A Database Design Case: Teton Whitewater Kayak

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ABSTRACT

The Teton Whitewater Kayak case is designed to provide students with a challenging hands-on exercise in relational database design. It is extensive enough to provide a stimulating exercise, but not so large as to be overwhelming. This case can be utilized for a group project in a database management or database design course. The case is sufficiently detailed to challenge students as they apply the design concepts explained in class to a problem that closely simulates a real-world problem. An associated project can be broken into deliverables, or individual components that cover a single task, to make the project more manageable. Some of the suggested deliverables associated with this project include the design of entity-relationship diagrams, normalization of the database schema, table creation, SQL query design, form and report design, and stored procedure and trigger design. The problem was designed to be extensible. For example, while it does into include credit card processing or selling equipment on consignment, those features can be easily added to make the case more complex. The case can even be extended for use in an analysis and design class, as the services provided by the company are presented as a set of processes that can be easily represented in a data flow diagram.

Keywords: Database design, database management, normalization, entity-relationship diagrams, case.

1. CASE SUMMARY

Teton Whitewater Kayak in Jackson Hole, Wyoming rents a variety of equipment to enable outdoor enthusiasts to enjoy the diverse waters of Grand Teton National Park, Yellowstone National Park, and Jackson Hole. Based in Jackson Hole, in the shadow of the Teton Mountains, they are specialists in the field of outdoor recreation. They have the latest model canoes, whitewater kayaks, touring kayaks, and inflatables, as well as all the necessary accessories to get their clientele on the water. Their top of the line boats and equipment are available to rent by the day or by the week.

Because they set high goals and standards for their company, they are concerned in improving their customer service and equipment rental system. They have requested a rental database that supports the core business requirements of the enterprise.

Based on your knowledge of database design, you know that you will first need to develop an entity-relationship diagram that models the system. Using the entities, relationships, and attributes that make up the E-R diagram, you will next determine and specify the relational schema for each relation. You will then normalize each relation. Once normalization is complete, other features can be developed based on the resulting implementation.

Since various types of watercraft are available, the term "equipment" may be used to represent all types.

2. CASE TEXT

Teton Whitewater Kayak (TWK) provides standard equipment rental services for customers:

- Customer submits equipment reservation
- Customer rents equipment
- Customer returns rented equipment
- Customer purchases used equipment

TWK needs additional "back office" services to support business requirements:
- Print rental agreement (report)
- Print unreturned equipment list (report)
- Reclassify excess equipment as sale item
- Print equipment rental report
- Print equipment sales report
- Order new equipment
- Process new inventory
- Print current inventory list

2.1 Processing Descriptions
The TWK computer system makes use of barcodes to record information. Each piece of equipment is assigned a unique ID for inventory control.

2.1.1 Customer Submits Equipment Reservation: In order to rent equipment on a certain date, a customer can submit a reservation. When a reservation request is received, an employee must perform the following tasks:

1. Employee checks to see if customer has rented equipment before.
   a. If they have, then the database is checked to be sure that prior rentals were returned on time and undamaged.
   b. If they have not, then the personal information is added to the customer list.
      - name
      - address (include city, state, zip)
      - telephone
      - e-mail address
2. For each reservation, details such as customer name and contact information are recorded.
3. For each item reserved, the following information is provided:
   a. Equipment type (selected from an alphabetical list of types)
   b. Requested pickup date
   c. Requested return date
   d. Deposit amount
4. The employee has to check to see if the requested equipment type is available on the requested date.
   a. If it is available, then the process continues.
   b. If it is not available, then the customer has to be notified. (Customer info is still recorded.)
5. If the rental is a same day rental, then the equipment is provided immediately (see Customer Rents Equipment).

2.1.2 Customer Rents Equipment: When a customer rents a piece of equipment the following events take place:

1. The customer provides the reservation confirmation (preferably hard copy).
2. The customer provides a picture ID. Note that customer details were recorded when the reservation was made.
3. Employee selects "Equipment rental" from the main menu.
4. The customer information that was recorded with the reservation is recorded on the contract.
5. The system checks for overdue or damaged equipment, and if any is found displays rental date, problem with return (damaged, late return, no return), and amount owed. The employee may print a copy of this screen if needed.
   a. If any previous charges are found, the customer is informed that these charges must be paid before any equipment can be rented.
   b. If any previous rentals were returned damaged, then the deposit is increased by 25%.
6. Employee enters each equipment ID, check out date, return date, and deposit into the system. For each piece of equipment the following things happen:
   a. Change the equipment status from "in stock" to "rented", and increment the rental count for this item.
   b. Calculate the rental charge based on equipment type and rental period. Equipment can be rented only in full day increments.
   c. Write a rental record.
   d. Calculate the charges and write a charges record for this item.
7. When all information for each rental item has been entered, the employee selects an option to print a rental agreement, as described in section 2.1.5.
8. The customer signs the printed contract. The employee requests payment for current charges as well as prior outstanding charges. (Note: deposit was paid with reservation.)
9. The employee retrieves equipment from storage.

