**Topic: Data Transmission**

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.

**Data Transmission in Computer Science**

Data transmission refers to the process of transferring data from one point to another over a communication channel, like cables or wireless signals. There are different modes of data transmission, each suited to specific situations based on data speed, direction, and reliability. It’s important to understand the types of data transmission modes, such as **simplex, half-duplex, and full-duplex**, as well as the methods used for transmission: **serial and parallel**.

**Categories of Data Transmission Modes**

1. **Simplex Transmission**
   * **Description**: Simplex transmission allows data to flow in only one direction, meaning one device transmits while the other can only receive.
   * **Example**: Television broadcasting, where the signal is sent from the broadcast station to TVs but not the other way around.
   * **Use Case**: Useful in situations where data is only sent in one direction and does not need to return, such as sensors sending data to a control system.
2. **Half-Duplex Transmission**
   * **Description**: In half-duplex transmission, data can travel in both directions, but only one direction at a time. Only one device can send data at a time, while the other waits to receive.
   * **Example**: Walkie-talkies, where one person talks while the other listens, and they take turns to communicate.
   * **Use Case**: Effective for communication when both devices need to send and receive data but do not need to do so simultaneously.
3. **Full-Duplex Transmission**
   * **Description**: Full-duplex transmission allows data to flow in both directions simultaneously, meaning both devices can send and receive data at the same time.
   * **Example**: Telephone calls, where both people can talk and listen at the same time.
   * **Use Case**: Ideal for situations where continuous two-way communication is necessary, such as internet connections or live video calls.

**Categories of Transmission Methods**

1. **Serial Transmission**
   * **Description**: In serial transmission, data bits are sent sequentially over a single channel, one after another. This method is slower but more reliable for long distances because fewer wires are used, reducing interference.
   * **Example**: USB (Universal Serial Bus) for connecting peripherals to computers.
   * **Use Case**: Commonly used for longer-distance communication and devices that do not require high data transfer rates, like external hard drives.
2. **Parallel Transmission**
   * **Description**: Parallel transmission sends multiple data bits simultaneously across multiple channels (wires). This allows for faster data transfer but can be unreliable over long distances due to signal degradation and interference between the channels.
   * **Example**: Early printers connected to computers through parallel ports.
   * **Use Case**: Suitable for short distances and applications requiring faster data transfer rates, such as communication within a computer’s internal components.

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| **Aspect** | **Serial Transmission** | **Parallel Transmission** |
| **Data Transfer Rate** | Slower, as bits are sent one by one | Faster, as multiple bits are sent simultaneously |
| **Reliability** | Higher over long distances | Lower over long distances due to interference |
| **Cost** | Lower due to fewer wires | Higher due to multiple wires |
| **Example Use** | USB, Ethernet | Older printer connections, CPU-to-RAM communication |

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

**Q1: Describe the difference between simplex and half-duplex transmission.**  
**Answer:** Simplex transmission is one-way communication, allowing data to travel in only one direction. An example is a TV broadcast. Half-duplex transmission allows two-way communication but only one direction at a time, like a walkie-talkie.

**Q2: What is full-duplex transmission, and where is it used?**  
**Answer:** Full-duplex transmission allows data to flow in both directions simultaneously. It is used in telephone systems, where both people can speak and listen at the same time.

**Q3: Compare serial and parallel transmission in terms of data transfer rate and reliability.**  
**Answer:** Serial transmission is slower as bits are sent one after another but is more reliable over long distances. Parallel transmission is faster since multiple bits are sent simultaneously but is less reliable over long distances due to interference.

**Q4: Why is parallel transmission not suitable for long distances?**  
**Answer:** Parallel transmission is not suitable for long distances because the multiple channels can experience signal degradation and interference, making it unreliable over extended lengths.

**Q5: Give an example of a device that uses serial transmission and explain why.**  
**Answer:** A USB (Universal Serial Bus) uses serial transmission to connect external devices to a computer. Serial transmission is reliable for these connections, as they often span short to moderate distances and require stable data transfer.

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

**Q6**: What is the advantage of using simplex transmission over half-duplex or full-duplex transmission?

**Q7**: In which situation would half-duplex transmission be more appropriate than full-duplex transmission?

**Q8**: Why is serial transmission generally preferred over parallel transmission for long-distance communication?

**Q9**: How does the data transfer rate of parallel transmission compare to that of serial transmission?

**Q10**: How do the cost and complexity of serial and parallel transmission compare?

**6. Answer**: Simplex transmission is advantageous when only one-way communication is needed, such as in TV broadcasts or sensor data transmissions. It is simpler and more cost-effective because the data flows in only one direction, avoiding the complexity of managing two-way communication.

**7. Answer**: Half-duplex transmission is more suitable for communication systems like walkie-talkies, where users can communicate back and forth but only one person speaks at a time. It is cost-effective and less complex than full-duplex systems, making it ideal for simple two-way communication.

**8. Answer**: Serial transmission is preferred for long distances because it uses a single channel for data transfer, minimizing the risk of signal degradation and interference. In contrast, parallel transmission requires multiple channels, which can cause timing issues and signal degradation over long distances.

**9. Answer**: Parallel transmission has a faster data transfer rate than serial transmission because it sends multiple bits at the same time over multiple channels. However, the speed advantage is limited to short distances due to signal interference, which does not affect serial transmission as much.

**10. Answer**: Serial transmission is generally cheaper and less complex than parallel transmission because it requires fewer wires and simpler hardware. Parallel transmission, although faster over short distances, requires more wiring and complex hardware, leading to higher costs and potential reliability issues.

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

2- Data can be transmitted from one device to another.

(a) Tick (3) one box to show which of the terms is not a method for transmitting data.

**A** serial

**B** simplex

**C** parallel

**D** parity

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(b) Data is broken down into smaller units to be transmitted from one device to another.

Give the name of the unit that data is broken down into.

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(c) Data is often encrypted when it is transmitted from one device to another.

(i) Explain how data is encrypted using symmetric encryption.

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(ii) Give the purpose of encryption.

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3-  Jermain uses the Secure Socket Layer (SSL) protocol for secure transmission when sending data using the internet.

(a) Explain how the SSL protocol secures the data for transmission.

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(b) Identify an alternative protocol that could be used for secure transmission of data using the internet.

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(c) Give two ways that a user can identify if a website uses secure data transmission.

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2 ................................................................................................................................................ ................................................................................................................................................... [2]