TEAM 48

CSC2042

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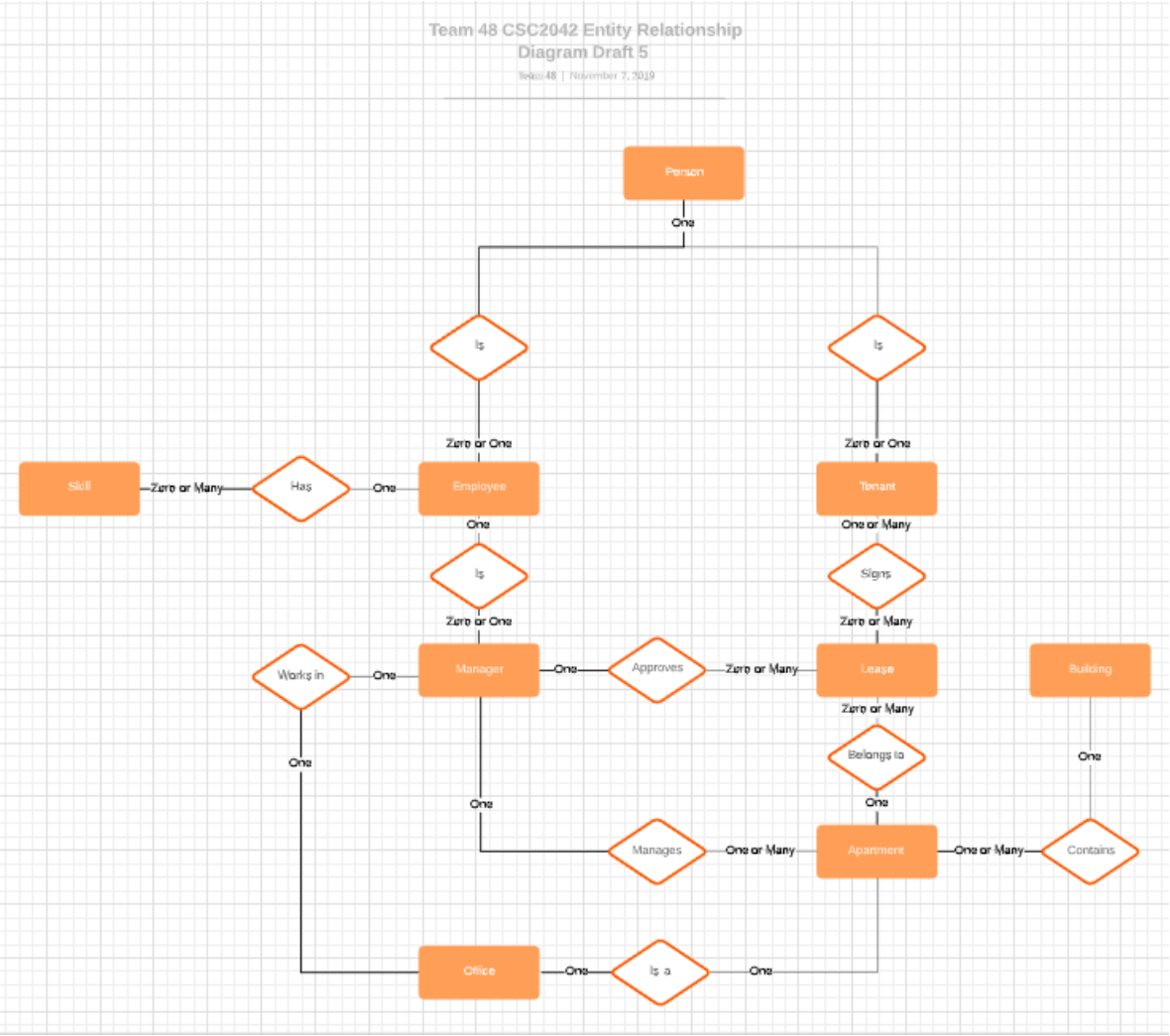
Entity Relationship Diagram



Constraints and About the Entity Relationship Diagram

A building owned by Queens University Accommodation will contain one or many apartments, but an apartment must be contained within an apartment building.

It has been assumed that in reference to the document, a person is an entity that can be zero or one tenant or an employee. A person will have a separate set of bank details as a tenant needs to pay rent from a bank account and an employee needs a salary payed into their account. A person will have one and only one set of bank details.

As is stated in the assignment a person can be a tenant, hence a zero or one relation and the same is to be said for an employee. Both an employee and tenant must be one person. Hypothetically a person can be a tenant and employee. Tenants and employees can do many different things.

