Department: Computer Engineering & Applications		**Set:** I
Program: B. Tech.	**Year:** II	**Semester:** III
Branch: CSE/CSED/AIML/DA/CCV/IIoT		
Subject Name: Database Management System		**Subject Code:** BCSC 1003

Assignment 1

Q1. A university registrar's office maintains data about the following entities:

Courses: number, title, credits, syllabus, and prerequisites.
course offerings: course_number, year, semester, section_number, instructor(s), timings, and classroom
students: student-id, sname, and program
instructors: empid, ename, department, and title.

Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints.

Q2. Consider the following schema:
Suppliers (sid: integer, sname: string, address: string)
Parts (pid: integer, pname: string, color: string)
Catalog (sid: integer, pid: integer, cost: real)

The key fields are underlined and domain of each field is listed after the field name

a. Find the name of suppliers who supply some red parts.
b. Find the sids of suppliers who supply some red or green parts.
c. Find the sids of suppliers who supply some red part and having cost more than 6000.

Q3. Suppose you are Data Base Administrator (DBA) working in sports Department and you are designing a Database for the National Hockey League (NHL) with following requirement and the constraints.

- NHL may have n number of teams and each team is having attribute a name, a city, a coach, a captain, and a set of players.
- Each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records.
- A game is played between two teams (referred to as host_team and guest_team) and has a date (such as September 8th, 2023) and a score (such as 4 to 2) of winning team is to be recorded.

Now, solve the followings:

i. Construct a clean and concise ER diagram for the NHL database.
ii. Generate tables from ER Model.
iii. Apply the knowledge of relational algebra to answer the followings.
iv. Find the names of teams who belong to Chandigarh.
v. Search the name of Players who are captains and not with excellent skill level.
vi. Teams who won the first league match.

Q4. Consider the following relations for a database that keeps track of student enrollment in courses and the books adopted for each course:

STUDENT (Ssn, Name, Major, Bdate)
COURSE (Course#, Cname, Dept)
ENROLL (Ssn, Course#, Quarter, Grade)
BOOK_ADOPTION (Course#, Quarter, Book_isbn)
TEXT (Book_isbn, Book_title, Publisher, Author)

Specify the foreign keys for this schema, stating any assumptions you make.

Q5. Consider the relation CLASS (Course#, Univ_Section#, Instructor_name, Semester, Building_code, Room#, Time_period, Weekdays, Credit_hours).

This represents classes taught in a university, with unique Univ_section#s. Identify what you think should be various candidate keys, and write in your own words the conditions or assumptions under which each candidate key would be valid.

Q6. Design a relational database schema for a database application of your choice.
   a. Declare your relations, using the SQL DDL.
   b. Specify a number of queries in SQL that are needed by your database application.
   c. Based on your expected use of the database, choose some attributes that should have indexes specified on them.

Q7. Solve the following queries in relational algebra expression.
The Relations are:
EMP (Ename, SSNo, Sal, Deptno)
Dept (Deptno, Dname, Dloc)

   a. Retrieve each employee name, department name having salary greater than 500.
   b. Join EMP & Dept on Deptno and SSNo.

Q8. Let Relation R (A, B, C, D, E) be a relation scheme with the following functional dependencies: {AB → C, C → D, B → E}

Determine the total number of candidate keys and super keys.

Department: Computer Engineering & Applications		**Set:** II
Program: B. Tech.	**Year:** II	**Semester:** III
Branch: CSE/CSED/AIML/DA/CCV/IIoT		
Subject Name: Database Management System		**Subject Code:** BCSC 1003

Assignment 1

Q1. A task of analyzing database is given to the Database Administrator of the company having the following relational database and give an expression in relational algebra each of the following queries:
Employee (person-name, street, city)
Works (person name, company name, salary)
Company (Company name, city)
Managers (person name, manager-name)

a. Convert these relations into ER model and specify Primary Key, Foreign Key, Candidate Key and Super Key in these relations.
b. Find the names of all employees who work for First Bank Corporation.
c. Find the names and cities of residences of all employees who work for First Bank Corporation.
d. Find the names of all the employees who do not work for First Bank Corporation.
e. Find names of all employees who earn more than $10000 per annum.
f. Find names of all employees who earn more than every employee of Small Bank Corporation.

