DATABASE SYSTEMS

ACTIVE LEARNING METHOD

ALM:-STUDENT-CREATED

PPT/CHARTS/MATRICES/FLOWCHARTS/MODELS

Students are encouraged to build charts, matrices, flowcharts, and models as contexts for extending their understanding of key course-specific concepts.

Procedure:

1. Faculty can provide the basic guidelines and the skeleton for the students to develop their presentation/Chart.
2. Faculty remains as a facilitator and limits himself/herself to asking probing and

Meaningful questions.

Rubric:

Marks to be awarded	5	4	3	1
Creativity	Highly Creative	Creative	Effective but lacking creativity	No Creativity
Presentation	Powerful Presentation, intelligent use of animation and sound	Good Presentation with good use of animation and sound	Average presentation lacking in captivating the audience	Poor presentation
Content	Meaningful content	Good and relevant content	Average content	Poor content

Batch No	Member-1	Member-2	Member-3	Member-4	*PS No
BATCH-1	218W1A5460	218W1A5462	218W1A5459	218W1A5427	1
BATCH-2	218W1A5415	218W1A5458	218W1A5405	218W1A5422	2
BATCH-3	218W1A5436	218W1A5465	218W1A5450	218W1A5421	3
BATCH-4	218W1A5461	218W1A5418	218W1A5447	218W1A5407	4
BATCH-5	218W1A5439	218W1A5401	218W1A5419	218W1A5434	5
BATCH-6	218W1A5406	218W1A5404	218W1A5453	218W1A5420	6
BATCH-7	218W1A5437	218W1A5426	218W1A5425	218W1A5431	7
BATCH-8	218W1A5417	218W1A5443	218W1A5416	218W1A5428	8
BATCH-9	218W1A5448	218W1A5449	218W1A5410	218W1A5441	9
BATCH-10	218W1A5423	218W1A5446	218W1A5438	218W1A5429	10
BATCH-11	218W1A5466	218W1A5464	218W1A5432	218W1A5430	11
BATCH-12	218W1A5424	218W1A5435	218W1A5463	218W1A5444	12
BATCH-13	218W1A5402	218W1A5414	218W1A5454	LEAIDS01	13
BATCH-14	218W1A5403	218W1A5409	218W1A5445	LEAIDS02	14
BATCH-15	218W1A5412	218W1A5457	218W1A5451	LEAIDS03	15
BATCH-16	218W1A5411	218W1A5442	218W1A5413	LEAIDS04	16
BATCH-17	218W1A5408	218W1A5456	218W1A5440	LEAIDS05	17
BATCH-18	218W1A5455	218W1A5452	218W1A5433	LEAIDS06	18

Note:*PS No* –***Problem Statement No***

System Architect **(Member-1)**

Role-1: Requirements Gathering & Analysis (**Member-2**)

Role-2: Schema Design (**Member-3**)

Role-3: Conversion to Relational Model (**Member-4**)

Role-4: Implementation-Database Creation (**Whole team** involved in this phase)

Role-5: Testing & Maintenance (**Whole team** in this phase)

Problem Statements

1) The Prescriptions-R-X chain of pharmacies has offered to give you a free life-time supply of medicines if you design its database. Given the rising cost of health care, you agree. Here's the information that you gather:

- Patients are identified by an SSN, and their names, addresses, and ages must be recorded.
- Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded.
- Each pharmaceutical company is identified by name and has a phone number.
- For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer.
- Each pharmacy has a name, address, and phone number.
- Every patient has a primary physician. Every doctor has at least one patient.
- Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.
- Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors. Each prescription has a date and a quantity associated with it. You can assume that if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored.
- Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract.
- Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

1. Draw an ER diagram that captures the above information. Identify any constraints that are not captured by the ER diagram.
2. How would your design change if each drug must be sold at a fixed price by all pharmacies?
3. How would your design change if the design requirements change as follows: If a doctor prescribes the same drug for the same patient more than once, several such prescriptions may have to be stored.

