

**PHASE 3: SUBMISSION CHECKLIST/SIGNOFF SHEET**

**GROUP #: 9**

**GROUP NAME: 9**

**Deliverables:**

- ◆ Requirements Description
- ◆ ER Diagram with min/max specifications
- ◆ Uncaptured Constraints
- ◆ Relational Schema
- ◆ Transaction Processing Needs: Categorized with brief description
  - ◆ Forms
  - ◆ Reports
  - ◆ Queries
- ◆ Completed Microsoft Access Implementation: Zipped MDB file in Digital Drop Box on myASU

**Assessment:**

- ◆ Group Status Report
- ◆ Confidential phase evaluation
  - Phase leader
  - Phase recorder
  - Phase checker
  - Technical advisor 1
  - Technical advisor 2
- ◆ Team assessment
- ◆ Graded Phase 2

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## **CSE 412/598**

### **Database Management**

### **Microsoft Access™ Project**

### **Sales Database and Payroll System (SALESDATA)**

### **Phase 3 Final Deliverable**

**Due Date:** December 2, 2003  
**Group No.:** 9  
**Group Name:** Group Nine  
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## 1. Introduction

The database enterprise used in this example is a simulation of a database that could be used to track and calculate various sales and payroll issues for a rental company.

The first part of this document discusses the relational design of SALESDATA. This part covers the following topics:

- Requirements Description
- Entity-Relationship (ER) model of SALESDATA with min/max specification
- Constraints not captured by the ER model
- Mapping from ER model to relational schema
- Summary of forms, reports and queries

The second part of this document addresses the theoretical issues of the SALESDATA database design. This part covers the following topics:

- Functional dependencies
- Normal forms
- Lossless join property
- Dependency preservation

## 2. Requirements Description

Our moving equipment rental company already has a payroll system and a reservation system in place. However, these systems are not equipped to handle commission calculations or sales reporting. Rather than modify the existing reservation and payroll modules to add these capabilities, the company would like to have a separate reservation commission module implemented for the sales staff. This commission system must interface to both the existing reservation system and payroll system. As the payroll system cannot currently handle formulas, our commission system will calculate both commission + payroll for each member of the sales staff. The payroll system will take this calculation as an override to what is being currently calculated.

Commission is calculated for each salesperson based on the equipment rental reservations made by that salesperson. A commission rate is associated with an equipment type. Currently, a commission of \$3.40 is paid for each reservation of the following equipment types: truck, trailer, or towing device. A commission of \$2.25 is paid for each storage room (equipment type) reservation.

Commission is calculated for each sales manager based on the team incentive. Current incentives include: \$200 for the team with the highest reservation amount/hr, \$100 for the team with the 2<sup>nd</sup> highest reservation amount/hr, and \$100 for the team with the highest reservation count/week. Commission is based on reservation and not actual sale. Any reservation not resulting in a sale is assumed not to be the fault of the salesperson and most likely due to insufficient equipment availability.

Once commission is paid, the employee cannot have the sale taken away (i.e. have the commission reversed) unless manually performed by a manager. A manager would only take away a sale if the sale were thought to be fraudulent. However, the existing reservation authorizes credit card transactions in a nightly batch run. It is in this nightly batch run that the updates to the reservation commission system will also be made. Any reservation cancelled the day it was placed, will not result in a commission for the salesperson entering the reservation. Any reservation cancelled after the day it was placed will result in a commission for the salesperson entering the reservation.

Sales managers need visibility to team performance against their incentives. Managers need to be able to generate reports based on any combination of selection: salesperson, sales team, equipment type, date range and time range.

The payroll system will receive a feed from our reservation commission system that will act as an override to the payroll currently being calculated for sales staff employees. In addition to a report, we will generate an interface file to transfer data from our reservation commission system to our payroll system. Our report will list any exceptions or errors occurring in the calculations or file transfer to ensure data integrity between the 2 modules.

The reservation commission system is populated by the nightly update of the reservation system. A report will be generated along with this nightly run to ensure data integrity between the 2 modules.

The Reservation Commission Database stores information about the employees, sales teams, equipment, reservations, commissions and team incentives of a moving equipment rental company. The Reservation Commission Database is to integrate with the existing Reservation Database and Payroll Database. The following data has been identified as necessary components of the Reservation Commission Database:

Information regarding each employee such as Employee ID, Address, Team ID, Birth Date, Hire Date, Pay Type and Pay Rate is stored in the database. Each employee may work in at most one of the company's fifty sales teams. Exactly one employee manages each sales team.

Each sales team may receive a team incentive. Information regarding the team incentive such as the Team Commission Rate, Incentive Type, Incentive Effectivity Dates and Incentive Id is stored in the database. Each sales team may receive a team incentive, although it's possible for a team to not receive a team incentive. Furthermore, a sales team may receive multiple team incentives. Historical team incentives may be stored in the database, which could result in the existence of a team incentive that is not actively being received by a team.

The database stores employee hours. The number of hours worked for each employee is recorded for each work date.

