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| Assignment 1 – Part A |
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# Brief

We are creating a database to control a City Council’s local libraries:

* Each Library has a number of Employees.
* One Employee is designated the manager and is responsible for day-to-day employee supervision.
* Each library stores a number of books on shelves.
* Each library stores a number of CDs in racks.
* Details of book publishers are maintained, but not CD publishers.

Searches are conducted based on:

* Book or CD title
* The artist/authors name
* Or the publishers name.

A Customer:

* Must register as a member of a library before they can borrow.
* Can borrow at any of the council’s libraries.

When a Customer borrows a Book or a CD:

* Loan is given for up to two weeks.
* A late fee of $1 per day is accrued per item, after the loan period expires.

Queries that must be supported:

* Present a report listing library details (Location, telephone, web address etc) and the manager.
* Present a library-wise, position-wise listing of employees who are earning over $50k and will retire in the next 15 months. Should detail; employee number, complete name, sex, various contact details, IRD number.
* Present a report listing all the books along with their authors, including ISBN, title, year of publications etc
* A category-wise report listing CDs along with their artists that were released in the last 2 years.
* Present a report listing, in ascending order of name, all the city council library employees who have served for longer than 10 years.
* Present a report listing all library members, by order of family name who are aged between 11-16 years and have borrowed any item from the adult fiction category in the last 6 months.
* Present a report that displays category-wise total number of books in a library.
* Present a weekly report listing all the members who are required to pay fines for late returns. This report should be sorted by the member’s first name.

# Assumptions about Entities:

There are an array of assumptions which I have had to make in order to construct my models. In this section I will briefly outline them. I will start with justification of entity properties. Some properties are self-explanatory, however others are not so clear cut, and it is here that I would like to explain my reasoning for including them. Although I will be listing some of the data I believe would be required for accounting purposes, I feel that it is outside the scope of this initial document.

### A Library:

As we think about a library, as a physical entity that is non-living it must have –

* A name by which it is known, for example Albany Public Library.
* A location which will include a physical address.
* A contact phone number.
* A general purpose customer care email address.
* A unique identification of some sort, preferably numerical.

### An Employee:

Thinking about an employee –

* A name, stored either as individual segments, or perhaps as a singular.
* A salutation. Are they known as Mr, Mrs, Ms, or Dr?
* An address, where the employee lives.
* A contact phone number.
* An email address.
* A Date of Birth.
* An Employment Start Date.
* An IRD number, for tax purposes.
* A tax code.
* A salary, or wage descriptor of some sort.
* Where the employee is employed.
* A role descriptor of some sort. For example; manager, returns specialist.
* A unique identification of some sort, preferably numerical. Does this need to be unique, or more accurately, do we need to create a new one? Perhaps not, the New Zealand IRD has already issued this person with a unique identifier in the form of their IRD number. This could possibly be used to identify the employee.

### A Customer:

In the sense of a Library we can loosely define a customer as a member of the public which uses the libraries services. As they are human, like an employee, we can start out with roughly the same host of attributes –

* A name, stored either as individual segments, or perhaps as a singular.
* A salutation. Are they known as Mr, Mrs, Ms, or Dr?
* An address, where the customer lives.
* A contact phone number.
* An email address if available.
* An account balance – this would be used to account for late fees.
* A current status – can they borrow, or are they forbidden?

**A Book:**

A book is a physical item which the library loans – the essence of the service supplied by the library. As we think about the sorts of fields required to describe a book, then we realise that these are well rehearsed –

* Title – what the book is called.
* Author.
* Publisher.
* Year of Publication.
* ISBN – depending on when the book was first published this may be a 10 or 13-digit number, and it may have multiple values that represent various editions.
* Series – is this book part of a series? Is it a prequel, sequel, or member of a trilogy, tetralogy etc. If so, what is the series known as?
* Subject – a group of key words which will aid in secondary type, wild car searches. For example; looking for books which are thrillers, or period pieces, or that are about international espionage.
* Library – the place that has the item.
* Location – where it can be physically found.
* Physical Description – in what format is the book presented?
* Availability Descriptor – is this book present in the library or is it currently out on loan?
* A unique identification of some sort, preferably numerical. Does this need to be unique, or more accurately, do we need to create a new one? Perhaps not, several have already been issued. However, because there may be more than one it is preferable that a new, unique identifier is created for THIS book. Also, the library may carry more than one copy of a single book. In this case the ISBN numbers would be the same, and there would need to be a method to identify which physical copy was being referred to.

**A Compact Disk (CD):**

As with a book, a CD is a physical item which the library loans. Although not a traditional item found in a Library, they have had a presence for some time now. There are some similarities between books and CDs from an attributes standpoint, however there are also differences.