Q2. Design an ERD for an e-commerce website. The website has multiple products, each identified by a unique product ID, and has attributes like name, price, and quantity in stock. Customers have unique customer IDs and attributes such as name, email, and shipping address. Customers can place multiple orders, and each order can include multiple products. Each product can belong to multiple orders.

Q3. Consider a scenario where a table has an attribute that can have NULL values. Should you use this attribute as part of the Primary Key or Candidate Key? Justify your answer.

Q4. Consider the relation scheme R = {E, F, G, H, I, J, K, L, M, N} and the set of functional dependencies {EF $\rightarrow$ G, F $\rightarrow$ IJ, EH $\rightarrow$ KL, K $\rightarrow$ M, L $\rightarrow$ N} on R. Identify the key for R? **[GATE-CS-2014]**
(a). {E, F, H} (b). {E, F, H, K, L} (c). {E} (d). {E, F}

Q5. In a university database, you have the following entities: Students, Courses, and Enrollments. Design appropriate tables for each entity and establish the necessary keys and relationships using primary keys and foreign keys.

Q6. Let a Relation R have attributes {a_1, a_2, a_3, …, a_n} and the candidate key is "a_1 a_2 a_3" then the possible number of super keys?

Q7. Consider the following six relations for an order-processing database application in a company:
CUSTOMER (Cust#, Cname, City)
ORDER (Order#, Odate, Cust#, Ord_amt)
ORDER_ITEM (Order#, Item#, Qty)
ITEM (Item#, Unit_price)
SHIPMENT (Order#, Warehouse#, Ship_date)
WAREHOUSE (Warehouse#, City)

Here, Ord_amt refers to total dollar amount of an order; Odate is the date the order was placed; and Ship_date is the date an order (or part of an order) is shipped from the warehouse. Assume that an order can be shipped from several warehouses. Specify the foreign keys for this schema, stating any assumptions you make. What other constraints can you think of for this database?

Q8. Consider the following relational database schema consisting of the four relation schemas:
passenger (pid, pname, pgender, pcity)
agency (aid, aname, acity)
flight (fid, fdate, time, src, dest)
booking (pid, aid, fid, fdate)

Answer the following questions using relational algebra queries;

i. Get the complete details of all flights to New Delhi.
ii. Get the details about all flights from Chennai to New Delhi.
iii. Find only the flight numbers for passenger with pid 123 for flights to Chennai before 06/11/2023.
iv. Find the passenger names for those who do not have any bookings in any flights.

Department: Computer Engineering & Applications		**Set:** III
Program: B. Tech.	**Year:** II	**Semester:** III
Branch: CSE/CSED/AIML/DA/CCV/IIoT		
Subject Name: Database Management System		**Subject Code:** BCSC 1003

Assignment 1

Q1. Consider the following relations for a database that keeps track of business trips of salespersons in a sales office:

SALESPERSON (Ssn, Name, Start_year, Dept_no)
TRIP (Ssn, From_city, To_city, Departure_date, Return_date, Trip_id)
EXPENSE (Trip_id, Account#, Amount)

A trip can be charged to one or more accounts. Specify the foreign keys for this schema, stating any assumptions you make.

Q2. Suppose you have a table with the following attributes: Employee_ID, Employee_Name, and Department_ID. Designate the Primary Key and Foreign Key(s) for this table, assuming it has a relationship with a department table with a primary key Department_ID.

Q3. Consider a relation scheme R = (A, B, C, D, E, H) on which the following functional dependencies hold: $\{A \rightarrow B, BC \rightarrow D, E \rightarrow C, D \rightarrow A\}$.
What are the candidate keys of R? **[GATE 2005]**

(a) AE, BE
(b) AE, BE, DE
(c) AEH, BEH, BCH
(d) AEH, BEH, DEH

Q4. Draw ER diagram and Map it to Relational Schema and Map it to Relational Schema.

In an educational institute, there are several departments and each student belongs to one of them. Each department has a unique department number, a

name, a location, phone number and is headed by a professor. Professors have a unique employee Id, name and a phone number. A professor works for exactly one department.

