Applied 3 Conceptual Modelling

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After completing this activity, 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 unit 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.

This activity supports unit learning outcomes 1, 2 and 3.

A3-1 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 can draw a wide range of different diagrams, including ER Diagrams, or
- any other drawing package you wish, such as:
    - DrawIO (https://www.drawio.com/) ,
    - Gliffy (https://www.gliffy.com/), or
- CASE (Computer Aided Software Engineering) tools

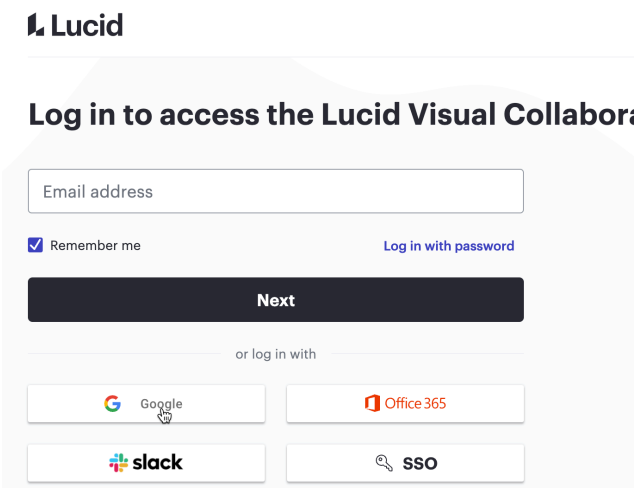
At this stage of our study, **we do not wish to use a CASE tool** - it is important that we first establish a clear understanding of Entity Relationship Modelling so we will ***only*** make use of a drawing tool. For our unit, we recommend Lucidchart, however you may use any drawing tools you wish **PROVIDED** you conform to the unit ERD Standards listed in section A3-2 of this lesson. Failure to conform to these standards will result in grade penalties for your assignments.

A3-1.1 Setting up Lucidchart

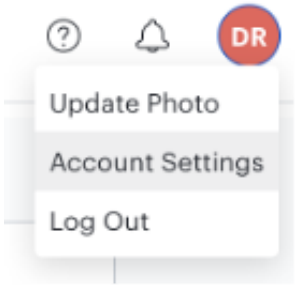
The Lucidchart Education account details and sign up are here.

> Students *must create their own account* by signing up for an education account with your **Monash educational email address** at the URL listed above. Please be careful to use your Monash student email address when you create your new account at this link and select "Student" in the pop up which occurs when you first login in. Rather than managing another password the *best* approach is to login to Lucidchart **with your Monash Google details** for all subsequent logins.

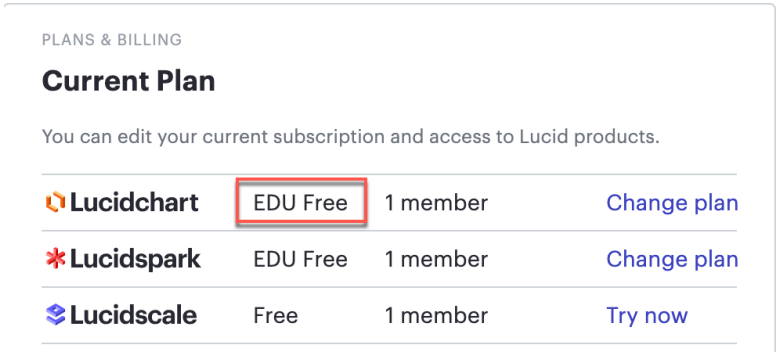
To use your Monash details, for subsequent log ins, simply ensure you have authenticated to Monash in your browser and select "or log in with" Google on the main Lucidchart page:



Once you logged in, go to Account Settings:



and check Plans & Billing and then the Current Plan panel, make sure that your plan is an Educational plan.



If your plan does not show “EDU Free”:

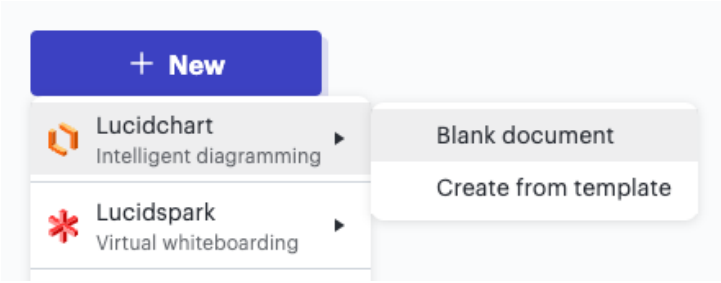
1. Use this form to request an education account, be sure to enter your Monash details, explain that you currently have a free account
2. If step 1 is not successful: Please contact the Lucidchart Support team with your Monash ID verification (support@lucidchart.com). The verification can be an image 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.

A3-1.2 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.