2) Computer Sciences Department frequent fliers have been complaining to Dane County Airport officials about the poor organization at the airport. As a result, the officials have decided that all information related to the airport should be organized using a DBMS, and you've been hired to design the database. Your first task is to organize the informa- tion about all the airplanes that are stationed and maintained at the airport. The relevant information is as follows:

- Every airplane has a registration number, and each airplane is of a specific model.
- The airport accommodates a number of airplane models, and each model is identified by a model number (e.g., DC-10) and has a capacity and a weight.
- A number of technicians work at the airport. You need to store the name, SSN, address, phone number, and salary of each technician.
- Each technician is an expert on one or more plane model(s), and his or her expertise may overlap with that of other technicians. This information about technicians must also be recorded.
- Traffic controllers must have an annual medical examination. For each traffic controller, you must store the date of the most recent exam.
- All airport employees (including technicians) belong to a union. You must store the union membership number of each employee. You can assume that each employee is uniquely identified by the social security number.
- The airport has a number of tests that are used periodically to ensure that airplanes are still airworthy. Each test has a Federal Aviation Administration (FAA) test number, a name, and a maximum possible score.
- The FAA requires the airport to keep track of each time that a given airplane is tested by a given technician using a given test. For each testing event, the information needed is the date, the number of hours the technician spent doing the test, and the score that the airplane received on the test.

1. Draw an ER diagram for the airport database. Be sure to indicate the various attributes of each entity and relationship set; also specify the key and participation constraints for each relationship set. Specify any necessary overlap and covering constraints as well (in English).

2. The FAA passes a regulation that tests on a plane must be conducted by a technician who is an expert on that model. How would you express this constraint in the ER diagram? If you cannot express it, explain briefly.

3) Notown Records has decided to store information about musicians who perform on its albums (as well as other company data) in a database. The company has wisely chosen to hire you as a database designer (at your usual consulting fee of $2,500/day).

- Each musician that records at Notown has an SSN, a name, an address, and a phone number. Poorly paid musicians often share the same address, and no address has more than one phone.
- Each instrument that is used in songs recorded at Notown has a name (e.g., guitar, synthesizer, flute) and a musical key (e.g., C, B-flat, E-flat).
- Each album that is recorded on the Notown label has a title, a copyright date, a format (e.g., CD or MC), and an album identifier.
- Each song recorded at Notown has a title and an author.
- Each musician may play several instruments, and a given instrument may be played by several musicians.
- Each album has a number of songs on it, but no song may appear on more than one album.
- Each song is performed by one or more musicians, and a musician may perform a number of songs.
- Each album has exactly one musician who acts as its producer. A musician may produce several albums, of course.

1) Design a conceptual schema for Notown and draw an ER diagram for your schema. The following information describes the situation that the Notown database must model. Be sure to indicate all key and cardinality constraints and any assumptions that you make. Identify any constraints that you are unable to capture in the ER diagram and briefly explain why
you could not express them.

4) Consider the following information about a university database:

Professors have an SSN, a name, an age, a rank, and a research specialty.

Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget.

- Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.).
- Each project is managed by one professor (known as the project's principal investigator).
- Each project is worked on by one or more professors (known as the project's co-investigators).
- Professors can manage and/or work on multiple projects.
- Each project is worked on by one or more graduate students (known as the project's research assistants).
- When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.
- Departments have a department number, a department name, and a main office.
- Departments have a professor (known as the chairman) who runs the department. Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.
- Graduate students have one major department in which they are working on their degree. Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.

Design and draw an ER diagram that captures the information about the university. Use only the basic ER model here, that is, entities, relationships, and attributes. Be sure to indicate any key and participation constraints.

5) A university database contains information about professors (identified by social security number, or SSN) and courses (identified by courseid). Professors teach courses; each of the following situations concerns the Teaches relationship set. For each situation, draw an ER diagram that describes it (assuming that no further constraints hold).

1. Professors can teach the same course in several semesters, and each offering must be recorded.
2. Professors can teach the same course in several semesters, and only the most recent such offering needs to be recorded. (Assume this condition applies in all subsequent questions.)
3. Every professor must teach some course.
4. Every professor teaches exactly one course (no more, no less).
5. Every professor teaches exactly one course (no more, no less), and every course must be taught by some professor.
6. Now suppose that certain courses can be taught by a team of professors jointly, but it is possible that no one professor in a team can teach the course. Model this situation, introducing additional entity sets and relationship sets if necessary

6) Consider a database system for a baseball organization such as the major leagues. The data requirements are summarized as follows:

■ The personnel involved in the league include players, coaches, managers, and umpires. Each is identified by a unique personnel id. They are also described by their first and last names along with the date and place of birth.

