reference book in page 195. The book talks about the case study of Simon Marshall Associates.*
 - *Try to answer the questions in the case study based on our described context in this session*
- *The Home work should be sent to FValilai@sharif.edu*
- *Email subject: "HW07:studentnumber"*

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Course Description (Continued..)

- **Contents:** (9 sessions)
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Information Technology

- *Software is the key*
 - *Hardware takes software to do anything useful with a computer.*
 - *we defined software as the instructions that tell a computer what actions to take*
 - *We generally divide software into two main types: systems software and applications software*
 - *Systems software manages the computer and/or provides a set of standard services to its users.*
 - *A second type of systems software is a programming environment. An environment provides the programmer with a virtual workspace and access to various libraries.*
- *Applications software solves an information processing problem in an organization. The programs constituting the systems we have seen so far are classified as applications software.*

Information Technology

SOFTWARE GENERATIONS

Generation	Software
First	1950–1958 Machine language Assembly language
Second	1958–1964 Assembly language Higher-level languages Batch operating systems Dedicated on-line systems Experimental time-sharing
Third	1964–1970 Preponderance of higher-level languages Expansion of packaged systems Operating system mandatory Mixed on-line and batch applications Virtual-memory time-sharing systems
Third-and-one-half	1970–1980 Expanded operating systems Virtual-memory batch systems Batch, on-line, and time-sharing mixed Database and communications packages
Fourth	1980 to present More application programs Higher-higher level or “fourth-generation” languages Application generators Virtual-memory operating systems for PCs Object-oriented languages Open systems

Information Technology

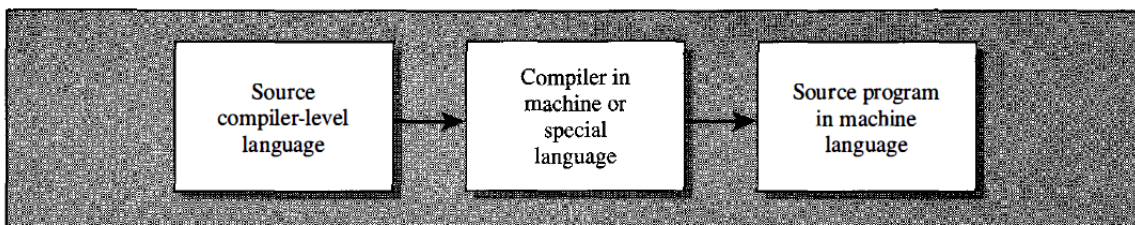
- *Software is the key*
 - *Higher-level languages make the computer easier to program and extend the use of computers to more individuals.*
 - *FORTTRAN (FORmula TRANslation) is designed to facilitate the use of computers by scientists and engineers and is well suited to solving mathematically oriented problems on the computer.*
 - *BASIC is a language very similar to FORTRAN except that it was designed for time-sharing. You can use a variation called Visual Basic to develop applications for Windows 98 on a PC.*
 - *COBOL (common business-oriented language) was developed to facilitate programming for business applications.*
 - *Report program generator (RPG) is suitable for business applications. RPG provides fixed program logic automatically, and programmers work from special RPG coding forms.*

Information Technology

- *Software is the key*
 - *The C language is extremely popular today. This powerful language was developed at Bell Laboratories and is used extensively on minicomputers, workstations, and personal computers for developing systems.*
 - *Object-oriented programming is a relatively new approach to developing software.*
 - *The idea is to create objects that are self-contained modules of code.*
 - *Designers encapsulate a set of data and all valid operations on that data together in an object.*
 - *All of the objects in a class inherit the characteristics of that class. A class is an abstract concept for a group of related objects*

Information Technology

- *Software is the key*
 - *A higher-level language will often be translated into machine language by a program called a compiler.*
 - *It accepts a program called the source program and translates it into machine language called the object program.*



Information Technology

- *Software is the key*
 - *One of the most important programs today for use on the Internet is a version of C++ called Java that was developed by Sun Microsystems.*
 - *Java is an interpreted program that programmers use to create "applets" (small programs) to be downloaded to client computers connected to the Internet.*
 - *Scripting languages are designed for "gluing" applications together. If adequate components exist, scripting languages let the programmer develop applications more quickly than conventional languages.*

Information Technology

- *Software is the key*
 - *A number of software vendors have developed languages that they advertise as belonging to the "fourth generation."*
 - *These languages are particularly appealing to users who need to access data on corporate computers.*
- **TABLE FILE SALES DAT**
- **PRINT NAME AND AMOUNT AND DATE**
- **BY REGION BY SITE**
- **IF AMOUNT GT 2000**
- **ON REGION SKIP - LINE**
- **END**