Employees may have zero or many skills, implying them to be an engineer of some degree. A list of skills will be available to be assigned to one employee. The role of a manager must exist within the structure of the database as inferred from the assignment documentation. It is then assumed that a manager is derived from employee meaning that an employee is or is not one manager, but a manager must be one and only one employee.

The role of a manager is twofold according to the assignment documentation. Firstly, they are responsible for the signing and approval of leases; a lease must be approved by one manager, but a manger can approve many leases in their tenure; hence the approval relationship in the ERD. Secondly, a manager manages at least one apartment in a building or range of buildings as it can be assumed that an apartment requires one and only one manager. Hence a manger may manage one or many apartments while employed. A perk of being a manger means you have an office in one of the buildings according to the assignment. So, a manager will have one office and an office will belong to one manager at any one time. Since an office is one of the apartments then an office is one apartment and one apartment can be an office.

In relation to the role of tenants in the database, when a tenant moves into an apartment, they must sign a lease. A tenant can assign zero or many leases if they wish to rent multiple facilities. A lease must be assigned by a minimum of one tenant. Leases will belong to one and only one apartment, but it can be assumed over time multiple leases will be taken out for an apartment therefore an apartment can have no leases, or many leases linked to it.

Such is the relational structure of this database system.

Database Design

Building(**BuildingID**, Address, Postcode)

Apartment(Apt. ID, Apt. No, Bedrooms, Bathrooms, Total Area, **ManagerID**)

ApartmentBuilding(**AptID, BuildingID**)

Office(OfficeID, **AptID**)

ManagerOffice(**ManagerID, OfficeID)**

ApartmentManager(**AptID, ManagerID**)

Person(PersonID, FirstName, Surname, Emergency Contact Name, Emergency Conatct Numer, Emergency Contact Relation, BankAccNo)

Tenant(TenantID, **PersonID**)

Employee(EmployeeID, **PersonID**, Pay)

Manager(ManagerID, **EmployeeID**)

TechnicianSkill(**EmployeeID**, **SkillID)**

Skill(**SkillID**, SkillName)

Lease(LeaseID, **AptID**, StartDate, Duration, Rent)

LeaseTenant(LeaseTenantID**, LeaseID**, **TenantID**)

LeaseManager(**LeaseID, ManagerID)**

- Primary Key
- **Foreign Key**

We tried to atomise our data as far as possible, giving each of the main tables their own primary key and only having data related to each table within it.

We then created links between tables, by creating linking tables consisting of the primary keys of the tables they are linking (e.g. LeaseManager).

Using these we were able to successfully link and reference the correct tables and data without issues.

SQL Queries

Query 1: Find the number of apartments with/without ensuites and the total apartments in the building.

```
SELECT apartmentbuilding.BuildingID AS "Building",
building.Address AS "Address",
 COUNT(CASE
    WHEN apartment.Bedrooms = apartment.Bathrooms
    THEN apartment.aptid
    END) AS "Number of Ensuite Apartments",
 COUNT(CASE
    WHEN  apartment.Bedrooms != apartment.Bathrooms
    THEN apartment.aptid
    END) AS "Number of Non-ensuite Apartments",
 COUNT(apartment.aptid) AS "Total Apartments"
FROM apartment
INNER JOIN apartmentbuilding ON apartment.AptID = apartmentbuilding.AptID
INNER JOIN building ON apartmentbuilding.BuildingID = building.BuildingID
GROUP BY apartmentbuilding.buildingid;
```

This query will return five separate columns. Firstly, the ID of the building being queried as “Building”. The address of the building as to confirm the location. Along with this identifying information, the next three columns return separate conditional counts based on assumptions about the system. Numbered 1 – 3 below explains each count case in order :

1. In the case where the number of bedrooms is equal to the number of bathrooms it can be assumed that the apartment is an ensuite apartment, as in reality apartments may have x number of bedrooms and possibly two/three shared bathrooms. Along with this in real life if x number of bedrooms is the same as the bathrooms then each bedroom has a bathroom.
2. The second count case is the reverse of the above count case assuming where the number of bedrooms does not equal the number of bathrooms; it can be inferred that the apartment is without ensuites.
3. The final count simply returns an unconditional value returning the total apartments in the queried building.

The query does make certain assumptions that based on the Elms Village layout of apartments that there is either a matching number of ensuites to bedrooms, and if there are not then there is a shared bathroom between tenants. A query like this may benefit from changes to the system going forward, for example perhaps bedrooms themselves should have their own tables determining if there is or is not an ensuite in this room. The query however functionally works based on the previous assumptions.

