**Entity-Relationship Diagramming In-Class Practicum (100 points total)**

*( 8pts each )*

**1. (32 points)** The following set of brief scenarios describes the relationships between various entity classes. Draw the entity classes (only show entity name – no attributes or identifiers) and the relationship making sure to add notation (use crow's foot notation) that shows reasonable minimum and maximum cardinalities given the implied scenario. All scenarios will only have one relationship. The one relationship may be between a maximum of two entity classes (binary) or between an entity class and itself (recursive). *If you make any assumptions beyond what is stated be sure to note that in your answer.*

**Example:** *Students can take no sections or may take any number of sections. Each section has anywhere from zero to an unlimited number of students.*

**Example Answer:**

Students ⊅○────────────────○⊏ Sections

**a.** A shipment may contain at least one and possibly many items. Each item is tracked individually (example: original artworks) so each item can be in zero shipments (if it is still in inventory) or, at most, one shipment.

Shipment ‖──────────────────⊣○ Item
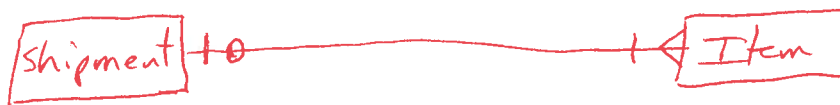
**b.** An assembly line has a sequence of machining stations. One station's output becomes another station's input (this would be the 'downstream' machining station) and this sequence is sometimes changed so the sequence of machining stations needs to be stored in the database. One machining station can have at most one downstream station that it feeds into and may have no downstream machining stations if it is last in the sequence. Likewise, each machining station may have zero or one upstream machining stations.

Machining Station ─○┤  (recursive relationship)
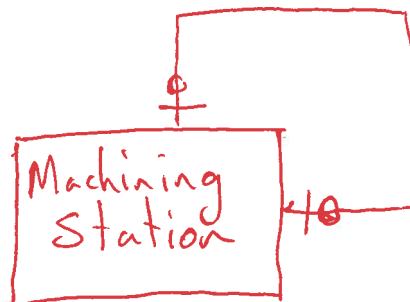
**c.** Credit bureaus keep track of individual's credit accounts (among other things). An individual in the credit bureau's database may have no credit accounts associated with them or they may have any number of credit accounts. Each of the accounts listed must be associated with at least one individual but may be associated with two or more individuals (joint accounts).



**d.** Each member of a security unit of a firm has their right thumbprint pattern on file in the system for biometric security scanners on secure doors. Thumbprint information is considered confidential and sensitive so they are stored in a separate table from employee's other data to aid in security. Thumbprint information is purged when an employee leaves so every thumbprint on file is related to exactly one employee. However, not every employee in the employee table is a security employee so some employees have their thumbprint on file and some do not.
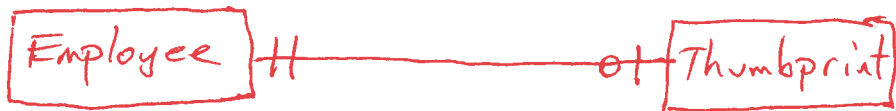


**2. (22 points)** A university offers two types of courses: (1) credit and (2) non-credit (community). Courses can be either type but not both. An entity is initially designed as shown below. However, it was noted that only credit classes need to store the number of credit hours and only non-credit courses need to have a course fee associated with it (for-credit classes are charged at a flat rate per credit hour). Redesign the following single entity appropriately as a supertype/subtype structure. Show all attributes (including the identifiers of the supertype *and* subtypes) and add an appropriate subtype discriminator. *(discriminator can appear in the attributes of the supertype or as shown below – both styles are used in practice)*

COURSE

| CourseID |
| --- |
| Course_Title |
| Credit_Hours |
| Course_Fee |
| DepartmentID |
| Course_Contact |
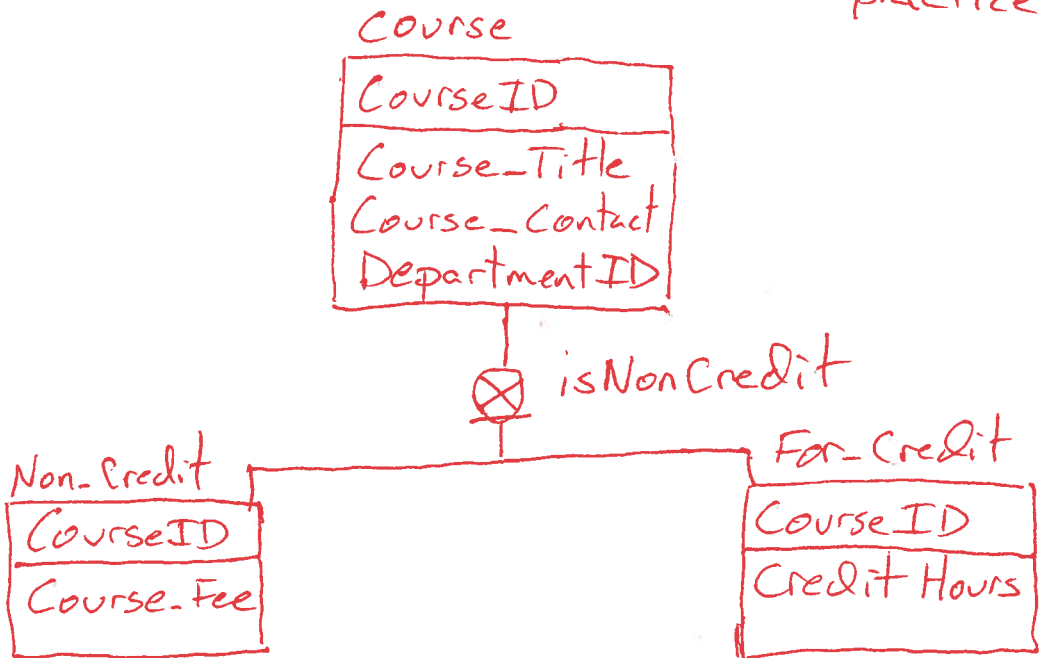
**3. (46 points)** A small university is creating a new database to manage its course enrollment process. They need to keep track of basic student information (name, address, etc.) as well as information on their courses, sections of the course, prerequisites, and instructors. Each student can enroll in multiple course sections and may be enrolled in none. Each course section can have many students and may have zero students (before enrollment opens, for instance). The final course grade for each student enrolled in each section must also be stored. Each course section is associated with one and only one course and each course may have zero to many course sections.

Instructors are assigned to course sections. An instructor may be assigned zero to many course sections and each course section is associated with zero or one instructors (sometimes course sections may be offered with the instructor to be determined at a later point).

Courses have other courses as prerequisites. A course may have zero to many prerequisites and a course may be a prerequisite for zero to many other courses.

Draw an E-R diagram to represent this database.

- If necessary, create an association pattern only if a relationship needs additional attributes other than foreign keys.
- Show all minimum and maximum cardinalities.
- Do not show attributes for entities. Some attributes are given as examples in the problem so that you understand what is being stored. These do not need to be shown on diagram.
- Do not use any three-way (ternary) relationships.
- Do not use any structures that imply multi-valued attributes would exist.
- List any non-obvious assumptions you made.
- *ID-Dependent vs non-ID-Dependent relationships do not have to be distinguished for this diagram (will not be a grading point).*