

Parity Check

A parity check is a simple error detection mechanism used in digital communication and data storage to detect errors in transmitted or stored data. It ensures that the number of bits with a value of 1 in a binary sequence is either even or odd, depending on the type of parity used.

There are two types of parity:

1. **Even Parity:** Ensures that the total number of 1 bits in the data (including the parity bit) is even.
2. **Odd Parity:** Ensures that the total number of 1 bits in the data (including the parity bit) is odd.

How Parity Check Works

- A **parity bit** is added to the original binary data to enforce the selected parity (even or odd).
- After data is transmitted or stored, a parity check is performed by counting the 1 bits in the received data (including the parity bit).
 - For **even parity**, the number of 1s should be even.
 - For **odd parity**, the number of 1s should be odd.
- If the parity condition is violated, an error is detected, indicating that the data may have been corrupted during transmission or storage.

Example

Let's assume we are transmitting the following 7-bit binary data: **1011001**.

1. **Count the number of 1 bits:** There are four **1s** in the data.
2. **Apply even parity:** Since there are an even number of **1s**, the parity bit is set to **0** to maintain even parity.
3. Data to transmit: **10110010** (the parity bit 0 is added at the end).

When the data is received, the system checks the number of 1s:

- If the number of **1s** is even, the data is considered correct.
- If the number of **1s** is odd, an error is detected.

Use of Parity Check

Parity checks are commonly used in:

- **Data transmission protocols:** To ensure data integrity when sending bits over a communication channel.
- **Memory systems:** Error-detecting memory like Parity RAM uses parity bits to detect errors in stored data.
- **Magnetic storage and hard drives:** To ensure that stored data hasn't been corrupted.

Disadvantages:

- **Limited error detection:** Parity checks can only detect single-bit errors (if one bit flips). It cannot detect multi-bit errors, where two or more bits are changed.
- **No error correction:** Parity checks only detect errors but cannot correct them. For correction, more advanced techniques like Hamming codes.

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