The inner joins join the tables :

1. apartment to apartmentbuilding through the “aptID” foreign key in apartmentbuilding and primary key in apartment.
2. apartmentbuilding to t building through “buildingID” foreign key in apartmentbuilding and primary key in building.

Finally, the query will group each record by “buildingID”.

Query 2 : Find managers managing multiple apartments over multiple buildings.

```
SELECT Person.FirstName AS "First name", Person.LastName AS "Last name", Manager.ManagerID AS "ManagerID"
FROM Person
JOIN Employee ON Person.PersonID = Employee.PersonID
JOIN Manager ON Employee.EmployeeID = Manager.EmployeeID
JOIN (
    SELECT ApartmentManager.ManagerID, COUNT(DISTINCT ApartmentBuilding.BuildingID) AS "Number of buildings"
    From ApartmentManager
    JOIN ApartmentBuilding ON ApartmentManager.AptID = ApartmentBuilding.AptID
    GROUP BY ManagerID
    HAVING `Number of buildings` > 1
    ) dataTbl ON Manager.ManagerID = dataTbl.ManagerID;
```

Queen's Accommodation (QA) wish to find out which managers are managing apartments that are in different buildings to each other. With this information they would be able to keep track of how difficult it is for the manager to manage their designated apartments and redistribute the management of apartments accordingly to ease the workload of their staff.

This query will provide QA with a list of managers who manage apartments over multiple buildings. The query returns a table with columns labelled; "First name", "Last name", and "ManagerID". The first two columns relate to the entry in the person table, whom the manager ID relates to.

The query works by first, returning a table with the aforementioned columns and data, then it runs a second query, which the second returned table is then joined to the first. They are joined using the Manager ID field, as this is a similar field in each table.

The sub-query that returns a second table works by counting the number of buildings, across which, each manager manages apartments. If we group the columns by the ManagerID, we remove the repeated entries of each manager, and we know that if the number of buildings that the manager operates in is greater than one, then we wish to include that manager in the table.

Finally, this second table is joined to the first, which, when using an inner join, will only output the managers that are present in the second table, providing QA with the required information.

Query 3 : Find employees with two or more skills and increase their pay appropriately.

```
SET SQL_SAFE_UPDATES = 0;
UPDATE employee
SET employee.pay=employee.pay * 1.2
WHERE employeeID in(
SELECT * FROM(SELECT technicianskill.EmployeeID
FROM technicianskill
LEFT JOIN employee ON technicianskill.EmployeeID=employee.EmployeeID
GROUP BY EmployeeID
HAVING  COUNT(DISTINCT technicianskill.SkillID)>1)tblTmp
);
```

This Query is used in order to adjust the pay of Employees with 2 or more skills in order to reward more skilled employees and raise morale and give reason for employees to expand their skill sets

The first line is used to disable safe update mode in order to allow changes to be made to the tables

it updates the pay field in the employee table for employees who fit the criteria where the code in the brackets is used to find the EmployeeIDs that have more than 1 technical skill by selecting the EmployeeIDs from the technicianskill which is left joined with the employee table using the shared field of EmployeeID the line

Group BY EmployeeID is used to ensure that more than one result is returned and make sure the select statement doesn't only return one result and the line that follows is used to Count the skills that each employee has using the SkillID

The SELECT * FROM()tblTmp is a Used in order to allow the statement to function in MYSQL

Query 4 : Increase rent based on size of apartments.

```
SET SQL_SAFE_UPDATES = 0;
UPDATE lease
Left JOIN apartment ON lease.AptID = apartment.AptID
SET lease.Rent = lease.Rent * 1.1
WHERE apartment.TotalArea >= 15;
```

This query is used to find the apartments with a large area and increase the rent of each by 10%.

The first line, SQL_SAFE_UPDATES = 0; is used to disable safe update mode in order to allow updating a table without referencing a primary key. The LEFT JOIN is used as the rent for the apartments is not in the apartment table, but rather in the lease table. The LEFT JOIN joins the apartment table and the corresponding apartments that match it in the Lease table.

The query then increases the rent of theses returned apartments by 10%, providing they match the WHERE criteria and are of a large enough area to warrant the rent increase.

Coping with Changes

Expansion Plan:

In designing our system, whilst important to meet the user requirements it is also a priority to design the database in such a way that it can adapt to both a change in business process as while as allowing room for expansion. As a result, we will detail how we approached this challenge. Queens Accommodation has a requirement for better management of their employees in particular, the managers. Through easy tracking of employees QA can identify employees who have shown commitment to work and handling jobs with considerable responsibility. Allowing for them to be considered for a managerial role, similarly mangers who are performing particularly well should have their current pay band evaluated based off their tracked statistics.