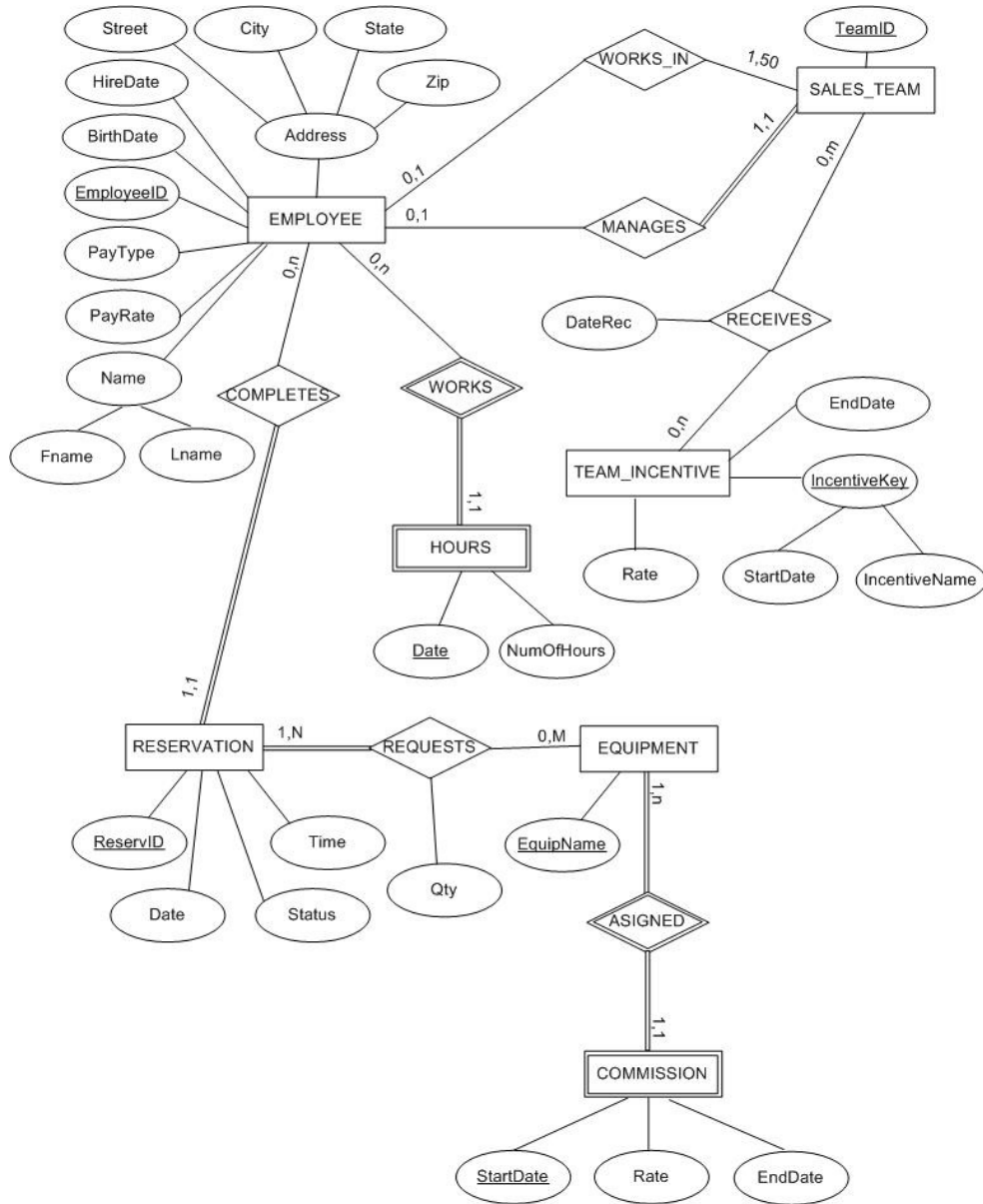
An employee may complete a reservation or may complete several reservations. It is possible for an employee to not complete any reservations. Exactly one employee, however, must complete each reservation. Information regarding the reservation such as Reservation ID, Reservation Date, Reservation Time, Reservation Status, Equipment ID, Employee ID, Commission ID and potentially Commission rate (if rate can be modified for an existing commission) must be stored for each reservation.

Each reservation must request at least one piece of equipment but may request multiple pieces of equipment. However, each piece of equipment is not necessarily on a reservation. Information regarding the equipment such as Equipment ID, Equipment Type, and Commission ID is stored for each piece of equipment.

Each piece of equipment is assigned exactly one commission. The same commission, however, may be assigned to multiple pieces of equipment. Historical commission may be stored in the database, which could result in the existence of a commission that is not active for, although still assigned to, one or more piece(s) of equipment. Information regarding the commission such as Commission ID, Commission Rate and Commission Effectivity Dates are stored in our database.

**3. ER Diagram**

The ER diagram that will serve as the basis for our database (SALESDATA) can be found below in figure 1.



