

COMP 353: MAIN PROJECT

DESCRIPTION: Your group has been asked to provide a design for a hospital called Starline Medical Center. In the text that follows, I will describe the general IT environment for Starline. Note that I will not provide all of the details of the individual entities and relationships. You will have to make reasonable assumptions where necessary in order to complete your design and implementation.



ENVIRONMENT

FACILITIES: Starline consists of 3 facilities: the long term palliative care unit, the children's unit, and the surgical unit. Each unit is a separate physical site, but Starline will use a single relational DBMS to manage all facilities.

STAFF: Each unit has its own Director, nurses and technicians. Doctors work mainly with a specific unit, depending on their specialty, but may move between any of the three units if required. There are also administrators who help manage the three facilities. Two of the administrators from each unit also serve as senior Starline administrators, along with the three Directors. This group of 9 run the entire hospital.

In addition, each unit has its own technicians: pediatric, x-ray, computer, blood work, and sterilization.

Nurses are paid as per the collective agreement. All nurses receive a base salary of \$24.50 per hour. For each 5 years of seniority (from the hire date), they receive an additional \$1.50 over the base rate. Some nurses serve as shift supervisors. Shift supervisors earn an additional \$3.25 per hour. Nurses generally work 36 hours per week in three 12-hour shifts. Overtime is paid at the rate of 1.25 * the base rate. Some nurses will work part-time hours as well.

Technicians earn slightly different rates: pediatric (\$16.00), x-ray (\$18.50), computer (\$18.00), blood work (\$17.50), and sterilization (\$16.00). They receive an additional \$1.25 per hour for each additional 8 years of services. Technicians work 37.5 hours per week. Overtime is paid at the rate of \$1.50 * the relevant base rate.

Administrator income is based upon a yearly salary. Basic administrators earn \$78,500 per year, with a 1% increase for every year of service. Senior administrators earn \$98,000 as a base with a 1.15% increase for each year of service (as a senior administrator). There are no overtime hours for administrators.

Directors are paid \$125,000 per year, with a 1.5% increase for each year of additional service.

Nurses, technicians, administrators, and directors are all paid bi-weekly (i.e., every two weeks).

Doctors are paid per visit and/or per operation. The actual rate will depend on the type of service provided. Doctors are paid weekly.

There are two other types of "junior" doctors. Interns have just graduated from medical school and generally work very long hours doing initial patient exams, follow up, and basically any work that nobody else want to do. The residents are essentially senior interns and also work long hours. They actually perform much of the real medical work in the hospitals, though there must always be an attending (or supervising) physician working with them. You are considered an intern in your first year, and then you do three years of residency. Interns are paid a salary of \$40,000, while residents are paid \$42,000, \$44,000, and \$46,000 in their first, second, and third year respectively.

SUPPLIES: Starline uses a lot of supplies. We can divide these into medical, non medical, and nutritional. The medical supplies consist of things like medications, surgical equipment, and supporting devices (e.g., wheelchairs). Within each of these basic categories, there are of course, many sub-divisions. Medications for example can be pain-killers, anti-psychotics, anti-inflammatory, etc.

The non-medical items consist of things like administrative supplies (e.g., paper, pens, phones) and basic patient materials (sheets, pillows cases, robes, etc).

Finally, the nutritional supplies are related to the kitchen services. Each site has its own kitchen.

Supplies are purchased from a variety of vendors. Nutritional supplies can only be purchased one week in advance and must be replenished on a continual basis. The one week supply is kept in a storage room on site. Each kitchen unit does its own orders (an administrator does this).

Medical and non-medical supplies are purchased whenever stock is low (less than 10 percent of capacity remaining). Medications and basic patient materials are kept in a supply room located on each floor. They are stocked independently (by another administrator). Other medical and non-medical supplies are kept in a storage unit at each site.

Some supplies must be shipped immediately (e.g., medications) if they are in demand. This can be done by a same day delivery service (e.g., Purolator) or by a local courier service.

