a) **Identify a primary key for each relation. For each key, briefly state the assumptions or conditions under which each key would be valid.**

Students: primary key: sid

Assumption: no 2 students should have the same student id, ie. Every student id should be unique. A student cannot have a null ID

Faculty: primary key: fid

Assumption: no 2 faculties should have the same id and a faculty cannot have a null id

Courses: primary key: cid

Assumption: no 2 courses should have the same id and a course cant have a null id

Rooms: primary key: rno, address

Assumption: rooms with different addresses (different buildings) can have the same room number. We use the combination of room number and the address of the building to uniquely identify the room.

Enrolled: primary key: sid, cid

Assumption: to identify if a student is enrolled in a certain course we use their student id and the course id to find if a student is enrolled within that course

Teaches: primary key: fid, cid

Assumption: a faculty member can teach a course only once

Meets in: primary key: cid, rno, time

Assumption: a course can meet in a unique room at a unique time only once. Without the attritubute time, a course can meet in the same room but at different times which will not uniquely identify a meeting

b) Given your choice of primary keys in (a), define two referential integrity constraints. State the appropriate primary to foreign key references, and describe in one sentence why your referential integrity constraint is necessary.

1. sid in the Enrolled relation is a foreign key that references sid in the Students relation.
    a. This integrity constraint ensures that students in the sid column of the Enrolled table are valid sid's from the Students table. This ensures that only registered students can enroll in classes.

2. cid in the Teaches relation is a foreign key that references cid in the Courses relation.
    a. This Integrity constraint ensures that the courses in the teaches column are valid courses that actually exist in the course's relation. This ensures a teacher isn't teaching a course that the university doesn't offer.

c) Give an example of a domain constraint and a tuple constraint over any of the above relations. Again, provide a one sentence justification for the constraint.

Domain constraint: in the students relation the gpa must be $(gpa \leq 4.0) \wedge (gpa \geq 0.0)$

The constraint ensures that a gpa is a valid gpa on a 4.0 scale

Tuple constraint: in the enrolled relation the grade must be in {'A', 'B', 'C', 'D', 'F'}

The constraint ensures that the grade is a valid letter grade