

Unit 7

MASS STORAGE

1.1. Read and translate the following words and word-combinations.

A mass-storage device, a nonvolatile medium, organized collections, space requirements, change the locations of data, without regard, a card catalog, a physical location, prior records, ascending sequence, speed up access to, sequentially, organize alphabetically, store sequentially, within the file.

1.2. Learn key words and word-combinations.

ascending order – зростаючий порядок
designate (v) – позначати; визначати
direct-access file – файл прямого доступу
directory (n) – каталог
field (n) – поле
index (n) – індекс
index-sequential (adj) – індексно-послідовний файл
key field – поле ключа
maintain (v) – обслуговувати
mass storage – запам'ятовуючий пристрій великого обсягу
multilevel index – багаторівневий індекс
record (n) – запис; (v) – записувати
retrieve data – відновлювати
sequential (adj) – послідовний

1.3. Read and translate the text.

Files and Mass Storage

The term **mass storage** is derived from the term **mass data**, which means a quantity of data larger than the amount storable in the memory of a computer at any one time. The purpose of a mass-storage device is to pro-

vide a permanent or nonvolatile medium for information so that it can be stored, retrieved, and manipulated. In effect, mass storage provides a place to store data and programs before and after processing. Data or information are always grouped together in organized collections called files, which often consist of records and fields. The operating system takes care of the details of storing and maintaining the files in a mass-storage device. For example, the operating system is free to change the location of data as space requirements on the device may dictate.

Operating systems support three basic types of files: **sequential**, **index-sequential**, and **direct-access**.

Sequential files can only be accessed from beginning to end sequentially. For example, to read or write the last record in the file, you must first read or write all previous records. As an analogy, think of a series of songs recorded on an audiocassette. Each song is stored sequentially, one after the other, and can only be accessed in sequential order. As a general rule, sequential files are sorted into an order: most often in **ascending order**, that is, starting with the lowest value and proceeding to the highest value. A variation of the sequential method is called index-sequential. An index-sequential file is one in which an index is created to speed up access to records within the file. To access a record in an index-sequential file, you first consult an index. Large index-sequential files multilevel indexes **Direct-access** files allow you to read or write any record in the file without regard to its location. Direct-access files require that you designate one of the fields to be a **key field** that denotes the record's position in the file. A disk can be used to store and retrieve data in a sequential, index-sequential, or direct manner, but magnetic tape can only be used to store and retrieve data in a sequential manner.

1.4 Give English equivalents of the following words and word-combinations:

індекс, засіб, розміщення, розташувати у зростаючому порядку, незалежно від його розміщення, багаторівневі індекси, файл послідовного доступу, розміщення фізичного запису, файл прямого доступу, визначити одне з полів як поле ключа, від найменшого значення до найвищого, розташувати у спадному порядку, поле, запис, енергонезалежний засіб, зберігати дані, в алфавітному порядку, послідовно, знаходити дані.

1.5. Complete the sentences with the words from the box.

ascending order mass storage sequential a key field index-sequential

1. Magnetic types, cassette types and the computer cards are the examples of _____ memory devices.
2. _____ provides a place to store data and programs before and after processing.
3. A field that denotes the record's position in the file is called ____ .
4. _____ files have multilevel indexes.
5. Sequential files are most often sorted in _____ .

1.6. Answer the questions.

1. What is the purpose of a mass-storage device?
2. What is a file?
3. What does a file consist of?
4. What software takes care of the details of storing and manipulating data in a mass-storage device?
5. What basic types of files are supported by operating systems?
6. In what order are sequential files usually organized?
7. What is the difference between index-sequential files and direct-access files?

2.1. Read and translate the following words and word-combinations.

Magnetically recorded, magnetic medium, a batch-processing mode, primary medium, mass-storage medium, flexible disks, compatible a metal shutter, a double-sided floppy disk, a nickname, a thin film of iron dioxide, single-sided floppy disks.