**Figure 1: ER diagram of the Sales Database and Payroll System.**

#### 4. ER Diagram Uncaptured Constraints

The following is a list of constraints that are not captured by the ER diagram of COMPANY:

- EMPLOYEE.Address.State is a the postal two character abbreviation for the state
- EMPLOYEE.PayType can only have two values: “hourly wage” or “monthly salary”
- If the value of this string is “hourly wage” EMPLOYEE.PayRate would hold the hourly pay rate for that employee, and if the value of this string is “monthly salary” EMPLOYEE.PayRate would hold the monthly salary for that employee
- RESERVATION.Status can have values from this domain: {QUOTE, TENT, CONF, CANC}
- EMPLOYEE.BirthDate + 16 years <= EMPLOYEE.HireDate <= current date
- EMPLOYEE.HireDate <= RECIEVES.Date <= current date
- TEAM\_INCENTIVE.Effectivity.StartDate <= TEAM\_INCENTIVE.Effectivity.EndDate
- The start date for any new team incentive must be greater than the end date for every exiting team incentive of the same type.
- COMMISSION.Effectivity.StartDate <= COMMISSION.Effectivity.EndDate
- The start date for any new commission for a piece of equipment must be greater than the end date for every exiting commission associated with the same equipment.
- HOURS.Date >= EMPLOYEE.HireDate
- RESERVATION.Date >= current date
- EMPLOYEE.PayRate > 0
- TEAM\_INCENTIVE.Rate >= 0
- COMMISSION.Rate >= 0
- HOURS.NumOfHours >= 0
- EMPLOYEE.Address.Zip must be a five digit number
- EMPLOYEE.EmployeeID >= 0
- SALES\_TEAM.TeamID >= 0
- TEAM\_INCENTIVE.IncentiveID >= 0



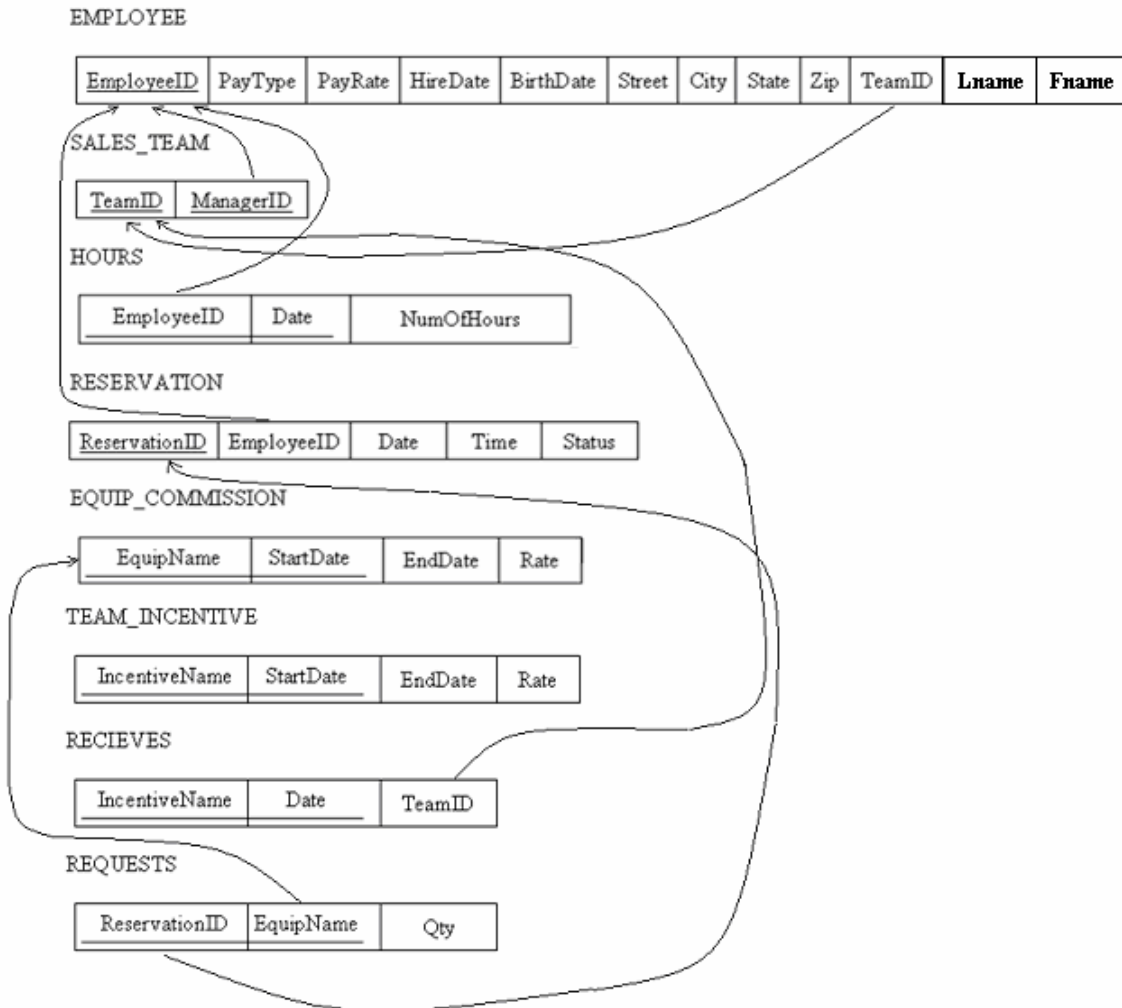
- COMMISSION.CommissionID >= 0
- EQUIPMENT.EquipmentID >= 0
- RESERVATION.reserveID >= 0
- IncentiveName and Date must be unique in RECEIVES

**5. Relational Schema**

This section provides the relational schema with referential integrity and the relational table details.

