Encoding Techniques for Binary Data `100110111`

To encode the binary data `100110111`, we will explore four different encoding techniques: **Bipolar-AMI**, **Pseudoternary**, **Manchester**, and **Differential Manchester**.

a. **Bipolar-AMI (Alternate Mark Inversion)**

In Bipolar-AMI:

- A '0' is represented by no signal (i.e., zero voltage).
- A '1' is represented by alternating positive and negative voltages (e.g., $+V$ and $-V$).

For the binary string `100110111`:

$$
\begin{aligned}
1 &\to +V \\
0 &\to 0 \\
0 &\to 0 \\
1 &\to -V \\
1 &\to +V \\
0 &\to 0 \\
1 &\to -V \\
1 &\to +V \\
1 &\to -V
\end{aligned}
$$

The encoded signal is: `+V, 0, 0, -V, +V, 0, -V, +V, -V`

b. **Pseudoternary**

In Pseudoternary encoding:

- A '0' is represented by alternating between positive and negative voltages.
- A '1' is represented by no signal (i.e., zero voltage).

For `100110111`:

$$
\begin{aligned}
1 &\to 0 \\
0 &\to +V \\
0 &\to -V \\
1 &\to 0 \\
1 &\to +V \\
0 &\to -V \\
1 &\to 0 \\
1 &\to +V \\
1 &\to -V
\end{aligned}
$$

The encoded signal is: `0, +V, -V, 0, +V, -V, 0, +V, -V`

c. **Manchester Encoding**

In Manchester encoding:

- A '0' is represented by a transition from high to low (first half high, second half low).
- A '1' is represented by a transition from low to high (first half low, second half high).

For `100110111`:

$1 \rightarrow$ Low to High
$0 \rightarrow$ High to Low
$0 \rightarrow$ High to Low
$1 \rightarrow$ Low to High
$1 \rightarrow$ Low to High
$0 \rightarrow$ High to Low
$1 \rightarrow$ Low to High
$1 \rightarrow$ Low to High
$1 \rightarrow$ Low to High

The encoded signal is: `10, 01, 01, 10, 10, 01, 10, 10, 10`

d. **Differential Manchester Encoding**

In Differential Manchester encoding:

- A '0' is represented by a transition at the beginning of the bit period.
- A '1' is represented by no transition at the beginning of the bit period.

For `100110111`:

Starting with Low:

$1 \rightarrow$ No transition, remains Low
$0 \rightarrow$ Transition at the start, goes High
$0 \rightarrow$ Transition at the start, goes Low
$1 \rightarrow$ No transition, remains Low
$1 \rightarrow$ No transition, remains Low
$0 \rightarrow$ Transition at the start, goes High
$1 \rightarrow$ No transition, remains High
$1 \rightarrow$ No transition, remains High
$1 \rightarrow$ No transition, remains High

The encoded signal is: `Low, High, Low, Low, Low, High, Low, Low, Low`

Difference Between Datagram and Virtual Circuit Operation

Datagram Operation:

- **Connectionless:** Each packet (datagram) is treated independently, and there is no need to establish a connection before sending packets.
- **Flexibility and Resilience:** Packets can take alternate routes to adapt to network changes.
- **Packet Delivery:** Delivery is not guaranteed, and packets may arrive out of order, be duplicated, or lost.
- **Example Protocols:** Internet Protocol (IP).

Virtual Circuit Operation:

- **Connection-oriented:** Establishes a dedicated path before communication begins, ensuring a reliable session.
- **Predictable Delivery:** All packets follow the same path, arriving in order and with reliable delivery.
- **Resource Reservation:** Resources may be reserved for the duration of communication, enhancing bandwidth and latency performance.
- **Example Protocols:** Frame Relay and X.25.