Question 1:

An entity-relationship diagram containing the following entities, attributes, and relationships:

Campus (attributes: Campus ID, Name, Address, City, State, Country, URL)

College (attributes: College ID, Name, Phone, Email, URL)

Unit (attributes: Name, Unit ID, Phone, Type, Job Description)

Course (attributes: Course Code, Number, Credit hrs, Title)

User (attributes: User ID, First Name, Last Name, Email)

Faculty (attributes: Type)

Student (attributes: Rank)

Tutor (attributes: Pay Rate)

Supervisor (attributes: Office Hours)

On-Call (attributes: Date, Location, ID, Start Time, End Time, Task Type, Status)

Appointment (attributes: ID, Location, Date, End Time, Start Time, Status)

Relationships: belongs, Offers, Is a, hired_by, responsible_for, scheduled_to, scheduled_by, Supervised_by, Assigned_to, Initiated_by
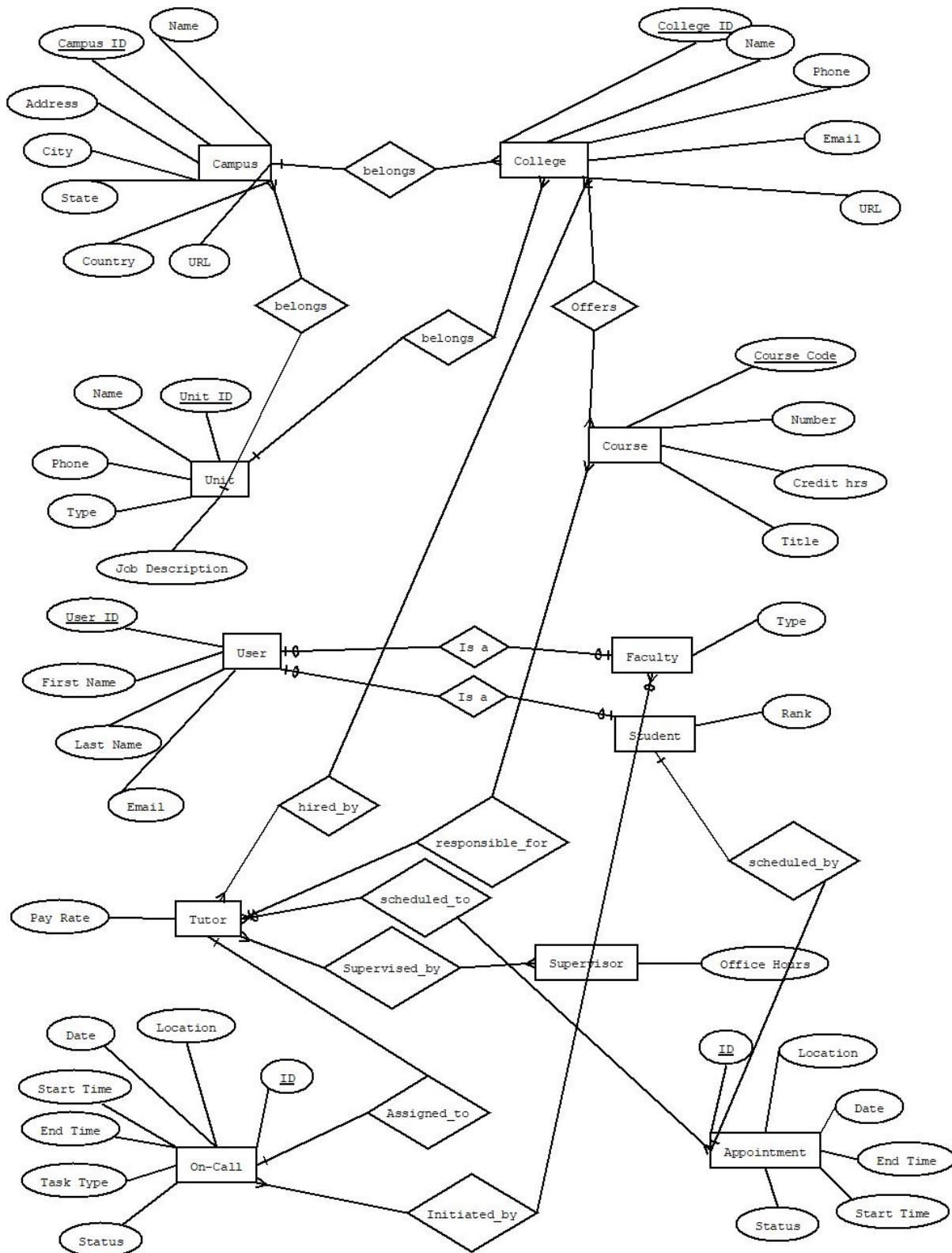
Entities:

1. Campus
   - Attributes: ID (Key), Name, Address, City, State, Country, URL

2. College
   - Attributes: ID (Key), Name, Phone, Email, URL
   - Relationship: Belongs to one Campus (Campus, 1..*)

3. Unit
   - Attributes: ID (Key), Name, Phone, Type (academic or non-academic), Job Description (for non-academic)
   - Relationship: Belongs to one Campus (Campus, 1..*)
   - Relationship: Belongs to one College (College, 1..*)

4. Course
   - Attributes: Code (Key), Number (Key), Credit, Title
   - Relationship: Offered by one College (College, 1..*)

5. User
   - Attributes: ID (Key), First Name, Last Name, Email
   - Multivalued Attribute: Phone
   - Relationship: Is a Faculty (Faculty, 0..1)
   - Relationship: Is a Student (Student, 0..1)

6. Faculty
   - Attributes: Rank

7. Student
   - Attributes: Type (undergraduate or graduate)

8. Tutor
   - Attributes: Pay Rate
   - Relationship: Can be responsible for many Courses (Course, 0..*)
   - Relationship: Hired by one or more Colleges (College, *)
   - Relationship: Supervised by one Supervisor (Supervisor, 1)

9. Supervisor
  - Attributes: Office Hours
  - Relationship: Supervises many Tutors (Tutor, *)

10. On-Call
  - Attributes: ID (Key), Location, Date, Start Time, End Time, Task Type, Status
  - Relationship: Initiated by one Faculty (Faculty, 1)
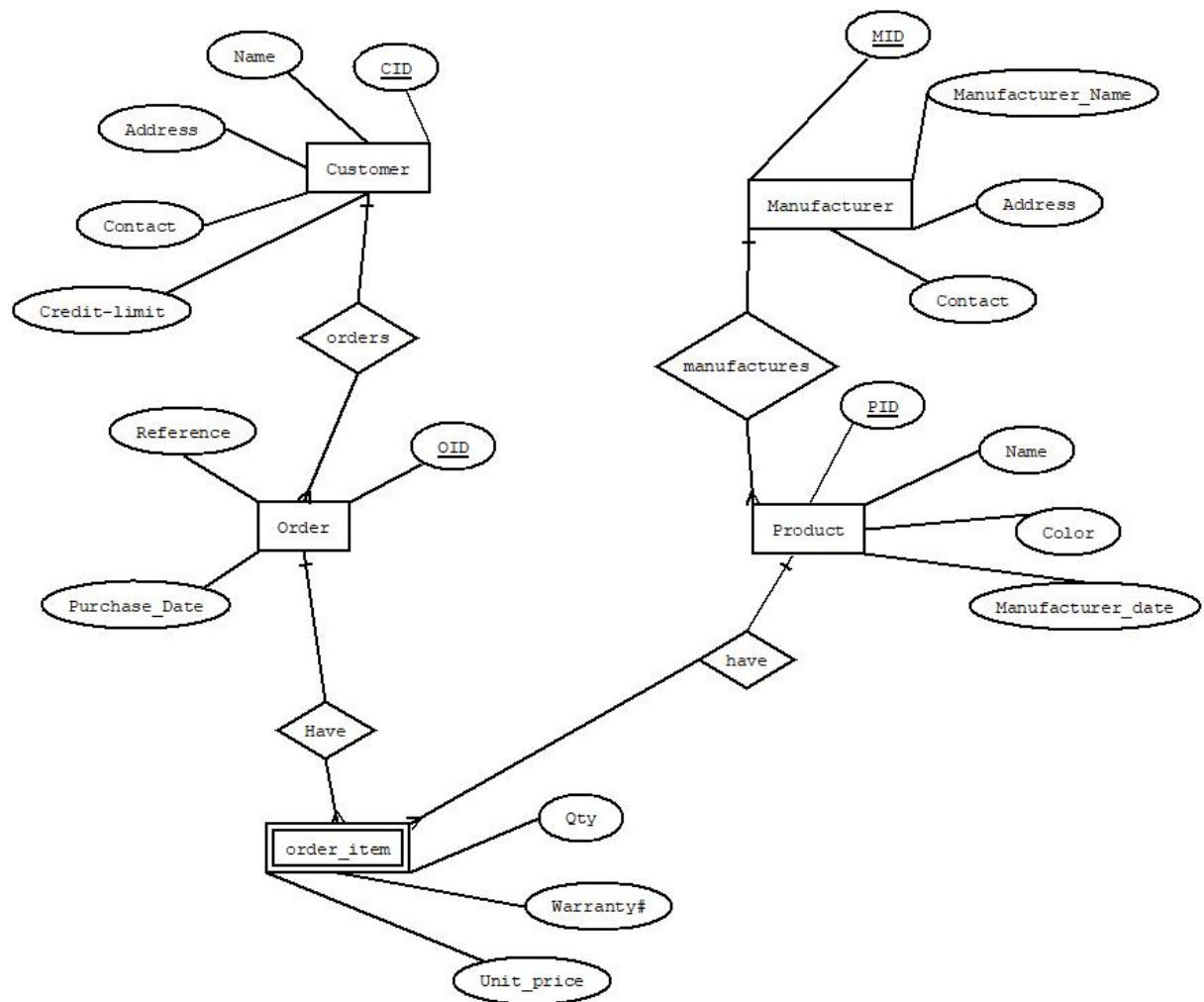 - Relationship: Assigned to one Tutor (Tutor, 1)