■ Players are further described by other attributes such as their batting orientation (left, right, or switch) and have a lifetime batting average (BA).

■ Within the players group is a subset of players called pitchers. Pitchers have a lifetime ERA (earned run average) associated with them.

■ Teams are uniquely identified by their names. Teams are also described by the city in which they are located and the division and league in which they play (such as Central division of the American League).

■ Teams have one manager, a number of coaches, and a number of players.

■ Games are played between two teams, with one designated as the home team and the other the visiting team on a particular date. The score (runs, hits, and errors) is recorded for each team. The team with the most runs is declared the winner of the game.

■ With each finished game, a winning pitcher and a losing pitcher are recorded. In case there is a save awarded, the save pitcher is also recorded.

■ With each finished game, the number of hits (singles, doubles, triples, and home runs) obtained by each player is also recorded.

Design an enhanced entity–relationship diagram for the BASEBALL database and enter the design using a data modeling tool such as ERwin or Rational Rose.

7) Design a database for an airline. The database must keep track of customers and their reservations, flights and their status, seat assignments on individual flights, and the schedule and routing of future flights. Your design should include an E-R diagram, a set of relational schemas, and a list of constraints, including primary-key and foreign-key constraints.

Airline Managmenet System entities and their attributes :

- **Airlines Booking Entity** : Attributes of Airlines Booking are airlines booking_id, airlines booking_type, airlines booking_date, airlines booking_description
- **Passengar Entity** : Attributes of Passengar are passenger_id, passenger_name, passenger_mobile, passenger_email, passenger_username, passenger_password, passenger_address
- **Ticket Booking Entity** : Attributes of Ticket Booking are ticket booking_id, ticket booking_type, ticket booking_Date, ticket booking_description
- **Booking Enquiry Entity** : Attributes of Booking Enquiry are booking enquiry,_id, booking enquiry,_title, booking enquiry,_type, booking enquiry,_date, booking enquiry,_description
- **Airline Enquiry Entity** : Attributes of Airline Enquiry are airline enquiry,_id, airline enquiry,_title, airline enquiry,_type, airline enquiry,_date, airline enquiry,_description
- **Employee Entity** : Attributes of Employee are employee_id, employee_name, employee_mobile, employee_email, employee_username, employee_password, employee_address

8)

This ER (Entity Relationship) Diagram represents the model of Provident Fund System Entity. The entity-relationship diagram of Provident Fund System shows all the visual instrument of database tables and the relations between Employees, Registration, Provident Fund, Users etc. It used structure data and to define the relationships between structured data groups of Provident Fund System functionalities. The main entities of the Provident Fund System are Provident Fund, Employees, Compnay Shares, Registration, Contributions and Users.

Provident Fund System entities and their attributes :

- **Provident Fund Entity** : Attributes of Provident Fund are provident_fund_id, provident_fund_name, provident_fund_type, provident_fund_description
- **Employees Entity** : Attributes of Employees are employee_id, employee_name, employee_mobile, employee_email, employee_username, employee_password, employee_address
- **Compnay Shares Entity** : Attributes of Compnay Shares are company_shares_id, company_shares_name, company_shares_type, company_shares_description
- **Registration Entity** : Attributes of Registration are registration_id, registration_employee_id, registration_name, registration_type, registration_number, registration_date, registration_description
- **Contributions Entity** : Attributes of Contributions are contribution_id, contribution_name, contribution_type, vdescription
- **Users Entity** : Attributes of Users are user_id, user_name, user_mobile, user_email, user_username, user_password, user_address

9)

This ER (Entity Relationship) Diagram represents the model of Student Management System Entity. The entity-relationship diagram of Student Management System shows all the visual instrument of database tables and the relations between Fees, Profiles, Student, Exams etc. It used structure data and to define the relationships between structured data groups of Student Management System functionalities. The main entities of the Student Management System are Student, Fees, Logins, Profiles, Cources and Exams.