Information Technology

- *Software is the key*
 - *Package programs are software programs written by a vendor to be sold to multiple customers.*
 - *One of the reasons for this proliferation is that the technology has matured. There are packages around today in the fourth or fifth (or more) version, improving with each version.*
 - *The other reason packages are gaining in popularity is the requirement to sell personal computer packages.*

Information Technology

- *Software is the key*
 - *A Web browser is a program that provides a client PC with a graphical interface to the Internet.*
 - *This combination of a Web browser and Internet standards makes it possible to create new applications such as those found on an Intranet, and to extend existing transactions processing systems to millions of users.*
 - *Early web browsers supported only a very simple version of HTML.*
 - *The rapid development of proprietary web browsers led to the development of non-standard dialects of HTML, leading to problems with interoperability.*

Information Technology

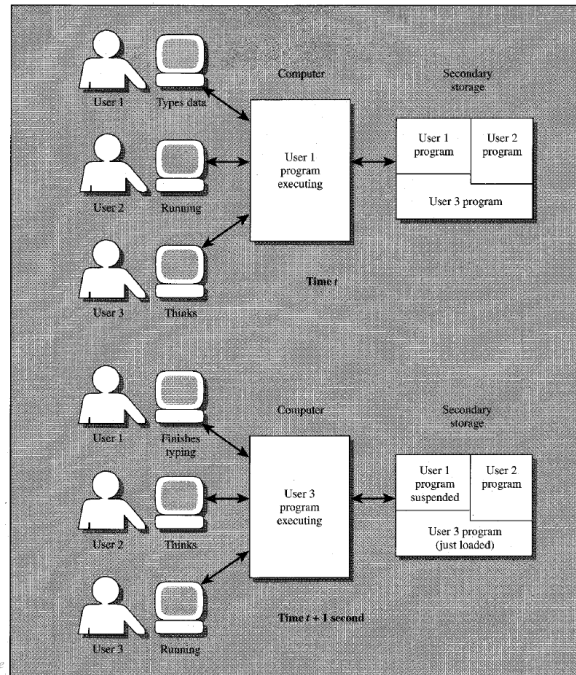
- *Software is the key*
 - *In the first generation of computers, and for many second-generation installations, the operator of the system had a central role in controlling its use.*
 - *A skilled operator balanced jobs that needed many tape drives with jobs that needed few or no drives so that the large tape job could be set up while the other job computed.*
 - *It became clear that the computer itself could be used to help make operations proceed more smoothly.*
 - *The operating system is concerned with providing your programs with the resources they need to run on the computer.*

Information Technology

- *Software is the key*
 - *Early Systems*
 - *Batch Monitor*
 - *Multiprocessing*
 - *On-line Systems*
 - *The Birth of Time-Sharing*
 - *Considering the operation of early time-sharing systems, only one program is executing at a time because there is only one CPU.*
 - *A program executes for a short time until it is interrupted and "swapped" out of memory onto a secondary-storage device.*

Information Technology

- *Software is the key*
 - *Another user's program is swapped into primary memory, and execution begins where it stopped when the program was previously swapped out of primary memory.*
 - *In a simple round robin scheme, each user is given a maximum time slice in sequence. A program may be swapped out of primary memory even though it has used less than its time slice if it needs to send output or receive input, since these activities are handled by a data channel*

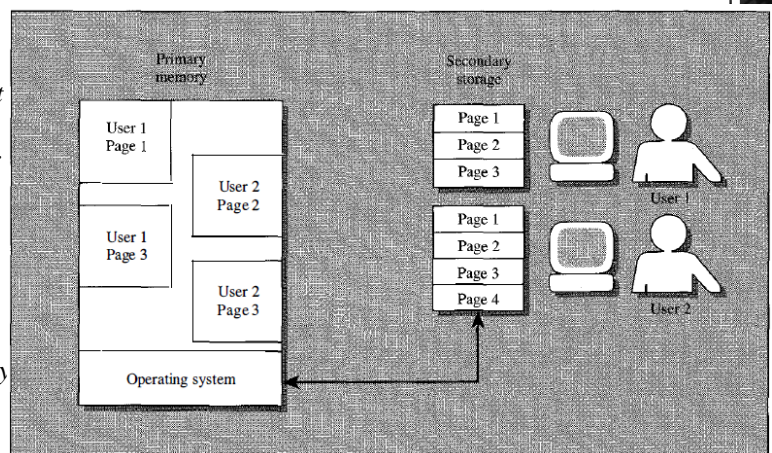


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Information Technology

- *Software is the key*
 - *Time-sharing users often run out of memory. Programmers would like to have limitless memory, or a virtual memory several times larger than physical memory.*
 - *In virtual memory, its data are broken into pages. Only those pages needed in primary memory at any one time are loaded.*



