FIT2094 Databases

Week 3 Applied Class Activities

CONCEPTUAL MODELLING

FIT Database Teaching Team

Complete the week 3 activities:

3.1. Conceptual Design - Class Discussion

3.2. Using Tools to draw an Entity Relationship Diagram
- 3.2.1 Setting up Lucidchart
- 3.2.2 Creating a new Lucidchart Diagram
- 3.2.3 FIT2094 Entity Relationship Diagram Standards
- 3.2.4 Drawing ER Diagram Using Lucidchart

3.3. Conceptual Modelling Exercise

FIT2094 2022 S1

FIT2094 Databases

Author: FIT Database Teaching Team

Important

Remember before starting any lab activity which involves working with files (here we will be generating PDF documents), first use SQL Developer to pull from the FIT GitLab server so as to ensure your local files and the FIT GitLab server files are in sync.

Learning Objectives:

At the completion of these applied class activities, you should be able to:

- develop a full conceptual model (on paper or using Lucidchart) from a supplied scenario
- use crows foot notation on a conceptual model according to the FIT2094 standards:
    - correct identification of the KEY attribute/s of an entity
    - correctly showing min and max cardinality on all relationships at both ends
    - correct naming via a verb of each relationship
    - correct indication of identifying vs non-identifying relationships

3.1. Conceptual Design - Class Discussion

Your tutor will discuss and draw an ER diagram for the Department-Employee-Project case study below:

Entities:

- Employee: employee id, name, address, phone, date of birth, degrees (an employe may have more than one degree)
- Department: department number, department name
- Project: project number, project description, number of employees assigned to the project

Business rules:

- A department employs many employees, but each employee is employed by one department.
- Some employees, known as "rovers," are not assigned to any department.
- An employee may be assigned to many projects, and a project may have many employees assigned to it.
- A project must have at least one employee assigned to it.
- One of the employees manages each department, and each department is managed by one employee. An employee can only manage one department.

3.2. Using Tools to draw an Entity Relationship Diagram

There are several tools available to draw ER diagrams. Some of them are available to be used within a web browser. Some examples of these are:

- Lucidchart - this product is a browser-based diagramming tool; it is able to draw a wide range of different diagrams, including ER Diagrams, or
- any other drawing package you wish, such as:
    - Diagrams.net (https://www.diagrams.net/) previously draw.io,
    - Gliffy (https://www.gliffy.com/), or
- CASE (Computer Aided Software Engineering) tools

At this stage of our study, **we do not wish to use a CASE tool** - it is important that we first establish a clear understanding of Entity Relationship Modelling so we will ***only*** make use of a drawing tool. For FIT2094, we recommend LucidChart, however you may use any drawing tools

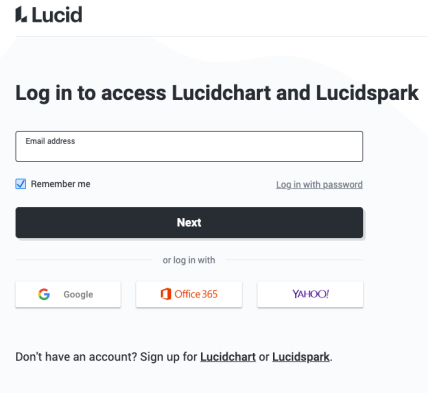
you wish **PROVIDED** you conform to the FIT2094 ERD Standards listed in section 3.2.3 below. Failure to conform to these standards will result in grade penalties for your assignments.

3.2.1 Setting up Lucidchart

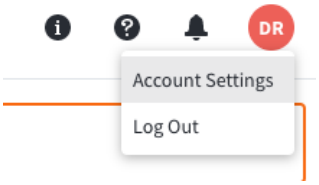
The Lucidchart Education account details and sign up are here.

Students *must create their own account* by signing up for an education account with your **Monash educational email address** at the URL listed above. Rather than managing another password the *best* approach is to login to LucidChart **with your Monash Google details**.