2.2. Learn key-words and word-combinations.

access time – тривалість доступу
 back-up file – резервний файл
 batch-processing mode – режим обробки пакетами
 compatible (adj) – сумісний
 disk (n) – диск
 disk drive – дисковод; накопичувач на дисках
 disk file – файл на диску
 disk storage – дискова пам'ять, накопичувач на магнітних дисках

magnetic tape – магнітна плівка
Mylar (n) – спеціальна плівка
read/write slot – отвір для головки читання/запису
sector (n) – сектор
track (n) – доріжка
track density – щільність доріжок
track per inch – доріжок на дюйм

2.3. Read and translate the text.

Magnetic Tape and Disk Devices

Magnetic tape is coated with a film on which data can be magnetically recorded. It is a widely used storage medium for large computer systems. In the early 1950s, tapes were made of flexible metal coated with a thin film of iron oxide, but plastic Mylar proved to be a more cost-effective medium. Although the disk has replaced magnetic tape as the primary mass-storage medium, magnetic tape is still used for archiving data and for backing up disk files because it provides the lowest cost per bit of any magnetic medium. A backup file is a copy of a file made for possible later reconstruction in case the original file is lost or damaged.

The need for direct access to data stored in files was recognized as early as the 1950s. Until then, magnetic tape had proved to be quite adequate for systems using a batch-processing mode. However, applications that require a response in a short time period, such as airline reservation systems or inventory-part-tracking systems, demand mass-storage devices that provide fast and direct access to data.

The major difference between disk and tape is the disk's faster access time. A disk device can retrieve data in milliseconds ($1/1000^{\text{th}}$ of a second) compared with the minutes that might be required to access data in on a magnetic tape. However, in archiving data, tape is the primary medium used because access time is irrelevant: the low cost of storing data on tape is the most important criterion.

The general characteristics and operation of all types of disks are the same. The disk consists of a platter in which a magnetic or reflective coating is applied. The disk drive unit contains a read/write head on a movable arm along with a motor and spindle assembly that rotates the disk. Data are

stored on a disk in sectors, which are circles of different radii on the disk. One way of classifying magnetic disks is by whether the disk is hard or flexible (floppy).

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In 1972 IBM introduced flexible disks as a medium for loading programs into mainframe computers. Because the disks were so flexible, they were nicknamed **floppy disks**. They are inexpensive, small, and easy to handle and can be sent through the mail. Most of the computers have at least one floppy disk drive. Floppy disks are also called diskettes.

The disks must be compatible with the disk drive. Lower-capacity disk drives cannot read higher-capacity disks. This is because the capacity of a disk depends on its **track density** measured in **tracks per inch**.

The early floppy disks were single-sided. The addition of another read/write head created double-sided floppy disks and doubled the capacity of the disk. Today, all floppy disks are double sided.

If you examine a 3.5-inch floppy disk, you will see that the read/write slot is covered by a metal shutter. When you insert the disk into a disk drive, the metal shutter slides back exposing the read/write slot. The read/write head of the floppy disk drive can mechanically position itself over specific tracks.

2.4. Give English equivalents of the following words and word-combinations.

Головка читання/запису, дисковод для гнучких дисків, завантажувати програму, бути сумісним, двобічний диск, магнітний диск, головна різниця, тривалість доступу, подвоїти ємність, магнітний носій, покривати плівкою, робити резервну копію, доріжка, сектор, щільність, пошкодити.

2.5. Translate the following sentences into English.

1. Сектори і доріжки утворюються під час форматування дискети.
2. Не забудьте заблокувати дискету, якщо ви хочете бути впевненими, що інформація не зміниться або не буде стерта випадково.
3. Магнітні поля можуть пошкодити інформацію, що зберігається на дискеті.
4. Гнучкі носії для магнітних накопичувачів випускають у вигляді дискет.

5. Найтипівіший сучасний дисковод – це пристрій, що працює з 3-5 дюймовими носіями з високою щільністю запису.

2.6. Form the words from the followings nouns and complete the sentences with some of these words.

record magnet

1. _____ is the science of magnetic phenomena and properties.
2. When you insert a blank disk into a disk drive, it must be formatted, before information can be _____ onto it.
3. _____ areas are created for each track and sector.
4. The _____ heads follow the tracks and _____ the coating along each track.
5. Information is _____ on a disk in a form of _____ spots called bits.
6. Floppy and hard disks are considered as _____ storage devices.
7. A disk drive works very much like a tape _____ that can both play and record.

2.7. Answer the questions:

1. What material is magnetic tape made of?
2. Why is magnetic tape still used?
3. In what case is a backup file made?
4. What is the major difference between disk and tape?
5. What are the ways of classifying disks?
6. Why are floppy disks so called?
7. What kind of surface do floppies have?
8. What parts is the surface of a floppy disk divided into?
9. What does a term “initialize” mean?