We like to keep track of the following details regarding students: name, unique roll number, sex, phone number, date of birth, age and one or more email addresses. Students have a local address consisting of the hostel name and the room number. They also have home address consisting of house number, street, city and PIN. It is assumed that all students reside in the hostels.

A course taught in a semester of the year is called a section. There can be several sections of the same course in a semester; these are identified by the section number. Each section is taught by a professor and has its own timings and a room to meet. Students enroll for several sections in a semester.

Each course has a name, number of credits and the department that offers it. A course may have other courses as pre-requisites i.e, courses to be completed before it can be enrolled in.

Professors also undertake research projects. These are sponsored by funding agencies and have a specific start date, end date and amount of money given. More than one professor can be involved in a project. Also a professor may be simultaneously working on several projects. A project has a unique projectId.

Q5. Let a Relation R have attributes $\{a_1, a_2, a_3, \ldots, a_n\}$ and the candidate key is "a_1 a_2 a_3" then the possible number of super keys?

Q6. Cardinality ratios often dictate the detailed design of a database. The cardinality ratio depends on the real-world meaning of the entity types involved and is defined by the specific application. For the following binary relation- ships, suggest cardinality ratios based on the common-sense meaning of the entity types. Clearly state any assumptions you make.

Q7. Consider a database that consists of the following relations.

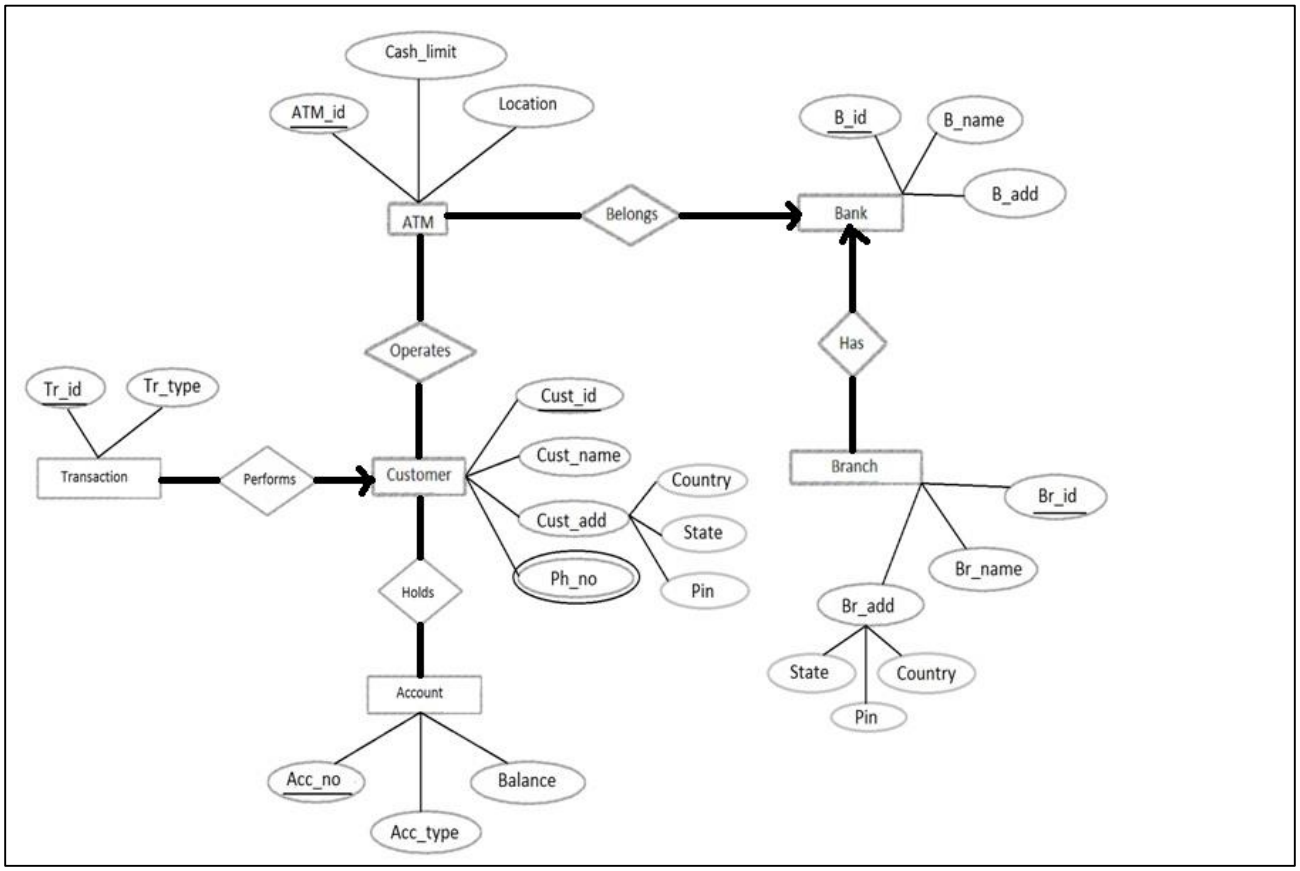
SUPPLIER (Sno, Sname) PART (Pno, Pname)