Student Management System entities and their attributes :

- **Student Entity** : Attributes of Student are student_id, student_college_id, student_name, student_mobile, student_email, student_username, student_password, student_address
- **Fees Entity** : Attributes of Fees are fee_id, fee_course_id, fee_amount, fee_total, fee_payment, fee_type, fee_description
- **Logins Entity** : Attributes of Logins are login_id, login_user_id, login_role_id, login_username, login_password, login_lastlogin
- **Profiles Entity** : Attributes of Profiles are profile_id, profile_name, profile_type, profile_description
- **Cources Entity** : Attributes of Cources are course_id, course_student_id, course_registration, course_name, course_type, course_year, course_description
- **Exams Entity** : Attributes of Exams are exam_id, exam_student_id, exam_roll_number, exam_date exam_name, exam_type, exam_description

10)

This ER (Entity Relationship) Diagram represents the model of Travel Agency Management System Entity. The entity-relationship diagram of Travel Agency Management System shows all the visual instrument of database tables and the relations between Customer, Bookings, Travel Agency, Payments etc. It used structure data and to define the relationships between structured data groups of Travel Agency Management System functionalities. The main entities of the Travel Agency Management System are Travel Agency, Customer, Cabs, Bookings, Hotels and Payments.

Travel Agency Management System entities and their attributes :

- **Travel Agency Entity** : Attributes of Travel Agency are agency_id, agency_name, comapny_type, agency_description, agency_address
- **Customer Entity** : Attributes of Customer are customer_id, customer_name, customer_mobile, customer_email, customer_username, customer_password, customer_address
- **Cabs Entity** : Attributes of Cabs are cab_id, cab_name, cab_type, cab_description
- **Bookings Entity** : Attributes of Bookings are booking_id, booking_hotel_id, booking_title, booking_type, booking_date, booking_description
- **Hotels Entity** : Attributes of Hotels are hotel_id, hotel_name, hotel_type, hotel_rent, hotel_description, hotel_address
- **Payments Entity** : Attributes of Payments are payment_id, payment_customer_id, payment_date, payment_amount, payment_description

11) An entity type DEPARTMENT with attributes Name, Number, Locations, Manager, and Manager_start_date. Locations is the only multivalued attribute. We can specify that both Name and Number are (separate) key attributes because each was specified to be unique.

2. An entity type PROJECT with attributes Name, Number, Location, and Controlling_department. Both Name and Number are (separate) key attributes.

3. An entity type EMPLOYEE with attributes Name, Ssn, Sex, Address, Salary, Birth_date, Department, and Supervisor. Both Name and Address may be composite attributes; however, this was not specified in the requirements. We must go back to the users to see if any of them will refer to the individual components of Name—First_name, Middle_initial, Last_name—or of Address. In our example, Name is modeled as a composite attribute, whereas Address is not, presumably after consultation with the users.

4. An entity type DEPENDENT with attributes Employee, Dependent_name, Sex, Birth_date, and Relationship (to the employee). Another requirement is that an employee can work on several projects, and the database has to store the number of hours per week an employee works on each project and this can be represented by a multivalued composite attribute of EMPLOYEE called

Works_on with the simple components (Project, Hours). Alternatively, it can be represented as a multivalued composite attribute of PROJECT called Workers with the simple components (Employee, Hours). (Fundamentals of database systems TB pb.no 101,113)

12) Design an ER schema for keeping track of information about votes taken in the U.S. House of Representatives during the current two-year congressional session.

- The database needs to keep track of each U.S. STATE's Name (e.g., 'Texas', 'New York', 'California') and include the Region of the state (whose domain is {'Northeast', 'Midwest', 'Southeast', 'Southwest', 'West'}).
- Each CONGRESS_PERSON in the House of Representatives is described by his or her Name, plus the District represented, the Start_date when the congressperson was first elected, and the political Party to which he or she belongs (whose domain is {'Republican', 'Democrat', 'Independent', 'Other'}).
- The database keeps track of each BILL (i.e., proposed law), including the Bill_name, the Date_of_vote on the bill, whether the bill Passed_or_failed (whose domain is {'Yes', 'No'}), and the Sponsor (the congressperson(s) who sponsored—that is, proposed—the bill).
- The database also keeps track of how each congressperson voted on each bill (domain of Vote attribute is {'Yes', 'No', 'Abstain', 'Absent'}).

  Draw an ER schema diagram for this application. State clearly any assumptions you make

13) Consider a MAIL_ORDER database in which employees take orders for parts from customers. The data requirements are summarized as follows:

■ The mail order company has employees, each identified by a unique employee number, first and last name, and Zip Code

■ Each customer of the company is identified by a unique customer number, first and last name, and Zip Code.

■ Each part sold by the company is identified by a unique part number, a part name, price, and quantity in stock.

■ Each order placed by a customer is taken by an employee and is given a unique order number. Each order contains specified quantities of one or more parts. Each order has a date of receipt as well as an expected ship date. The actual ship date is also recorded.

Design an entity–relationship diagram for the mail order database and build the design using a data modeling tool such as ERwin or Rational Rose.

14) Consider a MOVIE database in which data is recorded about the movie industry. The data requirements are summarized as follows:

■ Each movie is identified by title and year of release. Each movie has a length in minutes. Each has a production company, and each is classified under one or more genres (such as horror, action, drama, and so forth). Each movie has one or more directors and one or more actors appear in it. Each movie also has a plot outline. Finally, each movie has zero or more quotable quotes, each of which is spoken by a particular actor appearing in the movie.

■ Actors are identified by name and date of birth and appear in one or more movies. Each actor has a role in the movie. 104 Chapter 3 Data Modeling Using the Entity–Relationship (ER) Model

■ Directors are also identified by name and date of birth and direct one or more movies. It is possible for a director to act in a movie (including one that he or she may also direct).

■ Production companies are identified by name and each has an address. A production company produces one or more movies.

Design an entity–relationship diagram for the movie database and enter the design using a data modeling tool such as ERwin or Rational Rose.

15) Consider a CONFERENCE_REVIEW database in which researchers submit their research papers for consideration. Reviews by reviewers are recorded for use in the paper selection process. The database system caters primarily to reviewers who record answers to evaluation questions for each paper they review and make recommendations regarding whether to accept or reject the paper. The data requirements are summarized as follows:

■ Authors of papers are uniquely identified by e-mail id. First and last names are also recorded.

■ Each paper is assigned a unique identifier by the system and is described by a title, abstract, and the name of the electronic file containing the paper.

■ A paper may have multiple authors, but one of the authors is designated as the contact author.

■ Reviewers of papers are uniquely identified by e-mail address. Each reviewer's first name, last name, phone number, affiliation, and topics of interest are also recorded.

■ Each paper is assigned between two and four reviewers. A reviewer rates each paper assigned to him or her on a scale of 1 to 10 in four categories: technical merit, readability, originality, and relevance to the conference. Finally, each reviewer provides an overall recommendation regarding each paper.

■ Each review contains two types of written comments: one to be seen by the review committee only and the other as feedback to the author(s). Design an entity–relationship diagram for the CONFERENCE_REVIEW database and build the design using a data modeling tool such as ERwin or Rational Rose.

16) Consider an ONLINE_AUCTION database system in which members (buyers and sellers) participate in the sale of items. The data requirements for this system are summarized as follows:

■ The online site has members, each of whom is identified by a unique member number and is described by an e-mail address, name, password, home address, and phone number.

■ A member may be a buyer or a seller. A buyer has a shipping address recorded in the database. A seller has a bank account number and routing number recorded in the database. ■ Items are placed by a seller for sale and are identified by a unique item number assigned by the system. Items are also described by an item title, a description, starting bid price, bidding increment, the start date of the auction, and the end date of the auction.

■ Items are also categorized based on a fixed classification hierarchy (for example, a modem may be classified as COMPUTER → HARDWARE → MODEM).

■ Buyers make bids for items they are interested in. Bid price and time of bid are recorded. The bidder at the end of the auction with the highest bid price is declared the winner, and a transaction between buyer and seller may then proceed.

■ The buyer and seller may record feedback regarding their completed transactions. Feedback contains a rating of the other party participating in the transaction (1–10) and a comment. Laboratory Exercises 145 Design an enhanced entity–relationship diagram for the ONLINE_AUCTION database and build the design using a data modeling tool such as ERwin or Rational rose.