3.1. Read and translate the following words and word-combinations.

Magnetic oxide material, their primary advantages, access time, track density, an equivalent-sized floppy disk platter, a sealed container, the major source of contaminants, the high-speed spinning, a miniature gust of wind, a cushion of air, the nuisance of swapping floppy disks, removable disks, non-removable disks, in the same manner, the primary storage medium, multiple disk drivers, a self-contained unit, a physical record, a logic record, adjacent sectors.

3.2. Learn key-words and word-combinations.

access arm – важіль з магнітними головками
adjacent (adj) – суміжний
backup medium – резервний носій
coat (v) – покривати
enclose (v) – вкладати
fail (v) – виходити з ладу; (n) – несправність
logical record – логічний запис
physical record – фізичний запис
platter (n) – твердий (магнітний) диск
redundant (adj) – надлишковий
removable (adj) – зйомний
rigid (adj) – жорсткий
sealed (adj) – закритий; ізольований
spindle (v) – обертати(ся)
stack (v) – укладати; розташовувати
throughput – продуктивність

3.3. Read and translate the text.**Hard Disks**

Hard disks store data on rigid aluminium or ceramic platters coated with a magnetic oxide material. Their primary advantages over floppy disks are speed and capacity. With some hard disks, you can access information 100 times faster than with a floppy disk. Some of the speed advantage is gained because the hard disk is always spinning when the computer's power is on. In a hard disk, the disk and the read/write head are enclosed in a sealed container. By sealing the entire unit, the major source of contaminants – atmospheric pollution – is eliminated. Also, the read/write head can be made much smaller and can ride much closer to the surface of the disk. The closer the read/write head can be to the surface of the disk, the more data it can read from or write to the disk. The high-speed spinning of a hard disk (5000 to 7200 rpm) literally creates a miniature gust of wind at the surface of the disk. The read/write heads use that wind to float on a cushion of air. Because hard disks are rigid, groups of disks can be stacked on the same spindle. Such an assembly

requires multiple read/write heads for each surface; these are attached to **access arms** that move the heads to the desired track. As with floppy disks, the number of tracks and the density vary from disk to disk.

To a personal computer user, the speed and capacity advantages of hard disks over floppy disks offer access to program and data files without the nuisance of swapping floppy disks. In addition, some programs are extremely slow and limited without access to a hard disk whereas others require the use of a hard disk. The disadvantages are that most hard disks must be backed up regularly and are more sensitive to shock than floppy disks.

Disk cartridges are removable disks that are sealed in a container similar to a videotape cartridge. These disk cartridges offer the same amount of storage as many of the non-removable disks and can be inserted and removed in the same manner as floppy disks. They can be used as the primary storage medium or as a **backup medium**. A major drawback of any fixed disk is the need to make backup copies of files. Backing up is simplified in systems that have either two cartridge drives or one hard drive and one cartridge drive.

Disk arrays combine and synchronize multiple disk drives into one self-contained unit. The advantages include faster data access and higher data throughput than an equivalent-sized single disk drive because switching from a read/write head on one disk to one on another disk can be accomplished electronically. Disk arrays can also store redundant data on several disk drives, and automatically recover data should one or more drives in the array **fail**.

Each disk track is divided into regions called sectors. Depending on the disk, a sector may contain 512, 1024, or 2048 bytes, with the smaller numbers applying to floppy disks and the larger numbers to hard disks. In effect, a sector is equivalent to a physical record on a disk. The operating system's job is to keep a directory to show which **physical records** are in use by which files. If a record contains 122 bytes and you are going to store your file sequentially on a floppy disk that has 512-byte sectors, each 512-byte physical record can contain four complete 122-byte logical records with 24 leftover bytes. If, for example, your file is to contain 100 records, then 25 sectors will be required to store your file.

Knowing these figures allows you to calculate roughly the size of your files; that information, combined with an estimate of how many records are going to be in the file, allows you to estimate the **disk space** requirements for your application.

Storage of a direct file is different. If you described a direct file whose record length totalled 122 bytes, some disks would store one **logical record** per sector. This makes it easier and faster for the disk drive to know where to access records in a direct manner. Logical records whose length exceeds the sector size are often stored in **adjacent** sectors. For example, if the logical record size is 600 bytes and the sector size is 512 bytes, two adjacent sectors will be required per record.

3.4. Give English equivalents.

Безпосереднім чином, розмір сектора, надлишкові дані, таким же чином, щільність доріжок, повітряна подушка, головні переваги, тривалість доступу, головка читання/запису, перевага у швидкодії, поверхня диску, логічний запис, жорсткий диск, сектор, набір дисків, дисковод, записувати на диск, ємність/обсяг, високошвидкісне обертання, доріжок на дюйм, носій, середовище.

