**Topic: Secondary and Off-line Storage**

Reading Time: 15 mins

**·        Note\* Highlight important/core points while reading**

·        Read the content and write the answers given in the document in your words, to get the solid grip on topic.

**Secondary and Off-line Storage**

Secondary and off-line storage devices are used to store data permanently or transfer data between devices. Unlike primary memory, which is volatile and temporary, these storage types are non-volatile, meaning they retain data even when the power is off.

**Categories of Secondary and Off-line Storage**

1. **Secondary Storage**
   * **Definition**: Secondary storage provides permanent, non-volatile storage, accessible directly by the computer. It is used for long-term data storage and backup.
   * **Types of Secondary Storage**:
     + **Hard Disk Drives (HDD)**:
       - **Working**: HDDs use spinning magnetic platters to store data. A read/write head moves across the disk to read or write data by altering magnetic charges.
       - **Capacity**: Generally, very high, from hundreds of GBs to several TBs.
       - **Applications**: Used in desktops, laptops, and servers to store operating systems, software, and large files.
     + **Solid State Drives (SSD)**:
       - **Working**: SSDs use flash memory to store data. They contain no moving parts, making data retrieval faster than HDDs.
       - **Capacity**: Ranges from a few hundred GBs to several TBs, though generally more expensive per GB than HDDs.
       - **Applications**: Often used in modern computers and mobile devices for quicker boot times and data access.
2. **Off-line Storage**
   * **Definition**: Off-line storage refers to removable storage media that can be physically separated from the computer. It’s commonly used for data transfer or backup storage that doesn’t need to be constantly accessed.
   * **Types of Off-line Storage**:
     + **Optical Discs (CD, DVD, Blu-ray)**:
       - **Working**: Optical discs store data in pits and lands on a reflective surface, read by a laser in an optical drive.
       - **Capacity**: CDs hold about 700 MB, DVDs up to 4.7 GB, and Blu-rays can store up to 50 GB.
       - **Applications**: Often used for media distribution, backups, and data archiving.
     + **USB Flash Drives**:
       - **Working**: Flash drives use NAND flash memory, similar to SSDs, and connect to computers via a USB port.
       - **Capacity**: Ranges from a few GBs to over 1 TB.
       - **Applications**: Used for quick data transfer and portable storage.
     + **External Hard Drives**:
       - **Working**: External hard drives are essentially portable HDDs or SSDs encased in an external housing, connected via USB or Thunderbolt.
       - **Capacity**: Similar to internal HDDs and SSDs, with capacities from a few hundred GBs to several TBs.
       - **Applications**: Used for backups, portable storage, and expanding the storage capacity of computers.

**Working of Secondary and Off-line Storage**

1. **Hard Disk Drives (HDD)**
   * Data is stored magnetically on spinning platters. Each platter has sectors and tracks that organize the data. A read/write head moves to locate and modify the stored information.
2. **Solid State Drives (SSD)**
   * Data is stored in flash memory cells. Unlike HDDs, SSDs have no moving parts, so data retrieval is faster. Cells are organized into pages and blocks, and data is stored electronically.
3. **Optical Discs (CD, DVD, Blu-ray)**
   * Data is stored by creating pits on a reflective disc surface. A laser reads these pits, and the data is decoded to retrieve information. Different formats store varying amounts of data.
4. **USB Flash Drives**
   * Use NAND flash memory, which stores data electronically. Flash drives can be inserted or removed easily, making them ideal for transferring data between devices.
5. **External Hard Drives**
   * Function similarly to internal HDDs or SSDs but are portable and connected externally. They are often used for additional storage and backups.

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| **Storage Type** | **Advantages** | **Disadvantages** |
| **HDD** | High capacity, cost-effective | Slower speed, more susceptible to damage |
| **SSD** | Faster access, more durable (no moving parts) | More expensive per GB |
| **Optical Discs** | Good for archiving, inexpensive for smaller storage needs | Limited capacity, can be damaged easily |
| **USB Flash Drives** | Portable, easy to use | Smaller capacity compared to HDD/SSD |
| **External Hard Drives** | High capacity, portable | Can be lost or damaged if mishandled |

### ****A-Rated Questions/Answers By Examiner****

**Q1**: **What is the main difference between HDDs and SSDs?**

**Answer**: HDDs use spinning magnetic platters and a read/write head to store data, making them slower but more affordable. SSDs use flash memory with no moving parts, resulting in faster data access but at a higher cost per GB.

**Q2**: **Why are USB flash drives considered off-line storage?**

**Answer**: USB flash drives are portable and removable, allowing data to be stored off the computer and easily transferred between devices.

**Q3**: **How do optical discs store data?**

**Answer**: Optical discs store data in pits and lands on a reflective surface. A laser reads the data by detecting changes in the reflection caused by these pits and lands.

**Q4**: **What are the main advantages of SSDs over HDDs?**

**Answer**: SSDs offer faster data access, more durability due to the lack of moving parts, and quieter operation, though they are more expensive per GB than HDDs.

**Q5**: **Give one example of an application for external hard drives.**

**Answer**: External hard drives are commonly used for backing up data or expanding the storage capacity of a computer.

### Write your Answers on your Notebook and Verify it on Next Screen

**Q6: What makes SSDs more durable than HDDs?**

**Q7: Why are optical discs often used for archiving data?**

**Q8: How does an external hard drive differ from an internal hard drive in terms of use and accessibility?**

**Q9: What are the main disadvantages of using USB flash drives for long-term storage?**

**Q10: In what scenarios would an SSD be preferable to an HDD for secondary storage?**

**6. Answer**: SSDs have no moving parts, reducing the risk of mechanical damage and making them more durable than HDDs, which use spinning platters and moving read/write heads.

**7. Answer**: Optical discs are relatively inexpensive and stable for long-term storage, making them a suitable choice for archiving data that doesn’t need to be frequently accessed.

**8. Answer**: External hard drives are portable and can be connected to multiple devices via USB or Thunderbolt, whereas internal hard drives are fixed within a computer and provide primary storage for that specific device.

**9. Answer**: USB flash drives have limited capacity compared to HDDs and SSDs and are more prone to loss or damage due to their small, portable size.

**10. Answer**: An SSD would be preferable in scenarios requiring faster data access, such as booting an operating system, running applications, or in laptops and mobile devices where durability and speed are prioritized.

### ****Kindly Write down your answers on your Note book and than verifiy it with answers given at the end****

5- A computer uses both random access memory (RAM) and secondary storage.

 (a) State the purpose of secondary storage. .............................................................................................................................................. ....................................................................................................................................... [1]

 (b) One type of secondary storage is optical.

       Circle three examples of optical storage.

     read only memory (ROM)      secure digital (SD)      card compact disk (CD)    hard disk drive (HDD)

digital versatile disk (DVD)     Blu-ray disk

universal serial bus (USB)     drive solid-state drive (SSD)

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(c) Explain why a computer needs RAM. .............................................................................................................................................. ............................................................................................................................................. .............................................................................................................................................. .............................................................................................................................................. .............................................................................................................................................. ....................................................................................................................................... [3]

 (d) The computer processes instructions using the fetch–decode–execute (FDE) cycle.

 Draw and annotate a diagram to show the process of the fetch stage of the FDE cycle.

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9- A company uses both solid-state and optical secondary storage.

(a) Explain why a computer needs secondary storage.

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(b) Describe three differences between solid-state and optical storage.

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