PROJECT (Jno, Jname) SUPPLY (Sno, Pno, Jno)

The database records information about suppliers, parts, and projects and includes a ternary relationship between suppliers, parts, and projects. This relationship is a many-many-many relationships. Specify and execute the following queries using the RA interpreter.

a. Retrieve the part numbers that are supplied to exactly two projects.
b. Retrieve the names of suppliers who supply more than two parts to project 'J1'.
c. Retrieve the part numbers that are supplied by every supplier.
d. Retrieve the project names that are supplied by supplier 'S1' only.
e. Retrieve the names of suppliers who supply at least two different parts each to at least two different projects.

Q8. Consider the ER diagram mentioned below. Identify the entity sets, attributes & convert the following ER diagram to set of relational schemas.



Department: Computer Engineering & Applications		**Set:** IV
Program: B. Tech.	**Year:** II	**Semester:** III
Branch: CSE/CSED/AIML/DA/CCV/IIoT		
Subject Name: Database Management System		**Subject Code:** BCSC 1003

Assignment 1

Q1. Design an E-R diagram for keeping track of the exploits of your favorite sports team. You should store the matches played, the scores in each match, the players in each match and individual player statistics for each match. Summary statistics should be modeled as derived attributes.

Q2. Consider a database with the following schema:

Person (<u>name</u>, age, gender)	name is a key
Frequents (<u>name</u>, <u>pizzeria</u>)	(name, pizzeria) is a key
Eats (<u>name</u>, <u>pizza</u>)	(name, pizza) is a key
Serves (<u>pizzeria</u>, <u>pizza</u>, price)	(pizzeria, pizza) is a key

Write relational algebra expressions for the following queries:

a. Find all pizzerias frequented by at least one person under the age of 18.
b. Find the names of all females who eat either mushroom or pepperoni pizza (or both).
c. Find the names of all females who eat both mushroom and pepperoni pizza.

Q3. Let a Relation R have attributes $\{a_1, a_2, a_3, \ldots, a_n\}$ and the candidate key is "a_1 a_2 a_3" then the possible number of super keys?

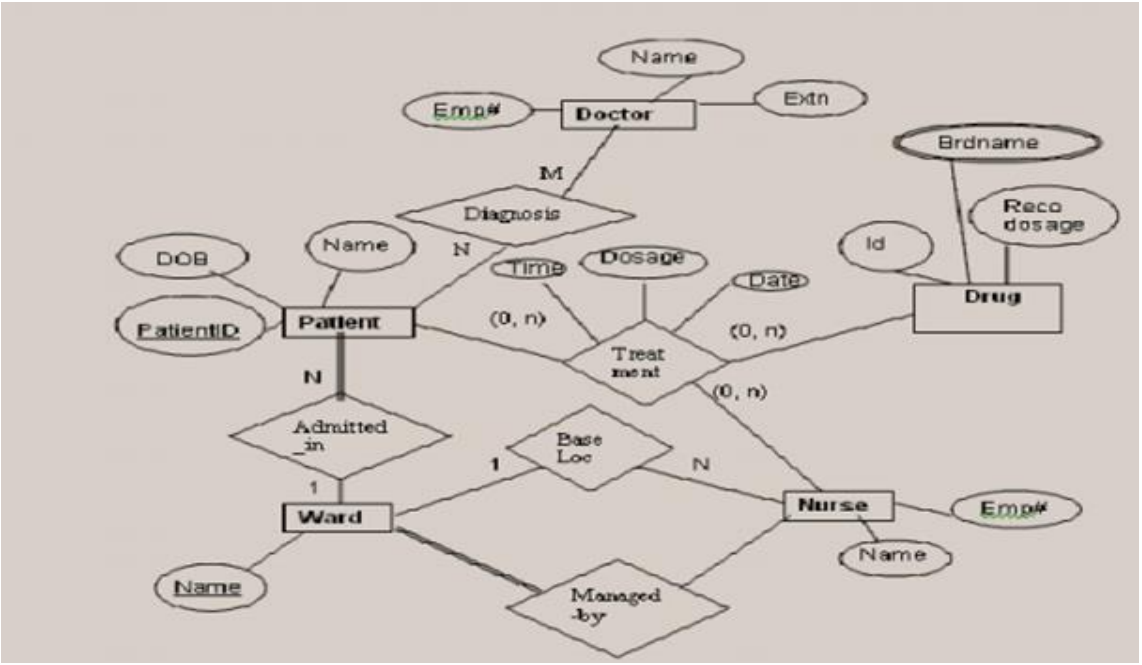
Q4. Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted.

