

Data Bases 2007/2008

Practical work

Foreword

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This work must be developed with:

- MS SQL Server 2000 and,
- Java Language

DI-UBI equipment availability

Laptop PCs, video projectors and video cameras are resources of the Informatics Department of UBI (DI-UBI) shared by its users (professors, students, researchers or external entities). The availability of these scarce resources is regulated by a reserve policy.

The users are classified by type. A two letter prefix is used to identify each user type (PR - professor, RS – researcher, ST – student, SF – staff, XT – external).

A user is identified by an ID (10 chars) and has a name and a type. The first three chars of the ID are ‘XX_’, where XX is a prefix. For example, “RS_Special” is a researcher ID. A phone number or an e-mail address is also required for contact.

The equipment assignment follows a preemption rule based on priority levels (maximum, above normal, normal, bellow normal and minimum).

For each user type a priority level is associated, known as base priority. The user type professor has a base priority “above normal”; all other user types have base priority “normal”.

Every user has its own priority, known as current priority. Initially the current priority is equal to the base priority. The current priority is dynamic, that is, it may change with user behavior: it decreases one level for each reserve error (when collecting reserved equipment with a late of one period, or more) or episode error (late returns of equipment; one or more periods); it increases one level after two consecutively correctly managed reserves (and returns). The user priority must never increase beyond the base priority. The priority of the head of department is always “maximum”.

The valid periods for collecting or returning equipment are from 8:00 to 21:00. One period has duration of one hour, and start at exact hour. The “time of use” is the time between two time points: the time to start the use until the time of return. The start time for the “time of use” may be, for example, 2006-05-19, 8 (where 8 is the period).

The reserve responsible is the user who places the reserve. For every new reserve, the date and time are automatically recorded and an ID (10 chars) is assigned to identify the reserve. The ID has the following format: TUyyyySSSS, where TU is a user type prefix; yyyy is the current year; and, SSSS is a sequential number for this prefix and this year – for example, RS20060001 is the ID of the first reserve placed by some researcher in the year 2006.

A reserve may be in the state *active*, *satisfied*, *cancelled*, *waiting* or *forgotten*. From the *active* state it can move to *satisfied*, *cancelled*, *waiting* or *forgotten* state. From the *waiting* state it can move to *active*, *satisfied*, *cancelled* or *forgotten* state. *Satisfied*, *cancelled* or *forgotten* states are final states (i.e., when a reserve enter in one of these states it never goes out).

A reserve is in *active* state when the equipment required is available in the required time and for all period of the reserve. It is in *waiting* state when at least one of its required equipments is not available (it is in use/reserved by another user). It is in *cancelled* state when it is canceled. It is in *satisfied* state when the reserved equipment is collected. It is in *forgotten* state when the “time of use” is elapsed without the reserve being satisfied or cancelled.

A reserve moves from *active* to *waiting* state as a consequence of new reserves (or episode), in this case, we say a preemption has occurred. In general, preemption can only occur until 48 hours before the start of “time of use”. After that time, only the head of department can provoke preemption. In fact, the head of department can preempt any reserve at any time.

A reserve can be cancelled until 24 hours before the start of their “time of use” without any priority penalization, or until 2 hours with a priority fault (5 faults are equivalent to a reserve error), or until 1 hour after the start of the “time of use” with 3 priority faults. After that time a cancellation is equal to a reserve error.

Note: Obviously, as new reserves can trigger state changes of others reserves, reserve cancellation can also trigger state changes (of waiting reserves).

The state of a reserve moves from *active* or *waiting* state to *satisfied* state if its responsible picks up the equipments until 30 minutes after the start of “time of use”. After that time, the responsible is late and enters in a fault schema (one fault for each). At the end of the “time to use” the state of the reserve is automatically changed to *satisfied* (if their responsible has collected the reserved equipment) or to *forgotten* (if the responsible not yet takes the equipment).

A reserve in waiting state has some equipment preempted but can have some other equipment (temporary) assigned. The responsible of the reserve must indicate, for each equipment, if it is mandatory or not (i.e., if this equipment is essential for the whole reserve make sense). For example, a video projector may be been indispensable but an electrical cable extension may not be. The preemption of mandatory equipment automatically causes the cancellation of the reserve if the equipment isn't available until 48 hours of their start of “time of use”.

When a reserve enters into one of its final states (*Satisfied*, *cancelled* or *forgotten*) the details (rows) of the reserve are deleted, that is, they don't have interests anymore.