11. Appointment
  - Attributes: ID (Key), Location, Date, Start Time, End Time, Status
  - Multivalued Attribute: List of Courses
  - Relationship: Scheduled by one Tutor (Tutor, 1)
  - Relationship: Scheduled with one Student (Student, 1)

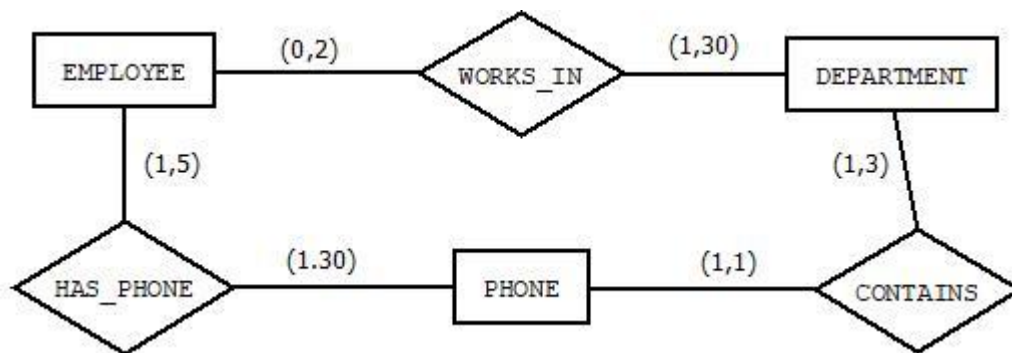# Now, let's specify the (min, max) constraints for the relationships:

- Campus to College: (1, *)
- Campus to Unit: (1, *)
- College to Unit: (1, *)
- College to Course: (0, *)
- User to Faculty: (0,1)
- User to Student: (0,1)
- Tutor to Course: (0, *)
- Tutor to College: (*, *)
- Supervisor to Tutor: (*, *)
- Faculty to On-Call: (0, *)
- Tutor to On-Call: (1, 1)
- Tutor to Appointment: (0, *)
- Student to Appointment: (1, 1)

Question 2:

Question 3:

a)

b)

The relationship "HAS PHONE" would be redundant if each employee could have at most one phone, and each phone could be assigned to only one employee. In other words, if the maximum cardinality for both "Employee to Phone" and "Phone to Employee" relationships was 1 (meaning each employee has only one phone and each phone is assigned to only one employee), then the "HAS PHONE" relationship would not be necessary because the direct relationship between employees and phones would already cover the assignment of phones to employees.