2.1.3 Customer Returns Rented Equipment: As each piece of equipment is returned, the following events take place. Note that the customer must be present when equipment is returned.

1. The employee selects "Equipment Return" from the main menu and the current time/date is recorded as the return time.
2. If the return date is later than the due date, a late fee charge is calculated and deducted from the rental deposit. Note that the late fee is always in increments of the daily rental, so an additional full day rental will be charged even if the equipment is returned only an hour late. The late fee is deducted from the equipment deposit.
3. The system changes the equipment status to "in stock" and the equipment is returned to the storage area.
4. The equipment is inspected, and if it is in good shape the equipment deposit is returned.
5. If it is damaged then either all or a portion of the deposit is retained.
6. If any of the deposit is not returned, then a receipt is printed indicating monies kept and the reason.
7. If any of the deposit is not returned, then the rental date, reason, and amount owed (if any) are recorded in the customer history.

2.1.4 Customer Purchases Used Equipment: TWK periodically retires equipment and offers it for sale to customers. The buyer does not have to be in the Customer table and no information about the buyer is recorded. The following events take place:

1. Customer selects one or more items from the used equipment section and indicates their selection to the employee.
2. The employee selects Equipment sale from the main menu.
3. Employee enters each equipment ID into the system. For each item, the following things happen:
   a. Change the status from "for sale" to "sold", and decrement the inventory count for this equipment count.
   b. Calculate the charges and write a charges record for this item. Assume that there is a uniform sale price for all equipment of a certain type, which is

normally 60% of the retail price. Refer to the business rules near the end of the case for details.

4. When all items have been entered, the employee selects an option to print a sales receipt, which contains the following information:
   - **Header Section**: Current date/time.
   - **Detail Section** (for each item): item description, equipment ID, and Sale price.
   - **Footer Section**: Sale subtotal, Tax, Grand total.
5. The employee requests payment for current charges. No customer information is recorded.

2.1.5 Print Rental Agreement: A rental agreement must be printed for every equipment rental. The rental contract contains the following information:
- **Header Section**: Contract ID, scheduled pickup date, scheduled return date, customer name, address (with city/state/zip), telephone, e-mail address.
- **Detail Section** (for each item rented): Item description, equipment ID, rental charge, deposit fee.
- **Footer Section**: Rental subtotal, Deposit subtotal, Tax, Grand total, signature line.
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2.1.6 Print Unreturned Equipment List: At the end of the day, if there are any outstanding rentals the employees may print a list of equipment that has not yet been returned by customers.

2.1.7 Reclassify Excess Equipment as Sale Item: At the end of the rental season (approximately Labor Day) inventory will be reduced by offering some of the equipment for sale.

- The number of rentals for each piece of equipment is checked. Those that exceed a certain number of rentals (that number is determined ad hoc and is a business rule) are visually checked for wear, and those with the most wear are removed from the rental inventory and offered for sale. It is placed in a special "for sale" inventory and its status is changed from "rental" to "for sale".

2.1.8 Print Equipment Rental Report: The monthly equipment rental volume report is printed on the first day of every month.

2.1.9 Print Equipment Sales Report: The monthly equipment sales detail is printed on the first day of every month.

2.1.10 Order New Equipment: An order for new equipment is generated under the following circumstances:
1. Periodically an employee runs an inventory report (as indicated in 2.1.12) that indicates the total number of a particular equipment type available for rental. If the number falls below a preset limit due to theft or damage, a reorder request is generated for a number of items equal to the limit minus the current number. The preset limit is based on projected demand for a particular equipment type and is outside the scope of this system.

2. Before an order is actually placed, this reorder request is compared with projected demand for this particular equipment type, with the remaining rental season taken into account, and order quantities can be adjusted. Price is obtained from the supplier for each item and entered into the purchase order. Shipping charges are also supplied by the vendor and are outside the scope of the system. The tax rate is obtained from local governmental tax regulations, and the subtotal, total tax, and total are all calculated.
3. Orders for the same supplier are gathered together into a single purchase order.
4. These purchase orders are sent via email to suppliers who have provided an email address. Otherwise they can be faxed or mailed to the appropriate supplier.

