1.4 Ethical Reflection: School Management System

The design of the School Management System is anchored on three core ethical pillars—**fairness**, **privacy**, and **transparency**—to ensure responsible handling of student and institutional data.

⚖️ Fairness

The system enforces fairness in course allocation through a **First-Come, First-Served (FCFS)** policy.

- **Data Structure Used**: **Queue** The queue supports FCFS behavior via constant-time operations: enqueue and dequeue ($O(1)$).

- **Mechanism**: Students are processed strictly in the order of their registration timestamps. This eliminates manual bias, manipulation, or favoritism, ensuring equal opportunity until course capacity is reached.

🔐 Privacy

Student data is safeguarded through structural design and access control mechanisms.

- **Data Structures Used**:

    - **Hash Table** for storing primary identifiers in the Student Registry

    - **AVL Tree** for managing sensitive financial records in Fee Tracking

- **Protection Mechanisms**:

    - **Role-Based Access Control (RBAC)**: Access is restricted by role (e.g., Registrar, Finance Officer), ensuring only authorized personnel interact with specific modules.

    - **Data Minimization**: Each module retrieves only the data it needs. For example, the Library System (Hash Map) uses only student IDs, avoiding exposure of academic scores.

    - **Anonymization**: In the Performance Analytics module (Max-Heap), student IDs are pseudonymized before ranking reports are generated, preserving privacy while enabling institutional insights.

🔍 Transparency

Transparency fosters user trust and system accountability.

- **Data Structure Used**: **AVL Tree** (Fee Tracking)

- **Mechanisms**:

- **Auditable Reports**: The AVL Tree's sorted nature allows efficient generation of itemized payment histories, making fee clearance status verifiable by students and guardians.

- **Explainable Decisions**: In Course Scheduling, students can view their exact position in the Queue and allocation timestamp, clarifying their enrollment status.