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Information Technology

- *Software is the key*
 - *One useful view of an operating system is as a resource manager.*

 - *The operating system consists of a series of managers, and each manager must accomplish the following: monitor resources, enforce policies on resource allocation, allocate the resource, and reclaim the resource.*
 - *The memory manager*
 - *The process manager*
 - *The device manager*
 - *The information manager*

Information Technology

- *Software is the key*
 - *Personal computers also have operating systems, though originally they had fewer features than their mainframe counterparts.*

 - *The highest level in the operating system is the command level, seen by users of the system. The lowest level is BIOS (basic input-output system), part of which is actually in read-only memory.*

 - *Chips with 32-bit processors and 32-bit memory buses are designed with hardware support for virtual memory.*

Information Technology

- *Database management*
 - *File Elements*
 - *Computers store data in a file, which can be defined simply as a collection of data.*
 - *A computer file is organized in a particular way with a well-defined structure for the information in the file.*
 - *A computer file consists of a collection of records, each of which is made up of fields. The various fields consist of groups of characters.*

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Information Technology

- *Database management*
 - *Data*
 - *The smallest unit of storage is the byte, which consists of 8 bits.*
 - *This byte can represent numbers, characters, or parts of an image. The unit of interest in processing business data is the character, for example, the number 9 or the letter A.*
 - *A key to a record is a specific field of interest that will be used as a basis for storing and retrieving data.*

Example:	Smith, D. J.	599	031875	250	C	G	
Field	Name	Department	Birth date	Salary	Occupation code	Last job code	

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Information Technology

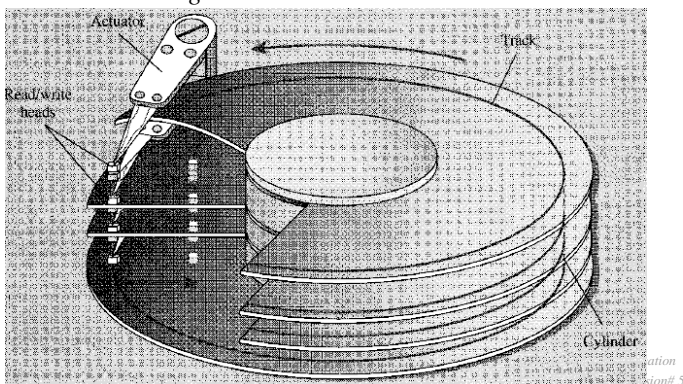
- *Database management*
 - *Direct-Access Files*
 - *There are two major types of files:*
 - *Sequential and*
 - *Direct access.*
 - *Sequential files were the first type of secondary storage. Records in this type of file are located one after another according to a given sequence.*
 - *On the average, if there are n records in the file, you will read $n/2$ records to find the one you are seeking.*
 - *A direct-access file uses a physical medium and programming, which facilitate the storage and retrieval of specific records.*

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Information Technology

- *Database management*
 - *Storage Media*
 - *The most common device for storing direct-access files is the magnetic disk*



Information Technology

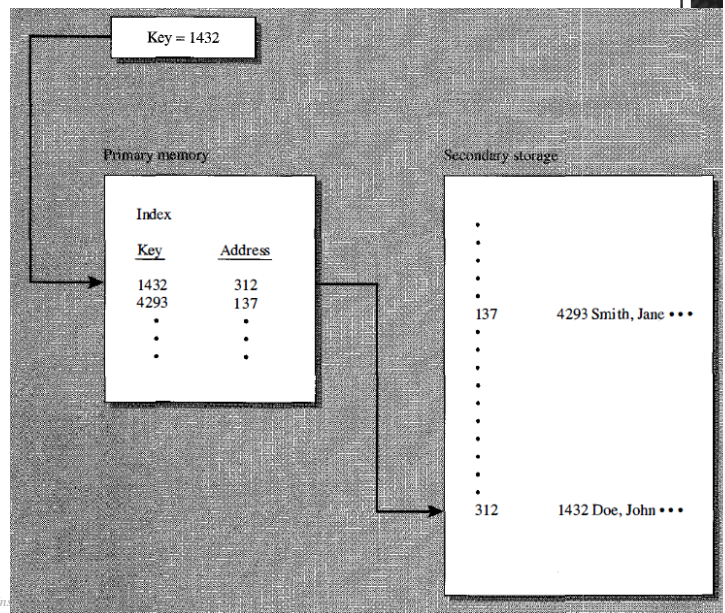
- **Database management**
 - **Storage Media**
 - *The total access time to read or write is made up of two components:*
 - *Seek time and*
 - *Rotational-delay time.*
 - *Seek time is the time needed to move the read-write heads from one position to another.*
 - *Rotational delay occurs because the data we want may not be directly under the read-write heads, even though they are located over the correct track.*
 - *The total time for seek and rotational delay adds to the average access time for the disk, usually 10-20 milliseconds.*