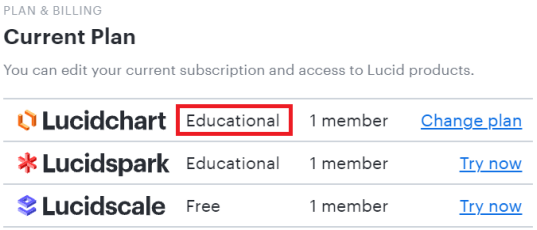
To use your Monash details to log in simply ensure you have authenticated to Monash and select "or log in with" Google on the main Lucidchart page:



Once you logged in, go to Account Settings:



and check the Current Plan, make sure that your plan is an Educational plan.



If your plan does not show “Educational”:

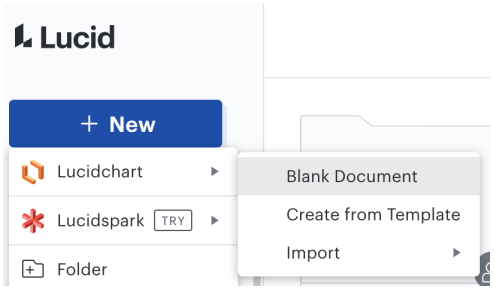
1. Use this form to request an education account, be sure to enter your Monash details, explain that you currently have a free account
2. If step 1 is not successful:
   Please contact the Lucidchart Support team with your Monash ID verification (support@lucidchart.com). The verification can be an image of your student id card, a screenshot of your Monash Gmail details clearly showing your Name and Monash email address (click on the top-right icon and capture the pop up which occurs), or a screenshot of your profile from Moodle, or enrolment documents which clearly show your name and Monash email address.

3.2.2 Creating a new Lucidchart Diagram

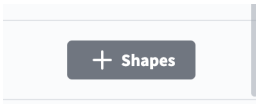
As an education user, you are limited to three editable documents, although each document can contain an unlimited number of objects.

A document may consist of multiple tabs, so we suggest that you use your three documents as one for applied class work, one for assignment work and one for general/testing work. In each of these documents you can add tabs as needed (see page 6).

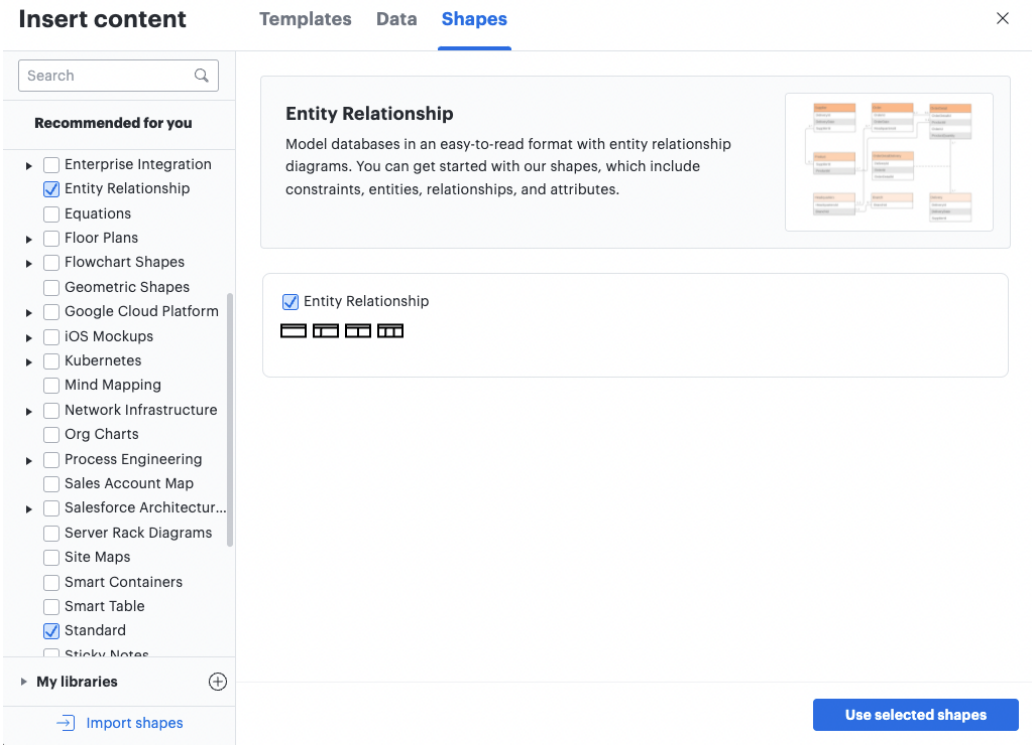
Login directly to Lucidchart, click + New → Lucidchart → Blank Document:



then add the ERD shapes by selecting "+ Shapes" (in the left panel)