SERVICES: Each unit provides specialized services. The palliative care unit supports those suffering from terminal illnesses. Basic services include nutrition, exercise, bathing, physiotherapy, general exams, psychiatric care, and administration of medications. Much of this care is provided by nurses as part of their regular duties. However, it must still be scheduled at specific times since all of these things are not necessary every day, or for all patients. Each nurse is assigned a group of patients/rooms and will have certain services to provide for each patient on his/her rounds.

Some of the more specialized care is provided by doctors (e.g., diagnosis). These services are billed directly and the doctor is paid varying amounts depending on the type and/or complexity of the service provided. Doctors must also have a schedule for each day so that they may see their assigned patients.

The children's unit deals with illnesses and injuries specifically related to children. The nursing situation is similar to that in the palliative care unit, though each nurse has a smaller number of patients. There are also additional facilities for the children. Specifically, there is a play area in the unit; nurses may be assigned 6 hour shifts in this part of the hospital.

The surgical unit is dedicated to surgeries and recoveries. It does not have long term patients of any kind. After surgery, patients may either return to their rooms for 12 hour recovery and release, or they are returned to their room for 2 to 14 days, depending on the situation. Nurses in this unit are of two basic types. Regular nurses are the same as the nurses in the other units. OR nurses work in the operating room only and do not work with patients in the recovery area. Doctors work both in surgery and in follow up exams in the recovery areas. They bill for both services.

SCHEDULE: Hospitals run 24 x 7. Nurses, in particular, must staff the units at all times. Shifts are 12 hours in length, 7 AM to 7 PM. However, additional nurses are employed during peak hours. Scheduled surgeries are only performed on the 7AM to 7PM shift. Emergency surgeries can be performed at any time of course.

Administrators, directors and technicians work more regular hours, essentially 9 to 5, Monday to Friday.

Doctors' schedules vary widely depending on the seniority and qualifications of the doctor. Both interns and residents are limited to 80 hours of work per week. The attending physicians are the senior doctors who are fully licensed and are ultimately responsible for patient care. They generally work 40-60 hours per week but have the flexibility to adjust their own hours (i.e., they can cancel a scheduled service if they choose). Interns and residents have no flexibility and do the work that they are assigned.

PATIENTS: All three units have patients. Because this is a Canadian hospital, patients are not billed directly for their hospital visits. However, they must of course have a valid Medicare card, as well as a hospital card that they register for on their first visit to the health care center. Doctors and nurses would need to access all patient information (medications, treatments, etc), including information about previous visits so this must be maintained. Starline would also like to make basic patient information available online so that patients can see information regarding their scheduled visit/surgery (doctors, dates, etc).

On a given visit, a patient is always associated with a specific unit. The palliative care patients may have no concept of a visit, since they may spend the remainder of their lives in the palliative care unit.

INTERFACE

Now that you have a database, you must of course provide an interface to the system. The Starline database will have a full web interface, implemented in PHP. In practice, there would be a lot of security issues here, but we can assume that these are being handled by a separate team. In other words, we can assume that it is possible, with the appropriate password/client software to access the system from any Internet connection.

Your PHP interface will provide the following views of the system (a simple employee ID and password will give access to the appropriate GUI elements).

DIRECTORS/ADMINISTRATORS: These people have access to all information in the system (human resources, scheduling, services, etc). The directors also have the ability to add or delete services to the system. The administrators are responsible for ordering supplies and scheduling surgeries in the Operating Room. To schedule surgical procedures, they must have access to the schedule in the various operating rooms so that they can see when the room are not being used. Directors and administrators should also be able to see several reports, as well, including the different services provided by unit, broken down by month and year; the costs and/or usage of the various supplies, and the number and/or type of surgeries/services performed by their doctors.