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Information Technology

- **Database management**
 - **Finding Data on the File**
 - *In a sequential file, finding the data you want is not too difficult, though it may be time-consuming. Each record is in a sequence, so you simply read the file until you get to the location of the record of interest*
 - *The major advantage of the direct-access file is, as its name implies, that you can locate any record in the file in roughly the same short (milliseconds) period.*



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Information Technology

- Database management
 - More Complex Access

FILE EXAMPLE

Record	Part no.	Assembly	On hand	Vendor
1	4326	103	27	ACME
2	6742	607	51	JOHNSON
3	8137	12	100	DAWES
4	3218	103	13	FRAZIER
5	3762	607	43	ARMOR

- To avoid this excess read time, we use a pointer-a piece of data whose value points to another record.
- This type of file structure is known as a linked list or a chained file.

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Information Technology

- Database management
 - More Complex Access

FILE EXAMPLE

Record	Part no.	Assembly	On hand	Vendor	Pointer
1	4326	103	27	ACME	4
2	6742	607	51	JOHNSON	5
3	8137	12	100	DAWES	13
4	3218	103	13	FRAZIER	42
5	3762	607	43	ARMOR	106

INDEX TO ASSEMBLIES

Assembly	Record
12	3
25	212
103	1
104	62
607	2

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Information Technology

- *Database management*
 - *Database management software*
 - *In the 1960s, software vendors developed products called database management systems (DBMSs).*
 - *A DBMS has to provide:*
 - *A method for defining the contents of the database.*
 - *A way to describe relationships among data elements and records .*
 - *A mechanism to set up the database in the first place.*
 - *Ways to manipulate the data including:*
 - *Updating (adding, modifying, and/or deleting information).*
 - *Using complex criteria to retrieve selected data.*

Information Technology

- *Database management*
 - *Relational Model*
 - *The relational model is the dominant structure for vendors writing DBMSs.*
 - *The underlying concept of a relational file system is very simple: Data are organized in two-dimensional tables.*
 - *The name of the model is derived from the fact that each table represents a relation.*
 - *Because different users see different sets of data and different relationships among them, it is necessary to extract subsets of the table columns for some users and to join tables together to form larger tables for others. The mathematics provides the basis for extracting some columns from the tables and for joining various columns.*

Information Technology

Database management

- Normalization
- One of the major tasks in designing a relational database is normalization.
- The process of normalization ensures that there will not be any problems in updating the database and that operations on the various relations will not lead to inconsistent and incorrect data

- First normal form requires that all occurrences of a record type contain the same number of fields.
- Second and third normal forms require the examination of the relationship between key fields and other fields in the record.

- In general, normalization creates a database in which there is minimum redundancy of data, and risks of damaging the database through updating are minimized.