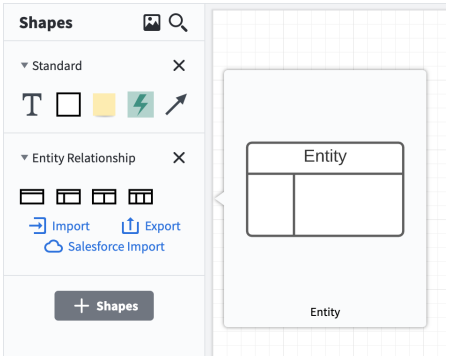


then check "Entity Relationship" in the "Standard" and then click Use Selected Shapes:

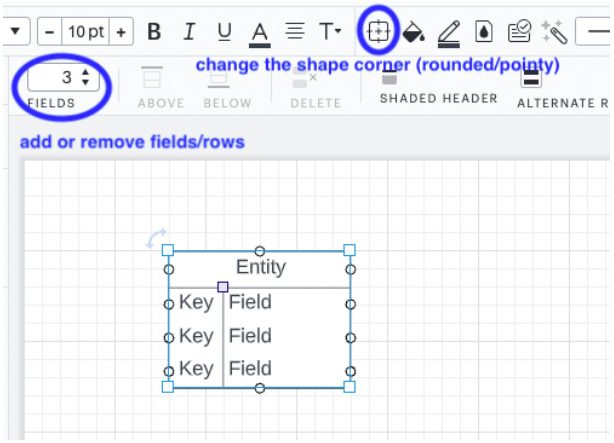


You can remove the Flowchart and Geometric Shapes symbols from the left panel as we do not use them.

For an ER Diagram. the **only** symbol we will use to represent an entity is the second symbol from the left:

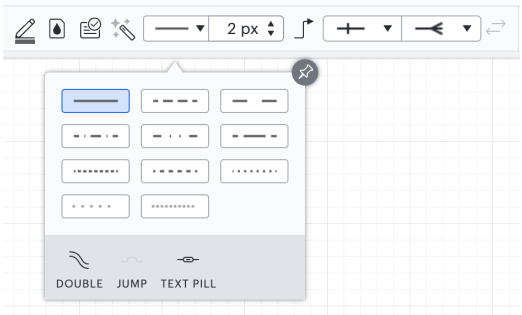


You can add or remove fields by clicking on the entity and use the advanced shape bar to change the number of fields and the shape of the entity:

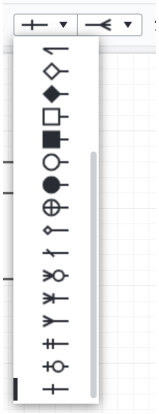


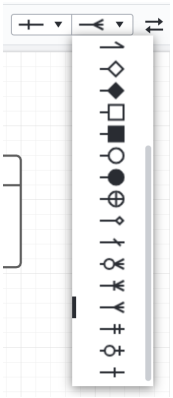
After you have added your entities you need to add the relationship lines. Click one of the dots in a entity and drag it to the other entity to add a relationship:

Click the line icon in the toolbar to pick the relationship line style - solid (identifying) or dashed (non identifying):

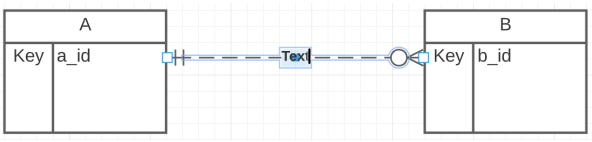


Click the end of line icon to pick the appropriate symbol to represent the min and max cardinality:



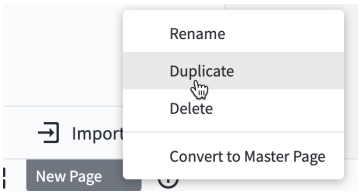


Double click the relationship line to add a label:



To add a new tab to your diagram, either:

- make a copy of the current tab - click on the down arrow of the tab (or right click) and select Duplicate



- or simply click on the ⊕ symbol to add a new blank tab.