DOCTORS: They have access to all information related to patients, schedules, and surgeries. They can only modify their own patient information, not the information of other patients belonging to other doctors. They can select specific interns and residents to work with them on rounds or in surgery. They can, of course see their own schedules and can cancel surgeries if necessary. Doctors should be able to get reports on patients who have had similar problems and/or treatments during their stay in the health care center. They should also be able to get a report on their interns/residents to determine who has the most experience in certain areas (i.e., the number of times they have assisted in certain surgeries).

RESIDENTS AND INTERNS: They must be able to access the system to see what they will be doing during the day. This schedule will be the one defined by the primary physician that they are working with.

NURSE SHIFT SUPERVISOR: They must be able to define the list of patients and patient services appropriate for the nurses on her shift. They should be able to get a report on the work history of the nurses in their units.

NURSE: They must see a list of the patients they will be working with, and any specific services they need.

All employees should be able to see how much they will be paid for the current period. Technicians do not use the GUI - though their personal information must be available to the administrators.

Finally, you can, and should, add any reports or GUI components that would significantly improve the user experience.

FINAL THOUGHTS: This is a fairly big problem. It is also described in a very general way. Your job is to really think about what you are trying to accomplish. In other words, how can you create a database that adds value to the client's environment. You will have to make a lot of assumptions about various entities and relationships. That's okay as long as the assumptions make sense. You are free to record whatever information you think would be relevant or useful for the various entities. Please remember that part of the final grade will be an evaluation of your effort versus the other groups. So feel free to be creative, to think "outside the box", and come up with elements that are novel and interesting.

IMPLEMENTATION: Traditionally, the projects have been done on the DBMS server supported by the university. Unlike the assignments, the project configuration is more complex as it includes the DBMS, a web server, and the PHP programming environment. So using the university server can make the installation easier. That being said, it is also a lot more restrictive and makes development more cumbersome. For this reason, most (if not all) of you will want to do the project on your own machines/laptops. This is relatively straightforward to set up. In fact, pre-packaged versions are available that can have you up and running in a half hour or less. We typically refer to the full environment as LAMP (Linux Apache MySQL PHP/Python/Perl) or WAMP (Windows Apache MySQL PHP/Python/Perl). For windows environments, for example, one can look at <http://www.wampserver.com/en/>.

Either way, we still have to create the group accounts on the university machine, just to make sure you have a backup solution (You do not actually have to use it). To create your account, your group should send the group name and the names and IDs of the students in the group to Stan at stan@encs.concordia.ca. You must do this in the next few days week as Stan will not have time to do this at the last minute.

DELIVERABLES: The project will consist of two components (equally weighted). First you will create a design document. This will consist of the relational diagram(s) used to implement the database. You must clearly indicate all primary keys, foreign keys, and any constraints. You should also briefly describe any assumptions you have made regarding your design. The MySQL Workbench would be the obvious choice here since you will be implementing your database with MySQL. That said, you can use any tool that you like. For consistency, I would prefer that Crow's foot notation be used.

You will also provide a demo (performed at the end of term... the exact time to be determined later, but it will not be before the last class). All group members must be present and basically you will give a demonstration of the main components (i.e., interfaces) of your system. In order to perform the demo, you must of course add some data to your tables. You don't need billions of records, but you do need enough to be able to effectively show what your system does and to create meaningful output on the reports. You may add the records manually, if you like, but this would be VERY tedious for a project of this size. I would suggest using a generator tool. There are a number of systems available for this but an application like Spawner is quite easy to use and can populate most of your database. You can download Spawner for free at:

<http://sourceforge.net/projects/spawner/>

At the demo you will provide an electronic copy of (1) your PHP source code (2) a series of screen shots showing what your system actually does, (3) sample output from your major reports (4) the relational diagrams mentioned above, and (5) a README file which lists the contributions of each member along with any other information or highlights you think might be useful. The full contents should be stored on a CD/DVD/USB key.

That's it. Have fun and make Starline proud.