**5.1 Relational Schema with Referential Integrity (From Elmasri & Navathe, 1994)**

The relational schema with referential integrity for the SALESDATA database can be seen in the diagram below.



**Relational schema of the SALESDATA database with arrows indicating referential integrity**

## 5.2 Relational Table Details

The relational schema given in Section 5.1 was mapped into the following tables in the SALESDATA database. Primary Keys have been underlined. Tables that have multiple keys underlined have composite keys.

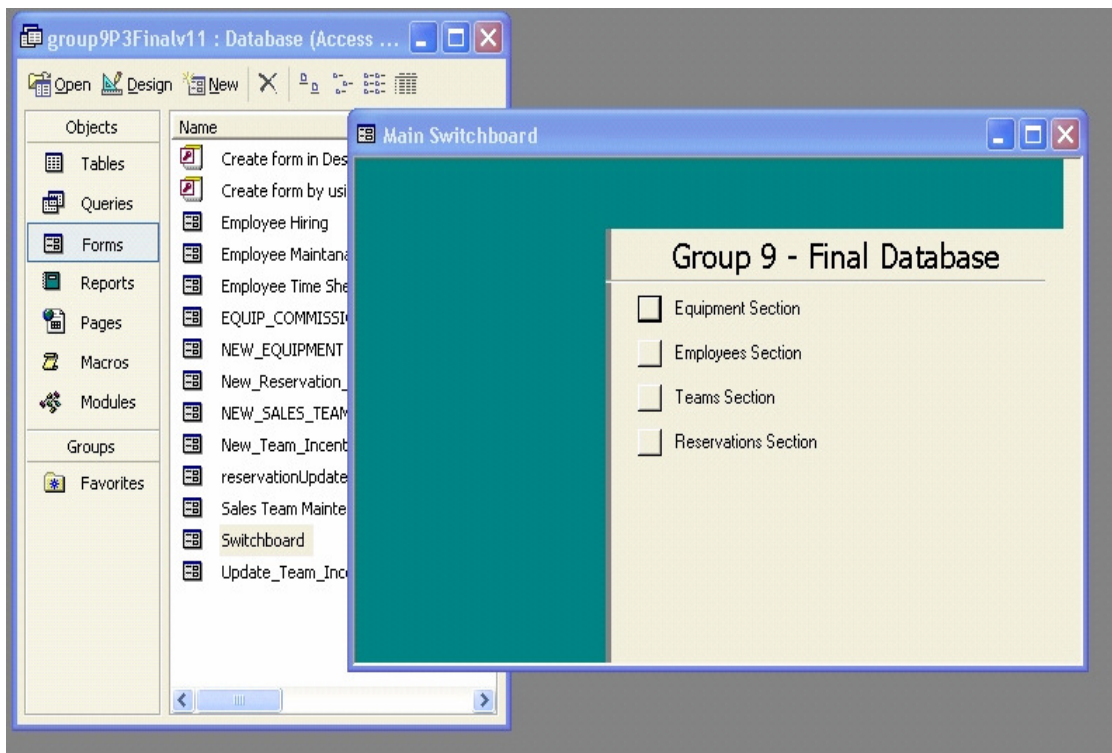
Table Name	Description	Attribute and Description
EMPLOYEE	Employee Information	<u>EmployeeID</u> – SSN of employee PayType – salary or hourly PayRate – hourly equivalent of wage HireDate – Date employee was hired BirthDate – Date employee was born Street – Street portion of address City – City of address State – State of address Zip – Zip code of address TeamID – Refers to TeamID in SALES_TEAM LName – Last name of employee FName – First name of employee
SALES_TEAM	Sales Team Declaration	<u>TeamID</u> – Identification number of team ManagerID – SSN of manager that manages the team
HOURS	Declaration of Hours Worked by Hourly Employees	<u>EmployeeID</u> – SSN of employee <u>Date</u> – Date employee worked NumOfHours – Number of hours worked by the employee that date
RESERVATION	Reservation Information	<u>ReservationID</u> – Unique number issued for the reservation <u>EmployeeID</u> – SSN of employee that took the reservation <u>Date</u> – Date the reservation was taken <u>Time</u> – Time the reservation was taken Status – quote, tent, conf to declare current status
EQUIP_COMMISSION	Bonus Declarations for Equipment	<u>EquipName</u> – Type of equipment the bonus applies to {truck, trailer, towing, storage} <u>StartDate</u> – Effective date for this commission rate <u>EndDate</u> – Ending date for this

		commission rate Rate – Amount to be paid for reservations of this type
TEAM_INCENTIVE	Bonus Declarations for Team Bonuses for Managers	<u>IncentiveName</u> – Bonus category <u>StartDate</u> – Effective date for this commission rate <u>EndDate</u> – Ending date for this commission rate Rate – Amount to be paid for this category of incentive
RECEIVES	Stores Information on Team Bonus	<u>IncentiveName</u> – Bonus category <u>Date</u> – Date that team earned bonus <u>TeamID</u> – Team that earned bonus
REQUESTS	Reservations must Request Equipment to Allow Multiple Types of Equipment on Reservations	<u>ReservationID</u> – Reservation requesting equipment <u>EquipName</u> – Type of equipment requested for the reservation Qty – Number of pieces of this type of equipment

## 6. Transaction Processing Needs

Section 6.1 describes the main switchboard which provides access to the Company Database application. Sections 6.2-6.4 describe the details of each form, report and query.

### 6.1. Main Switchboard



**Figure 4 Main Switchboard of SALESDATA.**

The switchboard permits the user to navigate the database to the Equipment, Employee, Teams and Reservations sections. The Equipment section permits the user to alter bonuses and commissions associated with the equipment available for rental. The Employee section allows the user to add new employees, alter an employee's status and access reports related to employees' pay and commissions. The Teams section permits the alteration or creation of new sales teams and retrieval of team bonus reports. The Reservations section permits the user to add or change reservations for equipment.

## 6.2 Forms

The following table summarizes the forms within the SALESDATA Database.

Form Name and Description	Relations Accessed	Explicit Constraints Checked
<b>New Sales Team</b> When a new sales team is formed a unique team ID is created and the team's manager and employees assigned.	<ul style="list-style-type: none"> <li>• Sales_Team (Insert)</li> <li>• Employee</li> </ul>	<ul style="list-style-type: none"> <li>• Employee Count &lt;= 50</li> <li>• TeamID &gt;= 0</li> <li>• Assigned Manager Count = 1</li> </ul>
<b>Sales Team Maintenance</b> This form is used to update the information for a sales team that is already in the database. This may include changes such as employee additions/deletions, a change in the assigned manager or dissolution of the team.	<ul style="list-style-type: none"> <li>• Sales_Team (update)</li> <li>• Employee</li> </ul>	<ul style="list-style-type: none"> <li>• Employee Count &lt;= 50</li> <li>• TeamID &gt;= 0</li> <li>• Assigned Manager Count = 1</li> </ul>
<b>Employee Hiring</b> When an employee is first hired, his or her information is entered on this form and that employee is given an ID.	<ul style="list-style-type: none"> <li>• Employee (Insert)</li> </ul>	<ul style="list-style-type: none"> <li>• Pay rage &gt;= 0</li> <li>• Birth date + 16 years &lt;= hire date &lt;= current date</li> <li>• Zip has to be a 5 digit number</li> <li>• State has to be a 2 character string</li> </ul>
<b>Employee Time Sheet</b> Employees use this form to log the number of hours they have worked	<ul style="list-style-type: none"> <li>• Hours (Insert)</li> </ul>	<ul style="list-style-type: none"> <li>• Date &gt;= current date</li> <li>• Number of hours &gt;= 0</li> </ul>
<b>Employee Maintenance</b> This form is used to update the information for an employee that is already in the database	<ul style="list-style-type: none"> <li>• Employee (update)</li> </ul>	<ul style="list-style-type: none"> <li>• Same as employee hiring</li> </ul>
<b>New Team Incentive</b> This form allows for the creation of a new team incentive. A unique incentive ID is required for the new incentive.	<ul style="list-style-type: none"> <li>• Team_Incentive (Insert)</li> </ul>	<ul style="list-style-type: none"> <li>• Start date &lt;= End Date</li> <li>• Rate &gt;= 0</li> </ul>
<b>Team Incentive Update</b> This form allows for information such as rate, start and end dates on an existing incentive to be updated.	<ul style="list-style-type: none"> <li>• Team_Incentive (Update)</li> </ul>	<ul style="list-style-type: none"> <li>• Start date &lt;= End Date</li> <li>• Rate &gt;= 0</li> <li>• Team Incentive ID cannot be changed</li> </ul>
<b>New Equipment</b> This form shall allow new equipment commissions to be entered in the system.	<ul style="list-style-type: none"> <li>• Equip_Commission</li> </ul>	<ul style="list-style-type: none"> <li>• EquipName, Date must form a candidate key</li> <li>• Cannot modify existing data</li> </ul>

<p><b>Equipment Commission</b> This form would allow updates to commissions on pre-existing equipment. This form also will enable users to delete a commission from the table.</p>	<ul style="list-style-type: none"> <li>• Equip_Commission</li> </ul>	<ul style="list-style-type: none"> <li>• EquipName, StartDate must continue to form a candidate key</li> <li>• Cannot add records only modify StartDate, EndDate and/or Rate</li> </ul>
<p><b>New Reservation</b> When equipment is reserved by person first time, its information is entered on this form and a unique reservation ID is given to person. This form allows for the creation of a new reservation.</p>	<ul style="list-style-type: none"> <li>• Reservation (Insert)</li> </ul>	<ul style="list-style-type: none"> <li>• ReserveID &gt;= 0</li> <li>• Reservation Date &gt;= current date</li> <li>• Reservation Status can have values from this domain: {QUOTE, TENT, CONF, CANC}</li> </ul>
<p><b>Reservation Update</b> This form allows for information such as date, time and status on an existing reservation to be updated.</p>	<ul style="list-style-type: none"> <li>• Reservation (Update)</li> </ul>	<ul style="list-style-type: none"> <li>• ReserveID &gt;= 0</li> <li>• Reservation Date &gt;= current date</li> <li>• Reservation ID cannot be changed</li> </ul>

### 6.3 Reports

The following table summarizes the reports in the SALESDATA Database.