You should use the "Rename" option on a tab to ensure it is named appropriately. When building a model at the end of each significant step (eg. adding entities and keys) you should duplicate the tab before moving to the next step. You can then move back a step if you need to.

Please note for FIT2094 you **must not** make use of the Lucidchart Import option, you must manually create your model by drawing the ERD in Lucidchart. **Models which have been imported *will not be assessed*.**

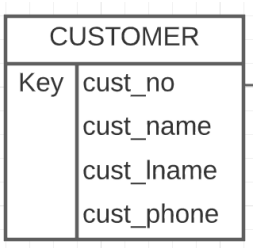
3.2.3 FIT2094 Entity Relationship Diagram Standards

Your models must conform to the following standards. For assessed work, failure to meet these requirements will incur grade penalties:

a. Entities must be indicated via the ENTITY shape:

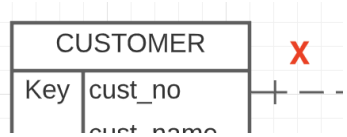
Entity names must not be pluralised

b. All key attributes must be indicated by the word Key in the first column of the entity shape, non key attributes should have the first column left blank. Attribute names should use a common prefix to indicate the entity they belong to (see cust_ below). Attribute names must not include spaces or hyphens (-). There is no requirement to indicate required and optional attributes, for example, by using a bold font.

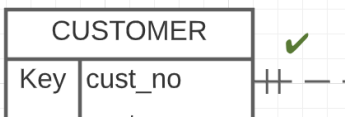


c. Relationship lines must include a label, a verb to describe the relationship eg. places (as a general rule try to name these relationships in the 1:M direction)

d. Minimum and maximum cardinality must be shown at each end of the relationship. Using a single line to indicate min 1, max 1, such as shown below, is not acceptable



two lines must be shown as indicated below



e. All relationship lines must correctly indicate if the relationship is identifying (a solid line) or non-identifying (a broken line). Each relationship must have a label.

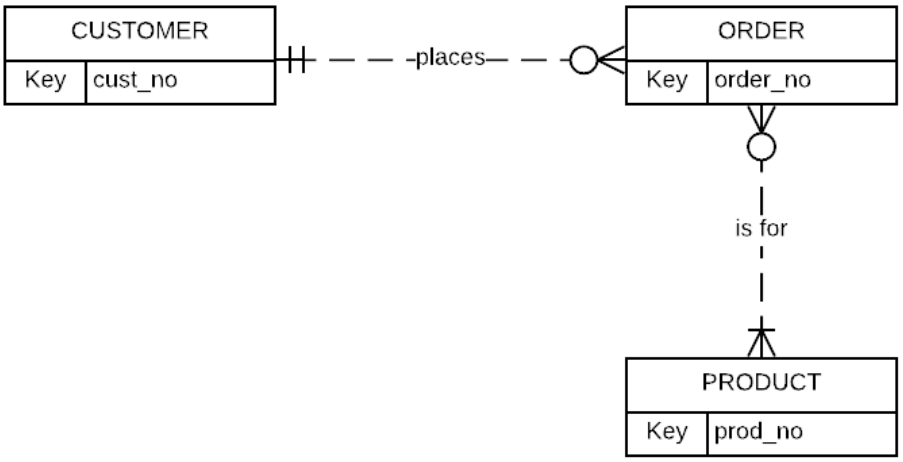
Relationship lines must be straight lines (although they may be stepped), and must not cross.

3.2.4 Drawing ER Diagram Using Lucidchart

Given a scenario represented by the following entities, where customers place orders for products:

- CUSTOMER - customer number, name, address, phone number
- ORDER - order number, order date and for each product ordered the quantity ordered and the total line price
- PRODUCT - product number, product description and product unit price

You should first draw an ERD that shows entities and key attributes only, as a preliminary analysis of the scenario you are modelling. An initial ERD using Lucidchart for the customer-orders scenario would be:



Prepare the ERD shown above using LucidChart.

Where possible M:N relationships should be left on a conceptual model as they make the model simpler and easier to visualise.

The next step is to draw a full conceptual model, i.e. a conceptual model which includes all attributes to satisfy the scenario.