One other possible area for expansion is seeking for ways to distinguish different roles within the company more clearly than the current system provides, for example, currently employees skill is separated by 3 skill types, as a result this would provide a more accurate representation of the administration roles and customer/tenant service. Therefore, they can place people in the correct roles, more suited to their ability and experience. QA are also in search of more experienced staff with broader skill sets and in conjunction; a system to track such experience and manage it appropriately. The system may also be required to keep track of staff conduct, rewarding or disciplining accordingly.

System Changes:

After careful consideration we will outline how our system can adapt to these possible areas of expansion by not only meeting the requirements but also future proofing the system. Our first area of change is regarding the employees, including managers. To do we will add a separate table relating the roles of employees separate to the skill they possess such as administration and service.

For managers we can take a similar approach by using a field which lists the number of apartments they manage and the number of leases they have signed and overview as it is assumed if a manager signs a lease it is their responsibility to supervise it. This method copes with two separate areas of expansion as it fully encapsulates the management of staff by rewarding both employees and managers for good performance as well as considering their skill type as a contributing factor.

Another change in the system is in relation to the experience employees have regarding their role. Rather than a linking table it should be considered that a field with years' experience with an auto incrementing formula based off the time served should be included in order to reduce complexity of the database. Diving in to the more complex system changes we evaluate the requirements of the appropriate assigning of employees to jobs based off their expanded skill set and roles as previously stated. Using the added fields and relationships we must construct a template query which accurately searches the most appropriate employee based off variables which are chosen by the user. This can be done via user interface with labelled text boxes whereby a member of staff can fill in the boxes to yield the most appropriate results.

The last area of expansion listed was the tracking and management of staff conduct. To cope with this within a database we can introduce a small int field which acts as a score based off conduct and possibly performance if deemed appropriate. A member of staff with complaints and a history of poor performance will have a lower number in this field, meanwhile staff with good reviews and performance will score higher. This not only helps rewarding/disciplining staff but can contribute towards the promotion of roles and pay bands. The primary focus of these changes is the management of staff rather than the tenants. However, these changes to administration process has a direct impact on tenant satisfaction making QA a professional and more organised business

Individual Contributions Record

Group Member St. Number	Task(i)	Task(ii)	Task(iii)	Task(iv)	Group Member Totals
40226787	60	5	17.5	15	97.5
40231585	10	37.5	17.5	15	80
40247459	10	30	17.5	15	72.5
40204680	10	0	30	40	80
40227918	10	27.5	17.5	15	70
Total	100	100	100	100	400

The team has agreed on the proportional weighting of this ICR and believe it is reflective of work done.

Individual Contributions Narrative

Rowan Adair: My primary role within the project was as team lead. Organizing the work done by team members using a Kanban through Trello to track stories. I also set up a private Git repository with extensive information on the syntax we would use, software used and anything else that needs to be known. Making sure everyone had the same scripts, report version and relevant resources. Along with this I organized and coordinated team meetings weekly, with stand-up meetings and more extensive 2-hour group work meetings. I designed the entity relationship diagram and established the different constraints within the system documenting all relevant assumptions. I was also responsible for completing query 1 in our group's querydb48.sql file. Along with writing my own script I tested the rest of the team's scripts and corrected any bugs as they arose. In summary my primary role was team lead and organization, my secondary role was system design and query script writing. My tertiary role was testing and debugging any scripts pushed to the master branch.
Conall Carlin: My roles within this project range from assisting group members in tasks listed for this project where appropriate. My specific roles in which I invested the largest amount of time was in creating the insert script for the database which I quickly learned this was a long task if done insufficiently. As a result, I designed small java programs to generate random values based off a defined array or random numbers in order to speed up the creation process and ensure accurate yet plentiful test data. Once finalised we as a group discussed coping with changes within the database as well as allowing for/looking in to possible areas for expansion and it was my role to bring these ideas together into a coherent analysis for future proofing.
Barney Young: The most significant part of my contribution was the createdb48.sql file, which I wrote, based on the ERD and schema. I was also responsible for completing query 2 in our group's querydb48.sql file. Like the other group members, I helped in other ways by attending and contributing to the group meetings and correcting and assisting with some errors in group files.
Youssef Emam: I contributed to the project by writing the cleaning script as well as writing the 3rd SQL Query which is used to raise the pay of employees with 2 or more skills in addition I contributed to the other tasks by helping with the planning for those tasks alongside the other members of the team.
Scott Lam: I designed our teams table schema, providing the core basis and backbone upon which to base the implementation and creation of the database. I was able to create the schema based off the E-R Diagram provided earlier. I created query 4, as well as attended team meetings and gave assistance wherever possible.