Q5. In a schema with attributes A, B, C, D and E following set of functional dependencies are given as, {A $\rightarrow$ B, A $\rightarrow$ C, CD $\rightarrow$ E, B $\rightarrow$ D, E $\rightarrow$ A}
Identify which of the following functional dependencies is NOT implied by the above set? **[GATE IT 2005]**

(a). CD $\rightarrow$ AC (b). BD $\rightarrow$ CD (c). BC $\rightarrow$ CD
(d). AC $\rightarrow$ BC (e). B $\rightarrow$E

Q6. A database is being constructed to keep track of the teams and games of a sports league. A team has a number of players, not all of whom participate in each game. It is desired to keep track of the players participating in each game for each team, the positions they played in that game, and the result of the game. Design an ER schema diagram for this application, stating any assumptions you make. Choose your favorite sport (e.g., soccer, baseball, football).

Q7. Consider the ER diagram mentioned below. Identify the entity sets, attributes & Convert the ER model into a relational Schema.

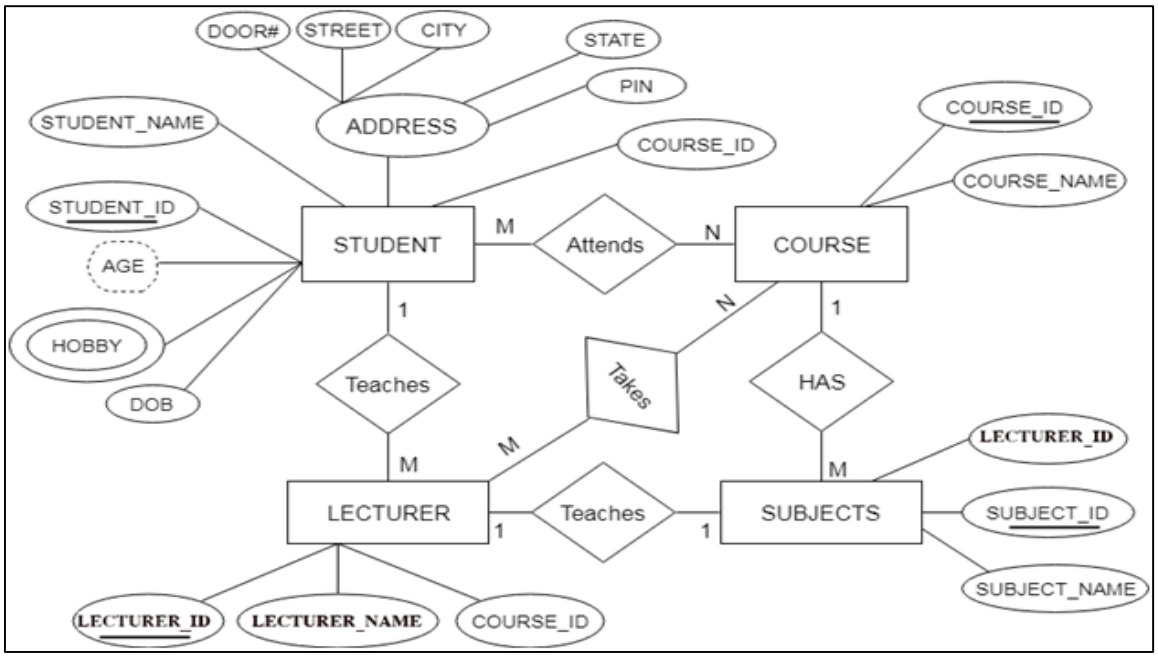


Q8. Let R (A, B, C, D, E) be a relation scheme with the following functional dependencies: {AB $\rightarrow$ C, C $\rightarrow$ D, B $\rightarrow$ E}
Determine the total number of candidate keys and super keys.

Department: Computer Engineering & Applications		**Set:** V
Program: B. Tech.	**Year:** II	**Semester:** III
Branch: CSE/CSED/AIML/DA/CCV/IIoT		
Subject Name: Database Management System		**Subject Code:** BCSC 1003

Assignment 1

Q1. Analyze the given ERD & reduce the following ER diagram to relational database schema. Identify Candidate keys & determine total numbers of Tables required.



Q2. Analyze a given dataset and identify various mapping constraints that need to be applied to ensure data integrity. Your dataset includes information about employees in a company, such as their names, ages, departments, and salaries. Consider the following constraints:

i. Primary Key Constraint: Identify the primary key(s) for the "Employee" table and explain why they are suitable for uniquely identifying each record.

ii. Foreign Key Constraint: Determine the foreign keys in the "Employee" table that reference other tables (e.g., "Department" table) and explain the relationships between them.
iii. Unique Constraint: Identify attributes that should have unique values for each record in the "Employee" table.
iv. Not Null Constraint: Identify attributes that must have a value for every record in the "Employee" table.
v. Check Constraint: Suggest a check constraint for the "Salary" attribute to ensure that it falls within a specific range (e.g., between $30,000 and $100,000).

Q3. Consider a database for an educational institution that offers various courses. Design a database schema to represent the entities "Course," "RegularCourse," and "WorkshopCourse" using specialization and generalization.

Q4. Compute the closure of the following set F of functional dependencies for relation schema R (A, B, C, D, E). FD: {A → BC, CD → E, B→D, E→A}
List the candidate keys for R.

Q5. Consider the following set F of functional dependencies on the relation schema R (A, B, C, D, E, F); FD: {A → BCD, BC → DE, B→D, D→A}
a. Compute B +.
b. Prove (using Armstrong's axioms) that AF is a super key.
c. Compute a canonical cover for the above set of FDs F; give each step of your derivation with an explanation.

Q6. Suppose there is a banking database which comprises following tables:
Customer (Cust_name, Cust_street, Cust_city)
Branch (Branch_name, Branch_city, Assets)
Account (Branch_name, Account_number, Balance)
Loan (Branch_name, Loan_number, Amount)
Depositor (Cust_name, Account_number)
Borrower (Cust_name, Loan_number)
a. Find the names of all the customers who have taken a loan from the bank and also have an account at the bank.
b. Find the names of all the customers group by Branch_city.
c. Find the names of all the borrowers along with loan number.

Q7. Consider a university database with the following requirements:
(A). There are two types of employees: "Faculty" and "Staff."
(B). Faculty members have attributes: Employee_ID, Employee_Name, Department, Salary.
(C). Staff members have attributes: Employee_ID, Employee_Name, Department, Salary, Role.
(D). Both types of employees share common attributes: Employee_ID, Employee_Name, and Department.

Create an entity-relationship diagram (ERD) using the specialization method to represent the "Employee" entity and its specializations. Clearly show the attributes of each entity type and their relationships.

Q 8. Draw ER Diagram for the scenario below and map it to Relational Schema:

We store each employee's name (first, last, MI), Social Security number (SSN), street address, salary, sex (gender), and birth date. An employee is assigned to one department, but may work on several projects, which are not necessarily controlled by the same department. We keep track of the current number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee (who is another employee).

Each department has a particular employee who manages the department. We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's first name, sex, birth date, and relationship to the employee.

A department controls a number of projects which has a unique number and a single location.