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## **Assignment: University Course Registration System**

### **Objective:**

Design and implement a scalable, modular university course registration system using Java Collections Framework. The system should support course creation, student registration with waitlisting, capacity validation, and course analytics.

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### **Requirements**

#### **1. Core Classes**

- Student: id, name, email, year, branch
  - Course: courseId, courseName, instructorName, capacity, credits, Set<Student> enrolledStudents, Queue<Student> waitlist
  - RegistrationSystem: Manages courses, students, registration, waitlisting, analytics
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#### **2. Functionalities**

- Register student to a course:
  - Check if already enrolled or waitlisted
  - If full, add to waitlist
  - Move waitlisted students when a spot frees up
- Drop a course:
  - Remove from enrolled list
  - Automatically promote next student from waitlist

- List students:
    - For a specific course (sorted by name)
    - For a particular branch across all courses
  - List courses:
    - Sorted by number of enrolled students (descending)
    - Filter by credits or instructor
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### 3. Collections to Use

- `HashMap<String, Course>` — stores all courses by `courseId`
  - `HashMap<String, Student>` — stores all students by `studentId`
  - `TreeSet<Student>` — maintain sorted enrolled students per course (by name or roll number)
  - `Queue<Student>` — waitlist using `LinkedList`
  - `List<Course>` — for reporting and filtering
  - `Map<String, List<Course>>` — group courses by instructor or branch
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### 4. Additional Requirements

- Override `equals()` and `hashCode()` for `Student` and `Course` to ensure uniqueness
  - Use `Comparator` for custom sorting (e.g., by year, branch, name)
  - Prevent duplicate registrations
  - Implement validation for data entry (e.g., invalid course ID or email)
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## **Deliverables**

- Full Java codebase with appropriate package structure (`model`, `service`, `util`, `main`)
  - Modular design with separation of logic and data
  - Sample console interactions for:
    - Registration
    - Dropping
    - Course & student listings
  - README with instructions
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