Available equipment can be taken without the user placing a reserve. This “take and use” without reserve is recorded, with all details necessary to follow the equipment “trail”, in a so called episode. When a reserve enters into it *satisfied* state (that is, when the reserved equipment is taken) it is also generate an episode (we don't have anymore reserve rows but have episode rows!).

An episode is identified by an ID with the same composition of the reserve ID (the number sequences are maintained by different counters). Each episode is time-stamped (day and time) with a mark indicating the moment of its generation. It must also be recorded the “period of use”.

At all time it is important to know the state of the equipment: available or in use (and by whom) or reserved (and by whom).

To be done

1. Develop a data model (ER diagram + relational schema) for the DI-UBI equipment use. Assume for not specified situations the solution that seems more reasonable.

Note: the model must be normalized.

2. Create scripts for:

- Create the database;
- Create tables and constraints (for the relations produce in 1.)

Don't forget setting the primary key (and foreign keys, if exists). Create the necessary constraints *UNIQUE/Check/Not Null*. Make attention to interval values for some attributes.

- Create stored procedures and user defined functions (UDFs);

Create, among some others, the *Stored Procedure Reserve2Episode* which receive an ID and creates an episode.

Create, among others, the *Function MakeID* which receive a user type prefix, a date and a number, and returns a string with a reserve (episode) ID.

- Create *triggers* and assure that "business rules" are enforced;

Create, for example, a trigger for reserve table update event. When the reserve moves to *satisfied* state, the trigger must call the *Reserve2Episode* procedure. In case of state move to a final state, it must also delete the reserve rows.

Note: you need several triggers to enforce the business rules. For example, it must be guarantee the prefix part of ID is valid.

- Create views;

Create, among others, the view *ResourceState* to present data in the following format:

ResID	ResDesc	State	ID	User
1	Asus LC3	Available		
12	Sony DCR405	Reserved	ST20060048	ST_Dragon
24	Toshiba	InUse	RS20060097	RS_Special
...

ID → reserve ID or episode ID!

- Insert some initial data;

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Insert users, user type prefix, and priority levels, resources, etc..

Note: the JBuilder application don't insert data in these tables, just query or update the data.

3. Develop a JBuilder application that allows:

- a) Show all the resources and their state (and user, if applicable).
- b) Reserve management: record a reserve; update the reserve state.

Note: don't forget that some reserve state changes are atomically triggered, for example, the move to the waiting state.

- c) Episode management: record an episode; accept equipment restitution.

Note: don't forget that these actions may have side effects...

4. Write a report that shows and justified the work developed.

Mode and dates of delivers

The work must be delivery by email:

Address: bd0708@di.ubi.pt

Subject: Erasmus-N1,N2,N3

Attach: app.zip; report.zip; scripts.zip; readme.txt

Where,

N1,N2,N3 = student numbers of the student group.

app.zip – developed application (.exe and source code).

report.zip – report (.doc e .pdf).

scripts.zip –scripts, final version.

readme.txt – user guide.

The report

The report must include the following chapters:

1. Introduction
Presentation of developed work and generic introduction to used tools (SQL Server; JBuilder; and others?).
2. Data model and scripts:
Presentation and justification of developed data model. Must include: the options taken for the situations not specified and also the “business rules”.
3. Application
 - 3.1 Configuration of the connection to the database
Show how to configure the database connection. Include illustrative screen snapshots of the configuration (ODBC, ...).
 - 3.2 Application capabilities
 - 3.2.1 Database connection
Show how to establish a database connection (source code example).
 - 3.2.2 Database access
Include illustrative source code fragments (examples for query, insertion, delete and update operations)
 - 3.2.3 Lists
For example, generate a list with all equipments with its state (and user/reserver, if it is the case).
 - 3.3 Application functionality
(Must include point 3 of the tasks to be done).
4. Conclusion
Indicate what has been done.
Indicate what hasn't been done. Indicate the reasons.
Etc.

Important dates:

Jan 11, 2008	: Send by e-mail the application. : A report paper must be placed in the secretary's department.
Jan 8, 2008	Written test (10 points)
Jan 15, 16, 23 - 2008	Work discussion (8 points)
Jan 22, 2008	Project validation (test) (8 points)

Work classification:

Topics to be evaluated: data model; scripts; application and report - 5 points

Individual work done in classes (2nd and 3rd weeks of Dec. and 2nd of Jan.) – 3 points.