A CD needs –

* A title – what the album or recording is called.
* An Artist or Performer – the party responsible for the creation of the recording.
* Publisher or ‘Label’.
* Year of Publication.
* ISBN – Some recordings are eligible for this. To qualify they must contain spoken words, or be instructional.
* ISNM – International Standard Music number, stored as a barcode on the CD cover-slip.
* Subject or Key Words - a group of key words which will aid in secondary type, wild car searches. For example; Rock music, Smooth Jazz, Saxophone.
* Number of Discs – often an album or will span one or two disks, so this information will be required to ensure that everything is returned or present.
* Library – the place that has the item.
* Location – where it can be physically found.
* Availability Descriptor – is this book present in the library or is it currently out on loan?
* A unique identification of some sort, preferably numerical. As with books before, these sorts of numbers already exist. However, they do not pertain to the actual stock that the Library has on hand, rather they relate to the recording in general. In other words, they do not actually identify a particular instance of the recording.

While the entities I have listed above are physical objects, there is an abstraction that has to be dealt with. This is a crucial business practice for a Library, and it is the act of borrowing (or lending) a book or CD.

**A Loan:**

Loan needs -

* A record of the Customer who borrowed something and created the Loan
* A record of what was borrowed/loaned – preferably referring to it by its unique identifier.
* A date the Loan was created.
* A date the Loan expires – when the item is due back.
* The date the Loan is terminated – the day the item is returned.
* Any fees that might be accrued by the Loan.

# Assumptions and Thoughts about Relationships:

In this section I will deal with, and try to explain, the assumptions about the relationships between entities. They can be summarized by a number of simple statements.

* A library may have many employees.
* While it is probable that an employee may work at more than one library, for the purposes of this assignment I have chosen to limit an employee to a single library. An employee cannot exist without a Library (otherwise where would they go to work? If they don’t have a job, they can’t be an employee.) Likewise, a Library must have at least one employee (unless completely automated).
* As with the number of Libraries an employee may work at, I have chosen to limit the relationship between employee and manager. For the purposes of this assignment an employee may only have one manager. Therefore; the relationship between employee and manager is 1:1. Although perhaps manager does not need to exist as a separate entity, rather as an employee.
* The relationship between manager and employee is 1:N; a single manager can manage many employees.
* A Library has only 1 manager. It is perfectly conceivable that there are more than one managers associated with the library, however for this assignment, it will be more prudent to define precisely the type of binary recursive relationship that exists here. Along with having an employee, a library must have a manager. I suppose, by default, a solo employee is declared a manager.
* A customer may borrow from many Libraries – the brief describes a City Council type situation where a single entity owns many Libraries. The Libraries provide a public service that is given to the customers by the council, therefor they should be treated as branches of a greater entity. A customer cannot create an instance of a loan without a Library, and vice-versa.
* A Library can have many CDs and Books, but the books and CDs can belong to only 1 Library.
* A customer may borrow many CDs and Books on/within a single instance of a loan entity. However, for practical reasons it would be advisable to impose a restriction on this amount, an arbitrary number of some sort to prevent over exposure of Library assets. However, this decision would be made from either a management or accounting standpoint, and is probably outside the scope of database design. For the sake of this assignment I will be leaving the relationship description as 1:N. In order to create a Loan instance a Book of CD must be borrowed. A loan cannot exist without something being borrowed, therefore an instance of a loan must have one or more Books or CDs. However, a loan can be just of a CD, or just a Book.
* A CD or Book may only be borrowed by one customer at a time. The relationship that exists is therefore a 1:1 relationship.

# Business Rules based on Assumptions:

For the purpose of this assignment I have chosen to examine rules other than the requirement that an entity must have a unique identifier. It should be assumed that, as well as the rules listed below, a unique identifier is required. It should also be assumed that all attributes of an entity are required fields.

### Rules for a Library:

1. A Library must have an employee.
2. A Library must have a manager.

### Rules for an Employee:

1. An employee must work at a Library.
2. An employee can have only one Manager.
3. An employee can work at only one Library.

### Rules for a Book or a CD:

1. A Book or CD must have a relationship with a Library.
2. A Book or CD can only be borrowed or loaned to one Customer at a time.

### Rules for a Customer:

1. A Customer can borrow from many Libraries.
2. A Customer may borrow many Books and/or CDs.
3. A Customer may have more than one instance of a Loan at any given time.

### Rules for a Loan:

1. A Loan must have a Customer
2. A Loan must have one or more items attached to it.

# Part A Logical Database Design

## An Entity Relationship Diagram:

Thinking about entities, there should be several. An employee is a required entity, along with a library. Both a book and a CD should be an entity. A customer is an entity that can generate a Loan, and a Loan is a non-physical entity.

Please see my Visio diagram, which details the relationships between each entity.

## Normalization Process: