1 Purpose of the Project
Analyze, specify, design, implement, document and demonstrate an information system application to support the operation of a new rail pass system for the Atlanta commuter rail network. You are required to use the Classical Methodology for Database Development. The system must be implemented on ORACLE available on ACME. The professor must approve other alternative implementations.

2 Project Phases
The three phases of the project cover the following work-processes from the Classical Methodology for Database Development.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>February 15</td>
</tr>
<tr>
<td>II</td>
<td>March 17</td>
</tr>
<tr>
<td>III</td>
<td>April 21</td>
</tr>
</tbody>
</table>

3 Groups
Projects with Lightweight phase III may have 3 or 4 members.
Projects with JDBC/Java GUI may have 3 or 4 members.

A group may remove a member from further participation in the group when Phase I is turned in or when Phase II is turned in. A written notification must be provided to the professor at that time.

4 Reports
A typed report is handed in for grading at the end of each phase.

The Phase I Report must contain a description of the purpose of the project and the purpose of this phase of the project. It must describe the problems encountered in the technical requirements of this phase and justify the solutions. It must contain all documentation produced in this phase, including Information Flow Diagrams, E-R Diagrams, and a high level description of how the tasks described in the project description will be supported by the database.

The Phase II Report must contain a description of the purpose of this phase of the project. It must contain the Phase I Report and must describe any revisions made to the specification described in

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1 This project is not actually affiliated with the Metropolitan Atlanta Rapid Transit Authority (MARTA), or any proposed changes to its rail network or fare structure.
the Phase I Report. It must further describe the problems encountered in Phase II and justify the solutions. It must contain all documentation produced in Phase II with the addition of a relational schema, and abstract code with SQL (for each task). The relational schema specification should include integrity constraints, foreign keys, primary keys, and domain constraints.

The Phase III Report must contain a description of the purpose of this phase of the project. It must contain the Phase I and Phase II Reports and must describe any revisions made to the specification described in the Phase II Report. It must describe the problems encountered in this Phase III and justify the solutions. It must contain all documentation produced in Phase III, including the schema definition, a source program listing (well documented), and a short description on your decision on creating indexes (see note on “Task Statistics at the end). It must contain a brief users’ manual for the system. Also, the specific contribution of each member must be indicated for all phases of the project.

5 Grading
The project will consist of three phases (deliverables) as well as a final demonstration to the TA. Phase I and Phase II of the project are each worth 10% credit. Credit for phase III depends on the implementation option you choose:

GUI/JDBC Phase III Option (20% credit): We will use the embedded SQL feature of ORACLE, called JDBC, which allows us to embed SQL statements in a Java program.

Lightweight SQLPLUS Phase III Option (5% credit): We will use the SQLPLUS feature of ORACLE, which allows us to execute SQL statements.

6 Overview of Project
The city of Atlanta has designed a new fare system that it hopes will encourage more frequent travel on its rail networks. Designed around the concept of zone travel, fares would vary with the distance traveled. Instead of the current fixed rate system, passengers traveling only locally within a single zone would pay less than passengers traveling from the perimeter to downtown or across it. The proposed zone system (seen in Figure 1), would split the rail system into 5 zones, corresponding to North, East, West, South, and Downtown (or Red, Green, Purple, Yellow, Blue). Travel that starts and ends within the same zone would be the least expensive. Then with each zone boundary crossed, the price would increase. Although the exact fares have yet to be determined, let us assume in the initial implementation a price of $1 for travel within the same zone, and $1 extra for each zone boundary crossed up to a maximum of $3. Because of the
design of the rail system, no two stations are more than 2 zone boundaries apart from each other.

As part of the same system redesign, the city of Atlanta is also hoping to simplify the purchase of rail passes by allowing customers to use their home computer (and a credit card) to purchase and print up a rail pass with a value of their own choosing. That pass will then be scanned by a barcode reader before the customer enters the station, and again when they leave the station to determine the distance traveled and the amount of money to deduct from the rail pass. The same passes may also be purchased from a ticket booth using cash. Your job, as part of this fare system redesign, is to develop the information management system that would support the purchase (online and over the counter) and use of passes for riding the rail system. It is assumed that another company is responsible for developing the barcode system, both the scanning hardware and barcode generating software, so you will not be responsible for generating any barcodes at this time.

The “Rail Pass” service will have 3 types of users, passengers, ticket clerks, and system administrator. Passengers include everyone interested in purchasing tickets using the online system. Ticket clerks are employees of the rail network that able to sell tickets, check in/out passengers, and try to handle in problems in the event of hardware error. System administrators are responsible for issuing announcements to the public through the website and monitoring system usage.

In the rest of this document, we will first describe the interface for each user type, followed by aspects of the system as a whole.

## 7 Passengers

Interested passengers log in to the online system through the interface in Figure 2. If the passengers already have a username and password, they enter those values and select enter. If the passenger does not yet have a username and password, then they may select the create profile button from the login interface to setup a new account with the system.

If the passenger already exists and has the correct username and password, or if a profile was created successfully, then he/she is logged into the system and presented with the “Passenger Main Menu” interface. (see Figure 3).

### 7.1 Create Profile

When “Create Profile” is selected from the login screen, the interface seen in Figure 4 is brought forward. The system requests from the passenger a desired username, password, contact email address, credit card type and number, credit card expiration date, first and last name on the credit card, and

![Figure 2. Log-in screen for passengers.](image)
address for the credit card. When they have finished entering all the information, the passenger selects “Create” at the bottom of the screen to create the system, and log in to the Rail Pass System.
The system should throw an error if any of the following conditions occur: information is missing from the profile, the password and re-typed password do not match, and/or the username has already been taken. It is acceptable for more than one username to be associated with the same email address. In the event of an error, an appropriate error message should be displayed, and then after a suitably long interval the login interface should be reloaded.

7.2 Buy Rail Pass

When the “Buy Rail Pass” option is selected from the main menu, the interface seen in Figure 5 is presented to the passenger. In this interface the passenger has the option of purchasing 2 different types of rail passes. The first type of rail pass is the regular rail pass. The regular rail pass is created like a customer account that is decremented every time a customer exits a rail station. To buy a regular rail pass, the customer enters the desired dollar amount they wish to put on the pass and selects “Buy Regular Pass”.

The second type of pass is a monthly pass. The monthly pass has a single set rate, allowing customers unlimited travel across all zones until it expires at midnight on the
same day of the following month. To buy a monthly rail pass, the passenger selects “Buy Monthly Pass” from the interface.

After either selecting “Buy Regular Pass” or “Buy Monthly Pass”, a confirmation screen (Figure 6 [Left]) is displayed. The confirmation screen should show the total dollar amount being paid (i.e. price entered by the user for the regular pass, or price of monthly pass) and the credit card information used to make the transaction including: name, address, credit card type, card number, and expiration date. If the passenger selects “Cancel” from this screen, the transaction should be discarded and the main menu is reloaded. Otherwise, if the passenger selects “Purchase”, then the transaction is completed and a rail pass is printed with a unique 12-digit Ticket ID# (Figure 6 [Right]).

7.2.1 Add Money to Existing Pass

The “Add Money to Existing Pass” option from the “Buy Rail Pass” interface allows a passenger to add money to an existing rail pass, rather than buying a new one. It is expected to be useful in the event that a passenger has to travel more than expected, and needs to add value to a rail pass that already has money but not enough to complete the trip. To add money to a rail pass, the passenger enters the desired additional money to put on their pass (see Figure 5) and the unique id of their rail pass, and selects “Enter”. This will bring up the confirmation and rail pass screens (Figure 6).

When adding money to a rail pass, for the rail pass screen (Figure 6 [Right]), change the rail pass type to “Money Added”, list the amount of money added for “Purchase Price”, and keep the ticket ID# the same as was entered into Figure 5.

7.3 Rail News

To keep passengers informed of schedule changes, station closings, or any other important information that might affect passengers traveling the rail network, rail network managers want to make news information available to passengers buying rail passes. By selecting “Rail News” from the main screen, a passenger can search for news relevant to a particular zone and/or general announcements (i.e. all zones) using the interface displayed in Figure 7 [Left].

Using this interface, a passenger selects the zone of interest (or all zones) and a date range over which their travel might occur. Selecting “search” will then bring up results similar to those seen in Figure 7 [Right]. General announcements that will affect all rail travel (i.e. is not zone specific) are displayed first, followed by all other announcements sorted by starting date, and ending date. Selecting “Cancel” from Figure 7 [Left] will return the passenger to the main menu.

7.4 View Transaction History

By pressing “View Transaction History” from the main menu, a passenger may view their history at the online service. The passenger selects the date range over which they would like to view their history of all rail passes they purchased during that time period. Rail passes are displayed for the passenger in reverse order, sorted by original
purchase date (i.e. June 2005 is displayed before June 2004). For each rail pass, list the following information:

- Type of Pass (Monthly or Regular)
- Purchase Date
- Cost (Original Purchase Price + All Added Money)
- Number of Completed Trips by Rail on that pass
- Money Remaining on Pass (0 or N/A for Monthly)

Note that “Add Money” transactions should not be listed separately from purchased passes. So with this task, each pass should only be listed once with the total amount of money put on the pass.

7.5 Update Information

Selecting this option from the main menu brings up an interface similar to Figure 3, except with the values already filled in with the passengers information. However, passengers cannot change their username this feature. All other fields can be changed by simply altering the information in the text boxes and selecting “Re-Submit Information” from the bottom of the interface. As with creating profiles, mismatched passwords and missing information should generate an appropriate error message and not update the database.

8 Ticket Clerk

Ticket clerks associated with the Atlanta Rail Pass service are employees of the company controlling the rail network. They will be physically located within each station, and are responsible for cash transactions (as opposed to credit cards) and checking passenger’s in/out. Ticket clerks log in to the system using a separate interface from passengers,
which requests an 8-digit employee id number and password (Figure 8). After successfully logging in, a Ticket Clerk is presented with the Ticket Clerk Main Menu interface (Figure 9).

### 8.1 Buy Rail Pass

Some customers will want or need to pay with cash at the station, so ticket clerks are responsible for generating their rail passes. The “Buy Rail Pass” option from the Ticket Clerk main menu is the same as “Buy Rail Pass” for passengers, except that the credit card confirmation screen is skipped for cash transactions. Otherwise, passengers paying in cash can still purchase regular or monthly passes, and add money to existing rail passes.

### 8.2 Check In Passenger

To begin their travel by rail a passenger must first present their rail pass to the ticket clerk to check in. A Ticket Clerk checks the passenger in by selecting “Check In” from the Ticket Clerk main menu, and then entering rail pass unique ID, and starting Zone into the interface seen in Figure 11 [Left]. The check-in process is completed when the clerk selects “Check-In”. Any of the following conditions, however, should generate an error:

- Ticket Unique ID is invalid
- The pass is a regular rail pass and does not have enough money remaining on the pass for travel within that zone.
- The pass is an expired monthly rail pass.
- The rail pass has an incomplete trip on it (i.e. the owner has checked in before without checking out).

If the ticket unique id is valid, and the rail pass is either a valid monthly pass, or has at least enough money remaining on the pass for travel within that zone, then the check-in process should be completed without error when the ticket clerk selects “Check-In”. If, however, those conditions are not met then an appropriate error message should be generated.

### 8.3 Check Out Passenger

A passenger’s travel is completed when they check out of a rail station by presenting their ticket to a ticket clerk. A ticket clerk checks out a passenger by selecting “Check Out” from the Ticket Clerk main menu, and then entering the rail pass unique ticket ID number and ending zone into the interface seen in Figure 10 [Right]. The clerk
completes the process by selecting “Check-Out”. If the pass is a regular pass, then this process should also subtract the appropriate fare from the money available on the pass. The appropriate fare is determined by the starting zone (at Check-In) and the ending zone (at Check-Out). Any of the following conditions should generate an appropriate error message at check-out:

- Ticket Unique ID is invalid
- The pass is a regular rail pass and does not have enough money remaining on the pass to pay the fare.
- The pass is an expired monthly rail pass.
- There is no starting zone listed for that pass (i.e. the owner never checked in).

Once the barcode reader hardware and software has been installed, both the check-in and check-out process will be also handled by barcode scanners independent of a human ticket clerk to streamline the flow of passengers into and out of the stations.

8.4 View Pass History

In the event of hardware error (i.e. the barcode scanners failed or the automatic gates did not open), then a human ticket clerk needs to take appropriate action. To know what action to take, the ticket clerk needs to know the latest status of the rail pass. Was the passenger already checked-in or out? And was the rail pass deducted appropriately. By selecting “View Pass History”, the ticket clerk can view the history of an individual rail pass. Just by entering the Ticket unique ID, a ticket clerk can view all check-ins and check-outs (with fare cost), sorted in reverse order by date, as well as the pass type, money remaining, and original purchase date (not including when more money was added). An example pass history is shown in Figure 11.

9 System Administrator

The system administrator is another employee of the company in charge of the rail network, responsible for posting news to the website, and tracking general of the rail pass system. They log in to the system using the same interface as ticket clerks, but select “System Administrator” instead of ticket clerk. Once they have logged in, they are given a menu with the options to:
1. Post Rail News
2. Report 1: Rail Network Usage
3. Report 2: Online Pass System Usage

9.1 Post Rail News

Only the system administrator is allowed to post messages directly to the rail news section of the website. To post news, the administrator selects “Post News” from the administrator main menu, bringing up the interface requesting the relevant zone, date range, and text of the message to be posted to the web. Instead of selecting an individual zone, the administrator may also choose general announcement, in which case it is zone specific. As soon as the system administrator selects “Post Message”, the news should be made available to interested passengers using the “Rail News” task.

9.2 Reports

To keep track of how the rail pass system is being used, system administrators will generate 2 reports on a monthly basis. The first report examines regular rail network usage. For each zone over the last month, the report should list:

- The total number of local train rides taken (i.e. starting and ending in the zone).
- The total number of inter-zone train rides starting or ending in the zone
- The total number of rides taken to, from, or within the zone.

The final report should order the zones by total number of rides, with that zone with the highest activity occurring first.

The second report examines looks at online purchasing, so that the rail network company can more accurately target zones with advertising dollars. To generate the report, the system should identify those passengers who, over the last month, rode the rail system the most (i.e. number of train rides) using passes purchased online. Then list the top 100 passengers, printing for each passenger:

- The total dollar amount spent on rail passes through the website.
- The total number of train rides taken
- The zone that the passenger started from or exited from the most
- The zone that the passenger started from or exited from the second most.

The resulting list should be grouped by most frequented zone, and then second most frequented zone.
10 General Comments

- Assume that news announcements can be associated with at most one zone.
- Passenger email addresses are not necessarily unique, but login names are unique.
- You do not have to worry about any station names or details. The zone map (Figure 1) alone is needed to determine fare prices.
- If a problem is identified with the hardware, we will assume that ticket clerks can handle it by either issuing a new rail pass or letting the customer through an open gate. The resulting effects on rail statistics are considered insignificant.

11 Project Statistics

- Roughly 100,000 riders take the Atlanta rail network every day
- The company hopes to see roughly 1/3 of those passengers adopt the online purchasing system over the next 5 years.
- Under the new fare system, its expected that roughly 1/3 of the total passengers will use the monthly passes vs the regular pass.
- There are 38 stations in the Atlanta rail systems, with each employing 3-5 full time ticket clerks.