17)

- For each person, the database maintains information on the person's Name [Name], Social Security number [Ssn], address [Address], sex [Sex], and birth date [Bdate].
- Two subclasses of the PERSON entity type are identified: FACULTY and STUDENT.
- Specific attributes of FACULTY are rank [Rank] (assistant, associate, adjunct, research, visiting, and so on), office [Foffice], office phone [Fphone], and salary [Salary]. All faculty members are related to the academic department(s) with which they are affiliated [BELONGS] (a faculty member can be associated with several departments, so the relationship is M:N). A specific attribute of STUDENT is [Class] (freshman = 1, sophomore = 2, … , MS student = 5, PhD student = 6). Each STUDENT is also related to his or her major and minor departments (if known) [MAJOR] and [MINOR], to the course sections he or she is currently attending [REGISTERED], and to the courses completed [TRANSCRIPT].
- Each TRANSCRIPT instance includes the grade the student received [Grade] in a section of a course.
- GRAD_STUDENT is a subclass of STUDENT, with the defining predicate (Class = 5 OR Class = 6). For each graduate student, we keep a list of previous degrees in a composite, multivalued attribute [Degrees]. We also relate the graduate student to a faculty advisor [ADVISOR] and to a thesis committee [COMMITTEE], if one exists.
- An academic department has the attributes name [Dname], telephone [Dphone], and office number [Office] and is related to the faculty member who is its chairperson [CHAIRS] and to the college to which it belongs [CD].
- Each college has attributes college name [Cname], office number [Coffice], and the name of its dean [Dean]. A course has attributes course number [C#], course name [Cname], and course description [Cdesc].

- Several sections of each course are offered, with each section having the attributes section number [Sec#] and the year and quarter in which the section was offered ([Year] and [Qtr]).10 Section numbers uniquely identify each section. The sections being offered during the current quarter are in a subclass CURRENT_SECTION of SECTION, with the defining predicate Qtr = Current_qtr and Year = Current_year. Each section is related to the instructor who taught or is teaching it ([TEACH]), if that instructor is in the database.
- The category INSTRUCTOR_RESEARCHER is a subset of the union of FACULTY and GRAD_STUDENT and includes all faculty, as well as graduate students who are supported by teaching or research. Finally, the entity type GRANT keeps track of research grants and contracts awarded to the university.
- Each grant has attributes grant title [Title], grant number [No], the awarding agency [Agency], and the starting date [St_date]. A grant is related to one principal investigator [PI] and to all researchers it supports [SUPPORT]. Each instance of support has as attributes the starting date of support [Start], the ending date of the support (if known) [End], and the percentage of time being spent on the project [Time] by the researcher being supported.

18) Consider a GRADE_BOOK database in which instructors within an academic department record points earned by individual students in their classes. The data requirements are summarized as follows:

■ Each student is identified by a unique identifier, first and last name, and an e-mail address. ■ Each instructor teaches certain courses each term. Each course is identified by a course number, a section number, and the term in which it is taught. For 144 Chapter 4 The Enhanced Entity–Relationship (EER) Model each course he or she teaches, the instructor specifies the minimum number of points required in order to earn letter grades A, B, C, D, and F. For example, 90 points for an A, 80 points for a B, 70 points for a C, and so forth.

■ Students are enrolled in each course taught by the instructor.

■ Each course has a number of grading components (such as midterm exam, final exam, project, and so forth). Each grading component has a maximum number of points (such as 100 or 50) and a weight (such as 20% or 10%). The weights of all the grading components of a course usually total 100.

■ Finally, the instructor records the points earned by each student in each of the grading components in each of the courses. For example, student 1234 earns 84 points for the midterm exam grading component of the section 2 course CSc2310 in the fall term of 2009. The midterm exam grading component may have been defined to have a maximum of 100 points and a weight of 20% of the course grade. Design an enhanced entity–relationship diagram for the grade book database and build the design using a data modeling tool such as ERwin or Rational Rose

Dates of Submission **(In A3 Chart)**

- ✓ **Requirements Gathering & Analysis -01-11-2022**
- ✓ **Schema Design -10-11-2022**
- ✓ **Conversion to Relational Model -17-11-2022**
- ✓ **Implementation-Database Creation - 28-11-2022**
- ✓ **Testing & Maintenance - 01-12-2022**