3.5. Complete the advertisement for the hard disk MegaMind with the words in the box.

Megabytes	drive	compatible	highest	time
protection	secure	write	multimedia	

MegaMind 400x

Today's personal computers are very powerful, but to handle large applications like data-bases, _____ DTP and CAD, you need to have more than 20 _____ in your hard disk. That's where MegaMind 400x comes in. A reliable hard _____ with 400 megabytes of capacity: with 12 ms average seek _____ and 13 mbits/sec average data transfer rate: with a 3.5" drive unit and a five-year warranty. You also receive software utilities that let you easily manage and _____ your data. Our software provides formatting, partitions, disk optimization and password _____. MegaMind 400x is _____ with IBM PCs as well as Macintosh computers. As with every MegaMind product – hard disk or optical, 20 megabytes to a gigabyte – the 400x gives you the _____ performance. So call us today on (903) 796 0402. Or ; _____ to MegaMind, PO Box 673, London, N22 1xB.

3.6. Make up phrases or words by combining *hard* and *disk* with the words below. Give the meaning of each phrase or word in Ukrainian.

hard | disk

Copy	sell	drive	drugs	magnetic	labour
worker	optical	internal	compact	capacity	currency
ware	time	directory			

3.7. Translate into English.

1. НЖМД забезпечує в сотні разів більшу ємність та швидкість обміну даними.
2. Інформація записується на набір дисків, що складається з кількох пластин, ідеально плоских, із відполірованим феромагнітним шаром.
3. Пакет дисків обертається безперервно і з великою частотою, поки ПК ввімкнений, і тому механічний контакт головок і дисків недопустимий.
4. Електромагнітну частину накопичувача закрито герметичним корпусом.

3.8. Answer the questions.

1. What is the main function of a hard disk?
2. Which unit is used to measure hard disk capacity?
3. What are the advantages of hard disks over floppy disks?
4. In what sectors is a file stored in a fragmented disk?
5. In what sectors is a file stored in a defragmented disk?
6. What are disk cartridges used for?

4.1. Read and translate the following words and phrases.

Magnetic media, density limitations, high-density magnetic disks, incompatibility problems, compression technique, to achieve erasability, write and erase times, an optical guidance system, chip technology, magnetic write head, conventional magnetic disks, a direct access retrieval.

4.2. Learn the key-words and word-combinations:

CD ROM (compact disk read-only memory) – постійна пам'ять на компакт-диску

DVI (digital video interactive) – цифровий відеоформат

WORM (write-once, read mostly) – оптичний диск (разового запису і багаторазового читання)

magnetic medium – магнітний носій

density limitation – обмеження за щільністю

concentric (adj) – концентричний

access speed – швидкість доступу

complement (v) – доповнювати

compression technique – техніка (метод) ущільнення

real-time (adj) – реального часу

seek time – тривалість установа (голівки)

reverse polarity – змінити полярність (на протилежну)

file server – файловий процесор

storage unit – запам'ятовувальний пристрій (блок)

indelible (v) – такий, що не стирається

large-scale integration – велика інтеграція

4.3. Read the text and note in the table the points for and against the three main types of optical disks. Then make notes about their use.

Optical disks

All the preceding technologies for improving the capacity of disks are pushing **magnetic media** to their density limitations. However, the optical disk continues where the high-density magnetic disk stops. An optical disk is a disk on which data are encoded for retrieval by a laser. Optical disks have a track density of 15,000 tracks per inch, which allows much higher capacity than on an equivalent-sized hard disk platter. Similar devices have been on the market for several years in the form of laser videodisks and audio compact disks for consumer use. These laser videodisks contain one spiral track, like the track on a phonograph record. Optical disks for computer applications store their information on concentric tracks, like their magnetic cousins. One major disadvantage of optical disks is their slow **access time** (300 milliseconds average), versus the **access speed** of a magnetic hard disk (10 to 20 milliseconds average).

Currently, three versions of optical disk technology are competing for the mass-storage market: (1) **read-only optical disks**, (2) **write-once optical disks**, and (3) **erasable optical disks**.

Read-only optical disks, also called **CD ROMs** (compact disk read-only memories) cannot be written on; thus, they have the functional equivalency of read-only memory (ROM). The most popular version of read-only optical disks employs the same technology as the compact disk (CD), which has become popular for audio recording.