Report Name	Description	Relations Accessed
Contest Results	Can calculate employees with most 'CONF' reservations in a user specified date range.	<ul style="list-style-type: none"> <li>• Sales_Team</li> <li>• Reservation</li> <li>• Equipment</li> </ul>
Weekly team bonus	Gives a list of the managers and the bonuses (team incentives) that their teams received within the last week	<ul style="list-style-type: none"> <li>• Query: bonuses within past seven days</li> </ul>
Payroll	Each Monday a report is necessary to give payroll the information they need to compute the weekly payroll. This report contains employee id, and payroll amount for the week (starting date supplied by user).	<ul style="list-style-type: none"> <li>• Employee</li> <li>• Hours</li> <li>• Reservation</li> <li>• Requests</li> <li>• Equip Commission</li> <li>• Receives</li> <li>• Team Incentive</li> </ul>
Weekly Sales Commission	Each Monday a report is generated showing the bonuses achieved by all of the sales people.	<ul style="list-style-type: none"> <li>• Employee</li> <li>• Reservation</li> <li>• Requests</li> <li>• Equip_Commission</li> </ul>
Week to Date	Each day every manager will need a report that displays the week to date sales statistics. Each manager will submit the fields they want on their particular report. Some common statistics include confirmed reservations per hour, total confirmed reservations, total tentative reservations, hours worked, total number storage reservations and tentative reservations per hour.	<ul style="list-style-type: none"> <li>• Employee</li> <li>• Reservation</li> <li>• Requests</li> <li>• Equip Commission</li> <li>• Team Incentive</li> </ul>



## 6.4 Queries

This table summarizes all the queries within the SALESDATA Database.

Query Name	Description	Output	Relations Accessed
Yesterday's Reservations	Returns the names of the employees that made reservations the prior day and the number of reservations they made.	<ul style="list-style-type: none"> <li>Employee's names</li> <li>Reservation count</li> </ul>	<ul style="list-style-type: none"> <li>Reservation</li> <li>Employee</li> </ul>
Reservations by a Person	Returns the reservation ID of all reservations taken by a particular employee.	<ul style="list-style-type: none"> <li>ReservID</li> <li>Employee name</li> <li>EmployeeID</li> </ul>	<ul style="list-style-type: none"> <li>Employee</li> <li>Reservation</li> </ul>
Sales Team Bonus	A parameterized query which gives the team incentives that have been earned during a certain period	<ul style="list-style-type: none"> <li>Incentive Name</li> <li>Date Recieved</li> <li>Incentive Rate</li> </ul>	<ul style="list-style-type: none"> <li>Recieves</li> <li>Team_Incentive</li> </ul>
Top Team Search	Gives the teams that have received the incentive for the most reservations in a week within the past 4 weeks.	<ul style="list-style-type: none"> <li>Team ID</li> <li>Week</li> <li>Manager name</li> <li>Number of reservations</li> </ul>	<ul style="list-style-type: none"> <li>Max number of reservations per week</li> <li>Sales team</li> <li>Employee</li> </ul>
Manager Of	For each employee, retrieve the employee's first name and last name and the first and last name of his or her manager	<ul style="list-style-type: none"> <li>Employee first name</li> <li>Employee last name</li> <li>Manager first name</li> <li>Manager last name</li> </ul>	<u>Relations</u> <ul style="list-style-type: none"> <li>Employee</li> <li>Sales Team</li> </ul> <u>Constraints</u> Employee ID <> Manager ID
Sales Person List	Retrieve the first and last name of all the sales people currently employed	<ul style="list-style-type: none"> <li>Employee first name</li> <li>Employee last name</li> </ul>	<u>Relations</u> <ul style="list-style-type: none"> <li>Employee</li> </ul> <u>Constraints</u> TeamID > 0
Salaried Employees	Retrieve the first and last name of all the employees that are paid a salary	<ul style="list-style-type: none"> <li>Employee first name</li> <li>Employee last name</li> </ul>	<u>Relations</u> <ul style="list-style-type: none"> <li>Employee</li> </ul> <u>Constraints</u> PayType = 'S'
Team Reservations	Retrieves the number of reservations made by a certain team.	<ul style="list-style-type: none"> <li>TeamID</li> <li>Count of CONF reservations</li> </ul>	<ul style="list-style-type: none"> <li>Employee</li> <li>Reservation</li> </ul>
Storage Reservations	Lists the name of the person that made each storage reservation	<ul style="list-style-type: none"> <li>Employee first name</li> <li>Employee last name</li> <li>Count of storage reservations</li> </ul>	<ul style="list-style-type: none"> <li>Employee</li> <li>Reservation</li> </ul>
Potential Carpools	Retrieve the name and addresses of other employees	<ul style="list-style-type: none"> <li>Employee first name</li> </ul>	<u>Relations</u> <ul style="list-style-type: none"> <li>Employee</li> </ul>

	that have the same zip code	<ul style="list-style-type: none"> <li>• Employee last name</li> <li>• Employee address with same zip code</li> </ul>	<u>Constraints</u> <ul style="list-style-type: none"> <li>• Employee Address Zip = 5 digit number</li> </ul>
Hours Worked	Lists the number of hours that each employee has worked over a specified period.	<ul style="list-style-type: none"> <li>• Employee first name</li> <li>• Employee last name With number of hours</li> </ul>	<u>Relations</u> <ul style="list-style-type: none"> <li>• Employee</li> <li>• Hours</li> </ul> <u>Constraints</u> <ul style="list-style-type: none"> <li>• NumofHours &gt;= 0</li> </ul>
Number of Reservations by team and date	Gives the number of Reservations completed by each team on each day for which that team had any reservations.	<ul style="list-style-type: none"> <li>• Team ID</li> <li>• Date</li> <li>• Count of reservations</li> </ul>	<ul style="list-style-type: none"> <li>• Employee</li> <li>• Reservation</li> </ul>
Number of Reservations by team and week	Gives the number of reservations completed by each team in each of the past 4 weeks, for which that team had any reservations	<ul style="list-style-type: none"> <li>• Team ID</li> <li>• Week</li> <li>• Count</li> </ul>	<ul style="list-style-type: none"> <li>• Number of Reservations by team and date</li> </ul>
Max Number of Reservations per Week	Gives the maximum number of reservations that any team has completed within each of the past 4 weeks for which there have been any reservations	<ul style="list-style-type: none"> <li>• Week</li> <li>• Count</li> </ul>	<ul style="list-style-type: none"> <li>• Number of Reservations by team and week</li> </ul>
Bonuses within past 7 days	Gives the incentives that each manager's team had received within the past 7 days	<ul style="list-style-type: none"> <li>• Manager Id</li> <li>• First Name</li> <li>• Last Name</li> <li>• Team ID</li> <li>• Date</li> <li>• Incentive name</li> <li>• Rate</li> </ul>	<ul style="list-style-type: none"> <li>• Employee</li> <li>• Sales team</li> <li>• Team Incentive</li> <li>• Recieves</li> </ul>

**7. Functional Dependencies**

The following is the set of functional dependencies (FD's) of SALESDATA.

F = {FD1: EmployeeID → PayType, PayRate, HireDate, BirthDate, Street, City, State, Zip,  
TeamID

FD2: TeamID → ManagerID

FD3: EmployeeID, Date → NumOfHours

FD4: ReservationID → EmployeeID, Date, Time, Status

FD5: EquipName, StartDate → EndDate, Rate

FD6: IncentiveName, StartDate → EndDate, Rate

FD7: IncentiveName, Date → TeamID

FD8: ReservationID, EquipName → Qty

FD9: ManagerID → TeamID }

<b>8. Normal Form of Relations with Justification</b>
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The table below shows the normal form of all SALESDATA relations together with justification.

<b>Relation</b>	<b>Highest Normal Form</b>	<b>Justification</b>
EMPLOYEE	BCNF	FD1: EmployeeID is a superkey
SALES_TEAM	BCNF	FD2: TeamID is a superkey
HOURS	BCNF	FD3: EmployeeID, Date together is a superkey
RESERVATION	BCNF	FD4: ReservationID is a superkey
EQUIP_COMMISSION	BCNF	FD5: EquipName, StartDate together is a superkey
TEAM_INCENTIVE	BCNF	FD6: IncentiveName, StartDate together is a superkey
RECEIVES	BCNF	FD7: IncentiveName, Date together is a superkey
REQUESTS	BCNF	FD8: ReservationID, EquipName together is a superkey

**Normal Forms of Relations with Justification.**

**9. Verification of Lossless Join Property**

This section presents the test for lossless join property of SALESDATA’s decomposition. Applying ALGORITHM 13.2 of Elmasri & Navathe, Fundamentals of Database Systems, to SALESDATA’s decomposition:

- R1: EMPLOYEE
- R2: SALES\_TEAM
- R3: HOURS
- R4: RESERVATION
- R5: EQUIP\_COMMISSION
- R6: TEAM\_INCENTIVE
- R7: RECEIVES
- R8: REQUESTS

Original matrix S at start of algorithm.

	EmployeeID	PayType	PayRate	HireDate	BirthDate	Street	City	State	Zip	TeamID	LName	FName	Date	NumofHours
R1:	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A28		
R2:	A1									A10				
R3:	A1												A12	A13
R4:	A1													
R5:														
R6:														
R7:										A10				
R8:														

	Reservati onID	Date	Time	Status	Equip Name	StartDate	EndDate	Rate	IncentiveName	StartDate	EndDate	Rate	Date	Qty
R1:														
R2:														
R3:														
R4:	A14	A15	A16	A17										
R5:					A18	A19	A20	A21						
R6:									A22	A23	A24	A25		
R7:									A22				A26	
R8:	A14				A18									A27

After applying FD's in the order from FD1 to FD11, a stopping case has been obtained.