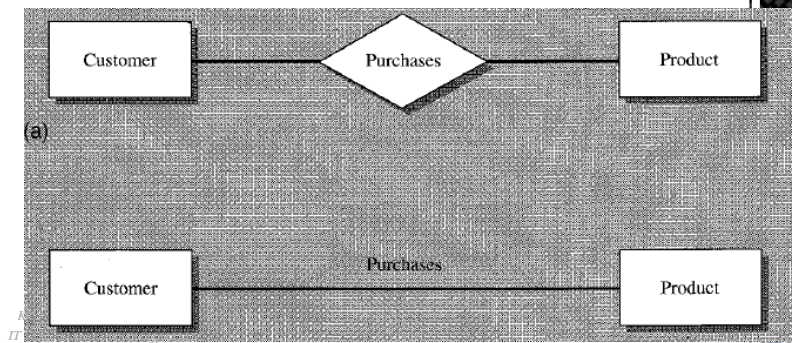
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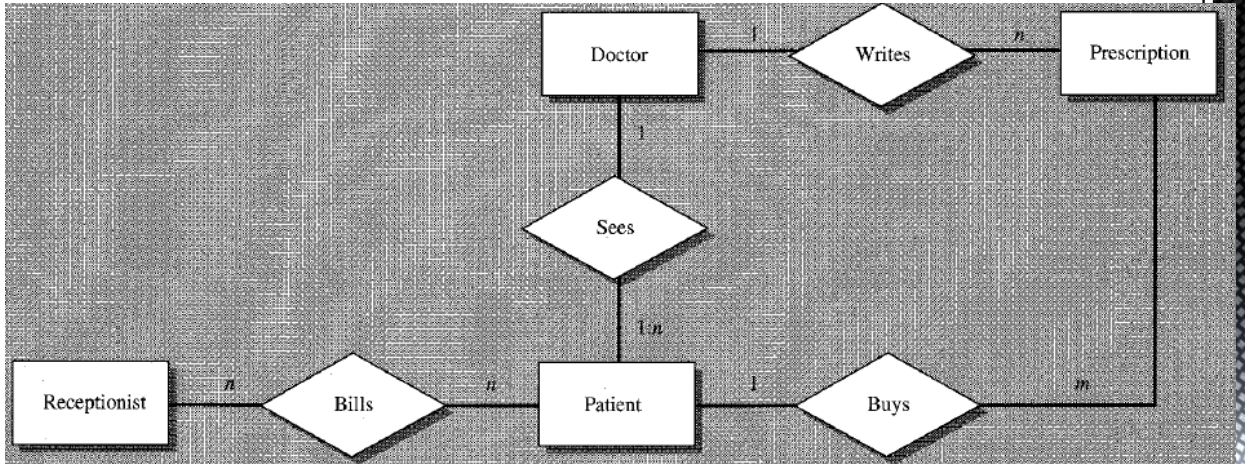
Database management

- Data Modeling
- A data model is useful for a number of reasons.
 - It helps us understand the relationships among different components in a systems design.
 - Data models show users more clearly how a system will function.
- The most common type of data model is the entity-relationship (ER) diagram.



Information Technology

- Database management
 - Data Modeling ::ERD



Information Technology

- Database management
 - The Role of the Database Administrator
 - Many organizations using database software have created a new position known as the database administrator (DBA).
 - This individual is responsible for working with systems analysts and programmers to define the physical and logical views of the data to be manipulated by computers.
 - DBMSs in Building Systems
 - Database management systems are very popular packages for personal computers.
 - These packages feature friendly interfaces that make it easy for users to define the structure of relations and enter data.

Information Technology

- *Database management*
 - *Distributed Databases*
 - *Organizations are building more distributed databases in which different parts of the database are located on different computers in a network.*
 - *This type of database raises a number of issues for the organization:*
 - *Will data be replicated across computers, or will there be only one copy?*
 - *If data are replicated, how frequently must different versions be updated to reflect changes?*
 - *How will updates to the database be coordinated so that its integrity is maintained?*
 - *Who "owns" distributed data, and who has access to it?*
 - *Distributed databases offer users easier access to data at the cost of overall higher complexity of the system*

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Information Technology

- *Database management*

Billions, Even Trillions of Bytes of Data

Bank of America regularly creates a database that consolidates 35 million records processed by separate computers handling checking, savings, and other routine transactions. The consolidated database has 800 billion characters of data. How does the bank use this information? Every day about 100,000 customers call the bank to check a balance, challenge a charge on a credit card, or ask about interest rates. The bank decided to try to sell them something when they call.

The way to accomplish this cross selling was to tailor the product to each customer's needs. For example, if you have been accidentally bouncing checks, maybe you would pay for overdraft protection. The consolidated database provides bank employees with incredible insights into customer behavior and preferences. Some companies call these applications "data warehouses" for obvious reasons.

Burlington Coat Factory depends on a 1.5 trillion byte database that runs on a cluster of eight superminicomputers from Sequent computer systems. Company managers use

the warehouse to determine a variety of information, for example, what styles are selling best, how are different stores performing, where to open the next store and so on.