Although a CD ROM can hold massive amounts of text, the most compelling area of CD ROM applications is in the storage and retrieval of multimedia images and sound along with text. Storing images requires millions of bits of data. The optical disk is the only medium that allows for the cost-effective, large-scale integration of graphics to complement traditional text and data. When combined with compression techniques, the graphic potential of an optical disk extends far beyond simple line drawings and includes pictures, the use of colour, animation, and real-time video.

CD-ROM is the most economical way of sharing information. In fact one CD-ROM disk (650 MB) can replace 300 000 pages of text (about 500 floppies), which represent a lot of savings in distributing materials and corporate databases. In addition, disk formats and interfaces have been standardized by the **ISO** (International Standard Organization), so manufacturers can exchange disks and cartridges. Yet CD-ROM technologies has some disadvantages. You cannot write anything onto a CD-ROM disk, nor can you change what is imprinted on it. Another reason why CD-ROM is not widely used for personal data storage is that CD-ROM drives are slow. They are fast enough for reading CD-ROM disks and audio CDs but are too slow when compared with hard drives. While there are hard drives with an average access time of 10 ms, most CD-ROM drives have a seek time of 200-3 ms.

Erasable optical disks (EODs) use lasers to read and write information to and from the disk, but also use a magnetic material on the surface of the disk and a magnetic write head to achieve **erasability**. To write on such a disk, a laser beam heats a tiny spot on it; then a magnetic field is applied to reverse the magnetic polarity of the spot. Because of this property, they are called magneto-optical disks. They offer the same storage capabilities of the non-erasable optical disks along with the same reusability capabilities of conventional magnetic disks; however, write and erase times are usually slow.

They are mainly used as secondary storage devices, functioning as file servers or as a second storage unit accompanying hard disks. EODs have two important advantages over hard disks: they are not affected by magnetic fields, and they have a longer **data life**.

Write-once optical disks (also called write-once, read-mostly, or WORM) are blank disks that are recorded on by the user. To write data, a powerful beam of laser light burns tiny spots or pits into the coating that covers the surface of these disks. Once burned in, the spots are not erasable. To retrieve the data, a less powerful laser is used to read the pattern of spots.

Write-once optical disks are being used to replace microfilm storage-and-retrieval techniques in which high density is combined with a direct-access retrieval. For example, Hitachi manufactures an optical filing system that could find application in banks, insurance companies, retail chains, and government agencies that have a need to copy and archive a vast number of documents. And like their CD ROM cousins, write-once optical disks can store video, images, and sound, as well as text. Being **indelible**, WORM disks can last 100 years.

	Pros	Cons	Use/Purpose
WORM			
CD-ROM			
Erasable optical disks			

4.4. Translate into English the following word-combinations so that you could form compound nouns:

Обмеження за щільністю, метод/техніка ущільнення, проблема несумісності, щільність доріжок, тривалість доступу, швидкість доступу, файлова система, промінь лазера, система-путівник, споживання енергії, дискова пам'ять, файловий процесор.

4.5. Look through the box and decide which of the products would be most suitable for the purposes below. Discuss the pros and cons.

Products available

CD-ROM drive

Each disk holds 650 MB

Removable cartridge disks

When you need additional storage you simply add another 45 or 88 transportable hard disk enclosed in a plastic cartridge.

Hard disk drive

Super fast 12 ms hard drive. Capacity ranges from 40 to 500 MB.

Erasable optical disk system

Two options:

- Erasable optical-magnetic 5.25" cartridges with 600 Mb of storage capacity. Can be erased and written on like a hard disk.
- Rewritable 3.5" floptical disks with a storage capacity of 128 MB.

DAT Data tape drive

Digital audiotape drives to store computer data. Used for back – up purposes. Slow access.

Huge amounts of information(about 2.3 gigabytes).

1. To store data and programs at home.
2. To hold large amounts of information in a large company.
3. To store an illustrated encyclopaedia for children.
4. To hold historical records in the National Library.

Useful expressions:

For personal use, I would ... because ...

In a big company, it would be a good idea to ...

However, ... is good for encyclopaedia because ...

Well, that depends on ...

Another reason why ...

I agree/disagree with you. CD-ROM ...

Besides,

For this reason, they may be used ...

In addition,

Test Yourself

Match the following terms to the appropriate definition:

A.

