1.
   a. A data dictionary holds the data about the data, also known as meta-data. It can be part of the database management system, or it can be freestanding. The user may want to get some information from a table without having to know all of the column names, the DBMS will be able to go to the data dictionary to find this information so that the user does not have to. It is also useful for a couple more reasons such as identifying inconsistencies, keeping track of changes, and providing audit information.
   b. Entities are real-world objects that we can collect data about, this can be anything from a person to a piece of software. Attributes are elements that we use to describe certain parts of entities that we want to record.
   c. A superkey is any set of attributes that uniquely identifies a row in a table. A candidate key or minimal superkey is a superkey that if you remove any of the attribute from the key it would no longer be a superkey.
   d. The database administrator designs, creates, and maintains the database. He is in charge of who gets access to what in the database and who is allowed to see what. If any problems arise in the database he needs to be able to fix them and he needs to make sure to get to know everyone who uses the database. He is also in charge of the planning and design stage, the development stage and the database management stage of creating the database.
   e. There are three different levels in the database. The External, Logical, and Internal. The two types of data independence say that any changes made to a lower level shouldn't affect a higher level. If something changes Internally this shouldn't impact anything logically or externally, and if something changes logically then it shouldn't impact anything externally.
2.
   a. This relation is in first normal form because it has no multi-value attributes, but course name is only partially dependent on the key. In other words the relation contains a partial dependency.
   b. – 1NF: CLASS(Course_No, Section_No, Course_Name, Room, Capacity)

      - 2NF: CLASS(Course_No, Section_No, Room, Capacity), CLASS_NAME(Course_No, Course_Name)

      - 3NF: CLASS(Course_No, Section_No, Room), CLASS_NAME(Course_No, Course_Name), CLASS_CAPACITY(Room, Capacity)

3. – Database: The database contains all of the data that is needed to be stored, in a relational database this will be done through tables that are organized through rows and columns. This may also include the data dictionary that includes meta data for the database.

- Users: The users are anyone who uses the database, there are three different types of users. Casual users that use query language, Naïve users that use programs, and Secondary users that only use the output that is produced by another user.

4. One advantage is that you will have minimum redundancy, this means that you only have to update one copy of a file rather than updating all of the copies. This also means that everyone can simply share one file rather than all having to get their own copy. A second advantage is that you can limit the view of the data depending on the level of access an employee has. A janitor has no need to know a machinist's home address or how much money said machinist is making.

5.

P	Q	R	B	C
10	a	5	b	6
10	a	5	b	5
15	b	8	-	-
25	a	6	c	3

6. - Domain: Limits the set of values for an attribute, such as a specific amount of characters that - the values can be. Problems that can arise from breaking this constraint is that you could have values in columns that do not logically work, for instance in a column called salary it could cause issues if a name is input as a value rather than a number.

- Entity Integrity: States that no attribute of a primary key can have a null value. The problem with violating this constraint is that if you have a row of data and you delete the key then you have no way to access those data. You will permanently lose access to whatever row that key was in.

- Referential Integrity: Each foreign key must match the primary key value of some tuple in its home relation or be completely null, otherwise you can no longer use that foreign to access a row of data in the table that the foreign key originated from.

7.

8.

a.

E110	Adams

b.
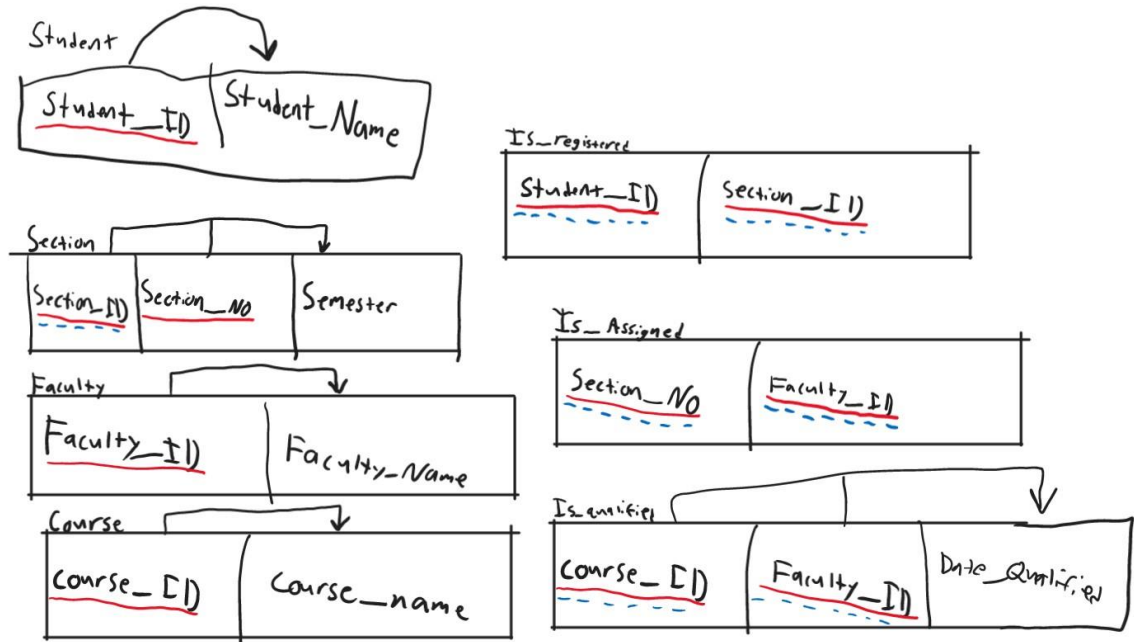
empId	lastName	projNo	hours
E110	Adams	P15	700
E110	Adams	P20	350

9.

empId	lastName	projNo	hours
E101	Smith	P10	200
E101	Smith	P15	300
E105	Jones	P10	400
E110	Adams	P15	700
E110	Adams	P20	350
E115	Smith	P10	300
E115	Smith	P20	400