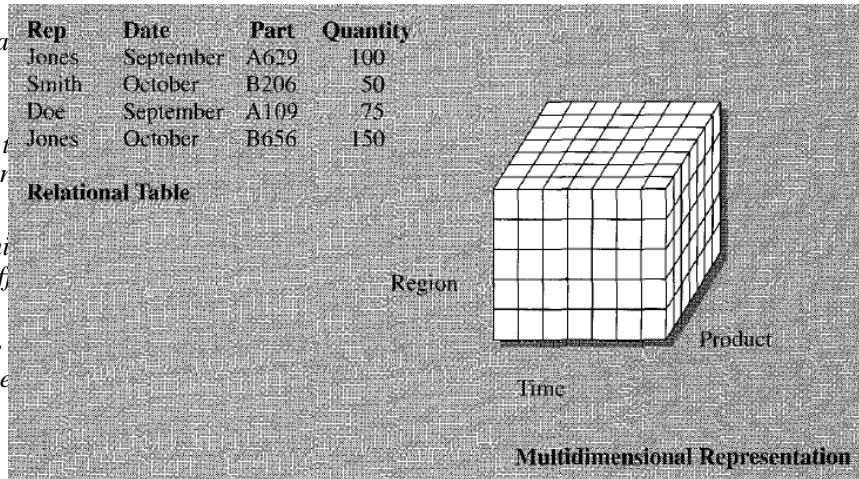
These data warehouses are good candidates for parallel computing—multiple processors working in parallel are powerful and cheap enough to perform analyses on billions of bytes of data. John Alden Life Insurance company has a warehouse with four years of detailed medical claims with extensive cross indexing, comprising some 150 billion bytes of data. The company figures that asking a question to compare hospital networks in Illinois and New Jersey on hip replacements would tie up a mainframe all night. A 24-processor IBM SP2 does this job in the "tens of minutes."

The computer can scan for information users request, or it can look for interesting relationships and patterns, a process called data mining. This kind of technology provides you with the ability to understand your customers and the nature of your business far better than in the past.

Information Technology

Database management

- Data Warehouse
- Businesses collect a lot of data from their operations
- Usually, Instead of traditional relational database, multidimensional analysis is used
- To accommodate this data, firms often use multidimensional databases
- You must define the dimensions of the data based on those dimensions



Information Technology

Database management

- Data Warehouse
- One strategy for creating the "data cube" associated with a multidimensional database is to create a "fact cube" through an n-way crossing of all the dimensions specified when defining the database.
- One objective of a data warehouse is to help you understand your business better. This kind of technology, then, helps create a "learning organization," an organization that is able to better understand its market, customers, and itself

Information Technology

- Database management
 - Data Mining
 - One of the reasons for building a data warehouse is to undertake data mining.
 - The idea is to look for interesting and important patterns in a huge database
 - Data mining is associated with **knowledge discovery** systems, applications that try to make sense out of data.

Information Technology

- Database management

Virtual Databases

It has been estimated that about 90 percent of the data in the world is not in relational databases; it is scattered across Internet Web sites, legacy applications, and nonrelational databases. Virtual database technology makes external data sources a part of your corporate, relational database system. With virtual database software, you can make queries of data that are scattered over a variety of locations and stored in different ways.

To find a job for a marketing manager position in a company at a certain location where the company's sales are growing at 25 percent a year would require an extensive search of Internet job directories. A virtual database allows the user to make one query. The database consolidates job listings from many sources and develops indexes for job title, category, and other attributes of the listings. The programmer accesses the virtual database using standard SQL commands while the end user might work with a query form on the Web.

There are currently a number of virtual database applications on high-traffic Web sites such as Yahoo! and the Wall Street

Journal Online. It is also possible to combine external data with a company's internal data warehouse to expand the range of data-mining and knowledge discovery programs. Virtual database technology is also very useful for electronic commerce. Junglee Corporation, a subsidiary of Amazon.com, uses a virtual database to integrate data from multiple merchants to give shoppers comparison data. One example is a virtual database that combines the contents of Amazon.com and Powell's Books with the *New York Times Book Review*; the result is a unified, relational schema with two tables: books and reviews. Junglee has also applied this technology for classified employment ads, real estate, and apartment listings.

Virtual database technology extends databases beyond the confines of the organization; it provides consistency in accessing data that originate in many different places and that is stored in different ways. The result is an extremely powerful technology for accessing the tremendous amount of data that exists in automated databases.

The role of managers in Information Technology (IT)

- *HW#08*
 - *Data base Assignment*
 - *Study your reference book through pages 255 to 257. The book talks about the two case studies for database management systems.*
 - *Try to answer the questions in the case studies based on our described context in this session.*

- *The Home work should be sent to omidf@ie.sharif.edu*
- *Email subject: “HW08:studentnumber”*