2.1.11 Process New Inventory: Assume that all orders placed to a given supplier are received in full, and there is no need to make an allowance for partial shipments and backorders.
1. When a shipment is received, an employee attaches a uniquely numbered inventory tag (equipment ID) to each item.
2. Next, the employee enters the following information into the system for each item:
   a. Equipment description (selected from a list)
   b. Retail cost
   c. (Refer to business rules for details.)
3. The system creates a new record in the equipment table for each item, and initializes additional fields as follows:
   a. Equipment ID is automatically generated by the system in sequential order, and is used as an inventory tag.
   b. Rental Status is set to "in stock" (not shown on the form).

2.1.12 Print Current Inventory Report: Periodically an employee may find it necessary to print an inventory report. Such reports are used when it is necessary to take inventory of current stock (equipment that is "rentable"), and also when ordering replacement equipment.

2.2 Additional Business rules
Assume for the sake of simplicity that no credit cards are accepted, only cash and checks. (Your professor may override this simplification.)

Each equipment type can have multiple units in stock.

Each equipment type is assigned to a single rental class.
Each rental class determines a rental charge and deposit amount.

If equipment is returned late, standard late fee processing is applied as described above.

Each piece of equipment has a unique number for inventory processing, and a status to indicate its current disposition. Some possible status values include:

- In stock
- Rented
- Overdue
- Sold

- Missing
- Damaged
- For sale
- Unknown

Rental Costs

CANOE	DAMAGE DEPOSIT	DAILY RENTAL COST
Rental includes: 2 Lifejackets, 2 Paddles, Roof pads, Tie downs, 1 Bail bucket	$400.00	$35.00

SEA KAYAK	DAMAGE DEPOSIT	DAILY RENTAL COST
Rental includes: 2 Lifejackets, 2 Paddles, Roof pads, Tie downs, 1 Bail bucket	$600.00	Solo Tandem $40.00 $60.00

W.W. KAYAK	DAMAGE DEPOSIT	DAILY RENTAL COST
Rental includes: Helmet, Skirt, Paddle, Wetsuit, Booties, Lifejacket, and Spray jacket	$400.00	$30.00

SIT-ON-TOP KAYAK	DAMAGE DEPOSIT	DAILY RENTAL COST
Rental includes: life jacket and paddle	$400.00	$30.00

RAFT	DAMAGE DEPOSIT	DAILY RENTAL COST
Rental includes: 5 Class V lifejackets, and five paddles	$600.00	Paddle Raft $30.00 Oar Raft $60.00

DUCKIE	DAMAGE DEPOSIT	DAILY RENTAL COST
Rental includes: Wetsuit, Paddle, Class V Lifejacket, Helmet, and Small Air Pump	$400.00	$40.00

A partial list of equipment types includes:

- canoe
- sea kayak
- whitewater kayak

- sit-on-top kayak
- raft
- duckie (inflatable kayak)

Equipment is reserved by type, not by actual equipment ID.

Reservation Deposit - A 50% deposit is required to reserve rental equipment. A customer must call or come by with a deposit, and provide their name, phone number, address, equipment type and dates. Final payment is due when equipment is picked up. (If credit cards are allowed then reservations and deposits can be made by phone or e-mail.)

Damage Deposit – Necessary for all rental equipment in a separate check or Visa or MasterCard. See table below for amounts.

Lost Equipment – will be charged at retail cost.

Damaged equipment will be charged for repair time ($25.00 per hour) and materials. Repair time will be standard for each equipment type and is obtained from a table produced by a supplier.

Cancellation Policy - Cancellations up to seven days prior to the scheduled pick-up date will receive a full deposit, less a $25 processing fee. Cancellations in less time prior to the scheduled pick-up date receive no refund of the deposit.

Author Biography

Kevin R. Parker is an Assistant Professor of Computer Information Systems at Idaho State University. He has taught courses in both computer science and information systems over the course of his eleven years in academia. Dr. Parker's research interests include e-commerce marketing, competitive intelligence, information filtering, and knowledge management. He has published several papers in these areas including publications in *Marketing Intelligence and Planning*. Dr. Parker's teaching interests include programming languages, data structures, and database management systems. Dr. Parker holds a Ph.D. in Management Information Systems from Texas Tech University.

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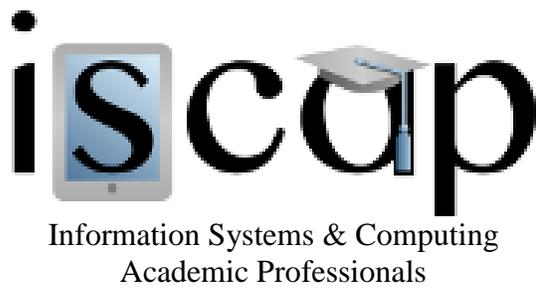
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