1. ___ Mass storage
2. ___ Sequential file
3. ___ Index-sequential file
4. ___ Direct-access file
5. ___ Magnetic tape

6. ___ Cartridge tape
 7. ___ Backup file
 8. ___ Disk
 9. ___ Floppy disk
 10. ___ Track density
 - a. A flexible disk.
 - b. A collection of records that can only be accessed by starting with the first record and proceeding through each record in the file.
 - c. A generic term for tapes and disks.
 - d. A file that contains an index to speed up access to records.
 - e. A flexible medium coated with a film on which data can be magnetically recorded.
 - f. A copy of a file that is made for possible later reconstruction in case the original is lost or damaged.
 - g. A tape designed for the purpose of making backup files.
 - h. A file that allows you to read or write any record in the file without regard to its location.
 - i. The number of tracks per inch on a disk.
 - j. A platter on which a magnetic or reflective coating is applied.
- B.**
11. ___ Hard disk
 12. ___ Cylinder
 13. ___ Disk cartridge
 14. ___ Vertical recording
 15. ___ Thin-film disk
 16. ___ Optical disk
 17. ___ Read-only optical disk
 18. ___ Write-once optical disk
 19. ___ Erasable optical disk
 20. ___ Memorycard
 - a. A removable disk in a cartridge-like container.
 - b. An alternative to rotating disks.
 - c. A disk that combines optical and magnetic techniques to record on the surface of the disk.
 - d. A disk that contains a metallic layer on its surface.
 - e. A disk on which data are encoded for retrieval by a laser.
 - f. Disks that can be recorded on once by the end user.
 - g. A technique that places magnetic spots on a disk so that the north-south poles point up and down.

- h. An optical disk that cannot be written on.
- i. The imaginary surface formed by tracks that are directly above and below one another.
- j. A platter made from ceramic or aluminum

True/False:

1. The purpose of a mass-storage device is to provide a volatile storage medium for information.
2. Optical disks have not improved the capacity of mass-storage devices.
3. To read or write the last record in a sequential file, you must first read or write all previous records in the file.
4. Searching an inventory file for a specific part number would lend itself to sequential processing.
5. Automated-tape libraries are similar to a jukebox.
6. Cartridge tapes are specifically designed to store backup copies of disk files.
7. A disadvantage of disk over tape is slower access time.
8. A disk device can retrieve data in billionths of a second.
9. Data are recorded on a spinning disk on a series of concentric tracks.
10. Each disk track is divided into regions called sectors.
11. By sealing the drive container, the read/write head can be made much smaller.
12. Read-only optical disks are replacing microfilm for storage and retrieval of information.
13. Memory cards are a read-only medium.
14. Erasable optical disks use a magnetic material on the surface of the disk.
15. CD ROMs have a standard format for storing data.

Multiple Choice:

16. The purpose of a mass-storage device is to
 - a. Provide a place to store data before processing.
 - b. Provide a place to store data after processing.
 - c. Provide a permanent or nonvolatile medium for information.
 - d. All of the above.
17. The choice of an organization method is based on
 - a. Whether the file is indexed, direct, or sequential.
 - b. The way the records need to be accessed during processing.

- c. The directory of the file.
 - d. The key field of the record.
18. A disk drive's access time is measured in
- a. Milliseconds.
 - b. Microseconds.
 - c. Nanoseconds.
 - d. None of the above.
19. Which of the following is not an advantage of floppy disks?
- a. Low cost.
 - b. Small size.
 - c. Direct access.
 - d. Optical surface.
20. One of the main advantages of disk over tape is
- a. Sequential access.
 - b. Faster access time.
 - c. Larger capacity.
 - d. Magnetic-oxide coating
21. One of the main advantages of tape over disk is
- a. Faster access time.
 - b. Sequential access.
 - c. Low storage cost per bit.
 - d. Magnetic-oxide coating.
22. A major drawback to fixed disks is
- a. They are removable.
 - b. It is necessary to make backup copies.
 - c. They operate at slow speed.
 - d. They are rigid.
43. Which of the following is not used to shrink the size of the magnetic fields on a disk?
- a. Using predetermined record sizes.
 - b. Using a smaller read/write head.
 - c. Placing the head closer to the surface.
 - d. Making the platter surface thinner.
23. A terabyte is equal to
- a. 2 bytes.
 - b. 220 bytes.
 - c. 230 bytes.
 - d. 240 bytes
45. Which of the following is not a promising area for erasable optical-disk applications?

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- a. Storing and retrieving microfilmed documents.
 - b. High-cost data storage.
 - c. The archiving of data.
 - d. Storing and retrieving images and sound.