Rather than overwriting your current diagram, whenever you are about to make major changes, you should duplicate the current diagram into a new tab, and then change this new tab.

When moving to a full conceptual model, it may be necessary to add attributes which need to be recorded in a relationship. In the customer-orders model above, if we wish to record the quantity of a product ordered and the total line price:

- These attributes cannot be placed in the ORDER entity (an order has potentially many products) nor
- can they be placed in the PRODUCT entity (a product has potentially many orders).

Here we need to add a new entity ORDERLINE which brings one order and one product together - this new entity converts the M:N relationship between ORDER and PRODUCT into two 1:M relationships. In naming this new entity which is called an "associative entity" (or composite entity

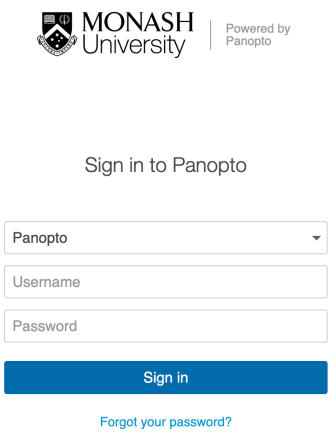
or bridging entity), when a natural name is not clear, you can use the parent entity names - here this would be ORDER_PRODUCT.

As you complete the parts of this exercise, regularly download your model as a PDF and add it to your local repo and push it to the FITGitLab server.

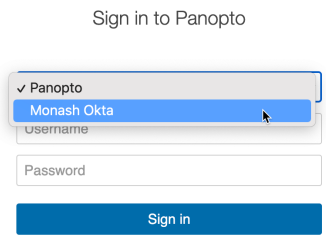
Note, the way in which Git manages files (creates versions) means *you do not, and should not, give your downloads names such as cust_order.pdf, cust_orders2.pdf etc*. **Simply use the same name all the time eg. cust_order.pdf, Git will manage the version control as you saw in the last applied class**.

A video is available which demonstrates the way you should download and manage your files in Git. This video shows how Git maintains a history of all the files you push and how you can access older versions of your files.

Please note if, when accessing the video link above, you see:



Please ensure you select Monash Okta from the pull down menu



And then sign in with your Monash credentials.

3.3. Conceptual Modelling Exercise

Prepare an Entity Relationship Diagram (ERD), showing all attributes and the identifier of each entity for the following description of a Property Rental System:

- Properties are rented by tenants. Each tenant is assigned a unique number by the Agency. Data held about tenants include family name, given name, property rented, contact address - street, city, state, postcode & telephone number. A tenant may rent more than one property and many tenants may rent parts of the same property (eg. a large shopping complex).
- Properties are owned by owners. Each property is assigned a unique property number. The agency only recognises a single owner for any of the properties it handles. The owner, address, and value are recorded for each property. Also, the lease period and bond are recorded for each property or sub-property rented. An owner may own several properties. For each owner an owner number is assigned, the owner name is also recorded.
- Properties are subject to damage and the agency records all instances of damage to its properties - property, date, type of damage and repair cost are recorded. Repair costs are charged directly to tenants
- Tenants pay accounts to the Agency - these consist of weekly rental payments, bond payments (for new properties) and damage bills. The date of payment, tenant, property, type of account (Rental, Bond, Damage) and amount are recorded. Each payment is assigned a unique payment number.

You should prepare a conceptual model based on the details supplied here, however as you model note down the areas where you consider further information is required from your client.

You may draw your initial conceptual model on a paper, but you must, in your own time outside the applied class, draw the diagram using Lucidchart. As you work on this model on Lucidchart, regularly download your model as a PDF document, add it to your local repo and push it to the FITGitLab server (you do not need to close your browser to do the push).

Important

After you have completed your current lab activities, at the end of each session remember to use SQL Developer to add files, commit and push any changes you have made to the FIT GitLab server.

You need to get into the habit of establishing this as a standard FIT2094 workflow - pull at the start of your working session, work on the activities you wish to/are able to complete during this session: add files, commit changes and then push the changes back to the FIT GitLab server.

You MUST also check regularly by logging in to the web interface of the FIT GitLab server to ensure your pushes are being received by the server correctly.