

CIS 401 - Normalisation Case Study Assignment

A Factory Production Information System

Scenario

A factory's records are kept on paper files. The records correspond to a series of tables with a structure that has not been normalised.

The factory production workers are organised into teams with each team consisting of 4 to 8 workers. There are currently 15 factory supervisors which each have 3 or 4 teams allocated to them to supervise. A production worker's allocation to a team is normally consistent to enable whole teams to become trained and experienced in various activities. However, a worker may change their team from time to time, or on occasion, a worker may be temporarily assigned to another team for half or a full day.

The factory is divided into zones with each zone corresponding to an area which can be worked on by one team. The factory supervisors also have several areas allocated to them to supervise so teams will never work in a zone not supervised by their supervisor. Each zone has only one supervisor allocated to it. Teams are allocated to zones on a daily basis so they will not change zones in a day but may work in different zones on different days.

The factory produces a number of different types of widgets. The limitations of the machinery within some zones mean that certain types of widget can only be produced in certain zones. As many of the machines need extensive reprogramming to handle a change in widget type only one type of widget is ever produced in a week in any one zone with the reprogramming taking place at the week-end so as not to disrupt production. The complexity of widget production also means that a team cannot produce any widget type unless the members have received suitable training. When a new worker joins a team it is assumed they will soon acquire the skills and training of the other team members through "on the job" training.

The production workers are paid weekly at a standard rate which depends on their job grade with, currently, 9 different grades being used. They are also paid a bonus if their team's daily production exceeds a nominal number of widgets where this nominal number is set for each type of widget in each zone (ie. The total number of bonus levels is number of zones x widget types). The amount of the bonus payout depends only on the zone, not on the widget type. The payout is divided equally among those workers working that day. Any team member working only half a day will get only half the payout.

A lower bound is also set for each type of widget in each zone for purposes of monitoring the machinery. If a zone fails to produce the number of widgets corresponding to this lower bound on three days in any one week the machinery is inspected for possible problems.

Production records are recorded on a daily basis on standard forms by a senior member of the team (ie. one of the highest grade team members) and is checked and countersigned by the supervisor at the end of the day. Each day is known by its day number in the range of 1 to 7 and its week number which is the number of the week calculated from the beginning of the year (counting the first Monday in January as the start of week 1).

The supervisor also keeps a daily record of which team a worker is working in on a daily basis in a worker allocation book. From time to time team members may be absent either through booked holidays or through illness. In the case of a holiday booked in advance, the team's supervisor records the information in a holiday bookings book. If a production worker books a holiday but for some reason the actual dates of the holiday are altered the supervisor simply changes the entry in the book. Any absence through holiday or sickness is also noted in the worker allocation book with an "H" or "S" being recorded instead of the team number on the daily allocation. The supervisor may consult these books from time to time to see how much holiday a worker has left (25 days holiday are allowed in each calendar year), or to see if any worker has had an excessive number of days off sick.

It is proposed to computerise the whole system using a relational database management system. There will be network access, suitably password protected, to allow managers and some office workers (such as in the finance or personnel departments) to review the data and extract data to calculate wages, etc. The supervisors will have access from shop floor terminals to record the daily production figures, worker allocations and booked holidays as required. The production workers themselves will not have access to the system but will continue to record the daily production on forms to be handed to their supervisor who will enter the data on the system. It is, however, recognised that the format of these forms may have to be altered to maintain compatibility with the new system. Note that this system will handle only the shop floor records of production and workers. There is an existing system for handling monthly paid salaried staff such as the supervisors. It will not, therefore, handle the supervisors' salary details or the supervisors' holiday and sickness records.

The Current Table Structure

(i) Table of Production Workers

A table of information on production workers. This information is currently kept in a card index file.

Field Names	Key Field?	Explanation
WorkerID	Yes	Unique ID number for each production worker
Name	No	Worker's Name
Grade	No	Job grade
Wage	No	Weekly pay

(ii) Table of Supervisor Allocation

A table giving the supervisor's unique ID number and name for every possible combination of team and zone. This information is currently kept in a card index file.

Field Names	Key Field?	Explanation
TeamNum	Yes	A team number of a team he or she supervises
Zone	Yes	A zone identifier that he or she supervises
SuperID	No	Supervisor's unique identity number
SupName	No	Supervisor's name

(iii) Table of Team Production

A table to record the teams' daily production. This is made up of the set of forms filled in by senior team members at the end of each day and kept in a filing cabinet.

Field Names	Key Field?	Explanation
TeamNum	Yes	Team number
Year	Yes	Last two digits of the year number
Week	Yes	Week number
Day	Yes	Day of week number in range 1 to 7
MembersPresent	No	The names of all production workers in the team present all day
MembersMorning	No	The names of all production workers in the team present in the morning only
MembersAfternoon	No	The names of all production workers in the team present in the afternoon only
Zone	No	Zone identifier of the zone which was being worked this day
Type	No	8 character type code of the widget produced
Output	No	Number of widgets produced by the team on this day
BonusLevel	No	The number of widgets above which will earn the team a bonus for this widget type and this zone
BonusPayout	No	The total bonus sum to be split between team workers

(iv) Table of Zone Production

A table to record the zones' daily production. This is made up of the set of forms filled in by senior team members at the end of each day and kept in a filing cabinet.

Field Names	Key Field?	Explanation
Zone	Yes	Zone identifier
Year	Yes	Last two digits of the year number
Week	Yes	Week number
Day	Yes	Day of week number in range 1 to 7
Type	No	8 character type code of the widget produced
Output	No	Number of widgets produced in the zone on this day
MinimumLevel	No	The number of widgets below which on three consecutive days the zone machinery will be checked

(v) Table of Possible Allocations

A table giving all possible combinations of allocation of team to a zone and the type of widget produced by that team in that zone. This is recorded in a note book.

Field Names	Key Field?	Explanation
Zone	Yes	Zone identifier
Type	Yes	Type code of the widget that can be produced in the zone
TeamNum	Yes	Team number of team that can work in the zone on the widget type

(vi) Table of Worker Allocation

A table giving the team number, the days taken as holiday or the days off sick for production workers recorded on a daily basis. This is recorded in a note book.

Field Names	Key Field?	Explanation
Year	Yes	Year
Week	Yes	Week number
Day	Yes	Day number
Time	Yes	Either "AM" or "PM" if the record refers to only half the day or a tick if it refers to the whole day
WorkerID	Yes	Unique ID number for each production worker
TeamNumOrAbs	No	The team number the worker is allocated to or "H" or "S" to indicate holiday or sickness

(vii) Table of Holiday Bookings

A table giving the holidays booked by production workers. This is recorded in a large note book.

Field Names	Key Field?	Explanation
WorkerID	Yes	Unique ID number for each production worker
Name	No	Worker's name
StartHolYear	Yes	Year of the start date of holiday
StartHolWeek	Yes	Week number of the start date of holiday
StartHolDay	Yes	Day number of the start date of holiday
StartHolTime	Yes	"AM" or "PM" depending when the holiday starts
Length	No	Number of days holiday booked/taken (can include half days eg 5.5 days)

Questions

1. What normal form is each of the above tables in?
2. How should the above tables be reorganised and normalised for the new database system?

State clearly any assumptions you are making.