Final matrix S.

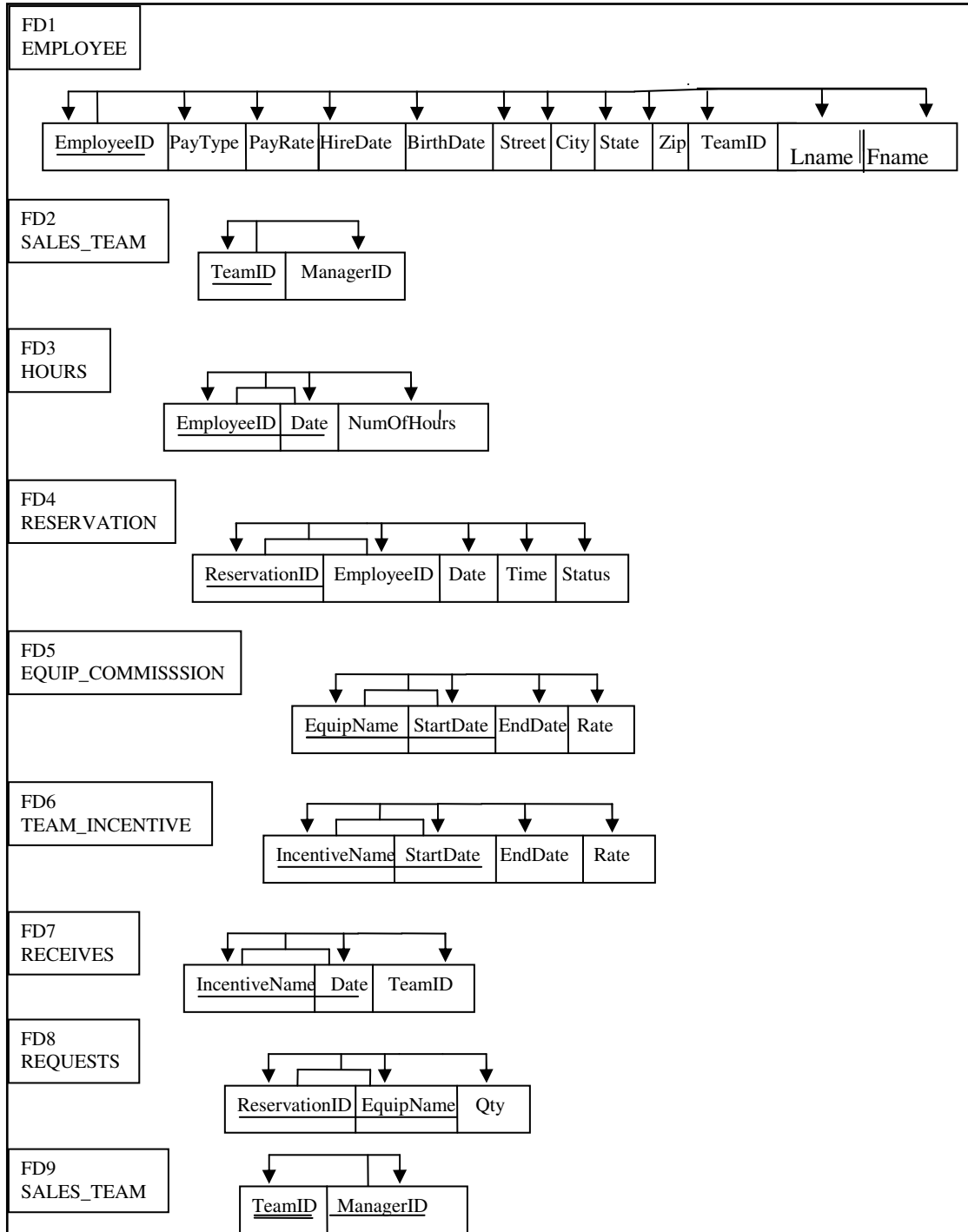
	EmployeeID	PayType	PayRate	HireDate	BirthDate	Street	City	State	Zip	TeamID	LName	FName	Date	NumofHours
R1:	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A28	A12	A13
R2:	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A28	A12	A13
R3:	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A28	A12	A13
R4:	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A28	A12	A13
R5:														
R6:														
R7:	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A28	A12	A13
R8:														

	ReservationID	Date	Time	Status	Equip Name	StartDate	EndDate	Rate	IncentiveName	StartDate	EndDate	Rate	Date	Qty
R1:	A14	A15	A16	A17										
R2:	A14	A15	A16	A17										
R3:	A14	A15	A16	A17										
R4:	A14	A15	A16	A17										
R5:	A14	A15	A16	A17	A18	A19	A20	A21						A27
R6:									A22	A23	A24	A25	A26	
R7:	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27
R8:	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27

Since there are at least one rows that are all a's, row 7, then we can stop and have proven that the lossless join property has been preserved in our decomposition of the system.

**10. Dependency Preservation**

From the schema and the key of each relation chosen, FD1, FD2, FD3, FD4, FD5, FD6, FD7, FD8 and FD9 are preserved in the schema.



**Function dependencies preserved in Rental Equipment Database schema.**