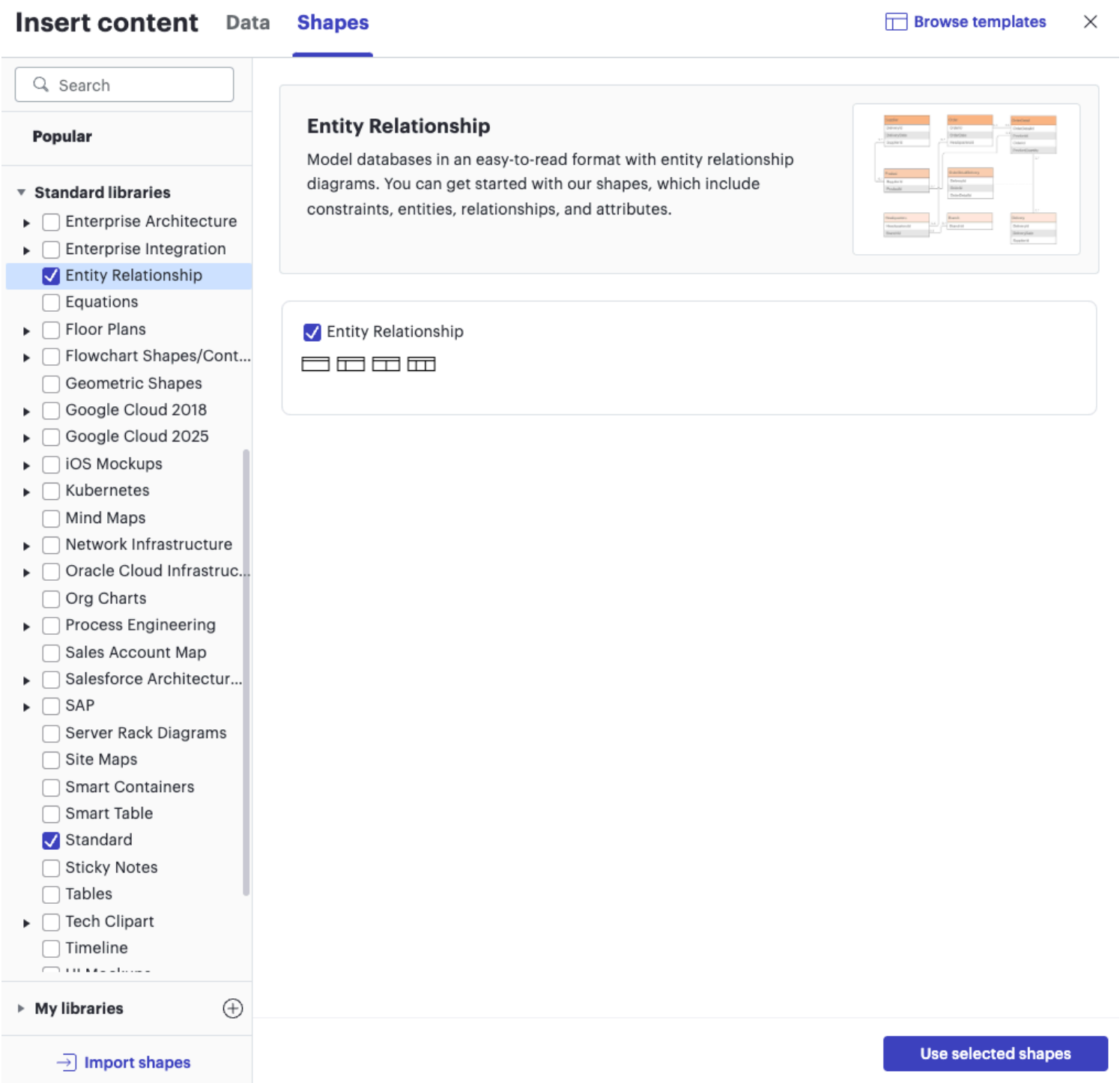
A document may consist of multiple tabs, so we suggest that you use your three documents as one for applied class work, one for assignment work and one for general/testing work. In each of these documents you can add tabs as needed (see below).

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



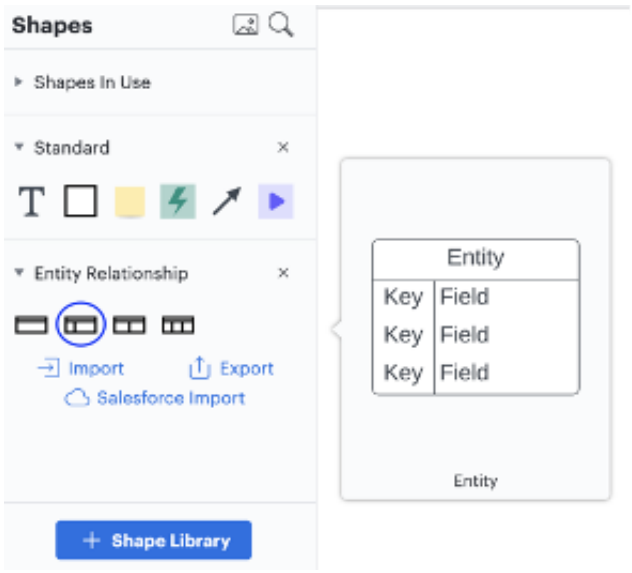
then add the ERD shapes by selecting "More Shapes" (in the left panel)

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

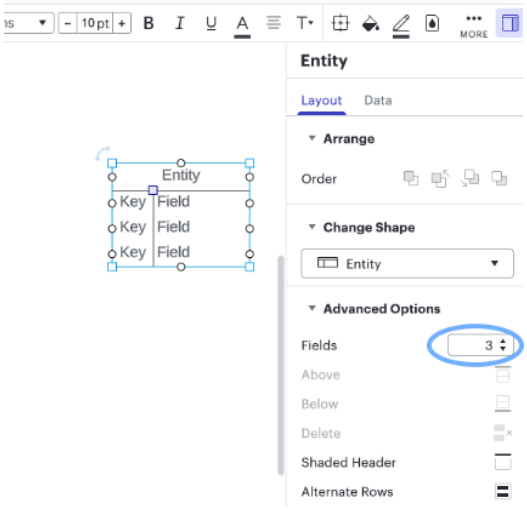


You can remove the Flowchart and Geometric Shapes symbols from the left panel as we do not use them.

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

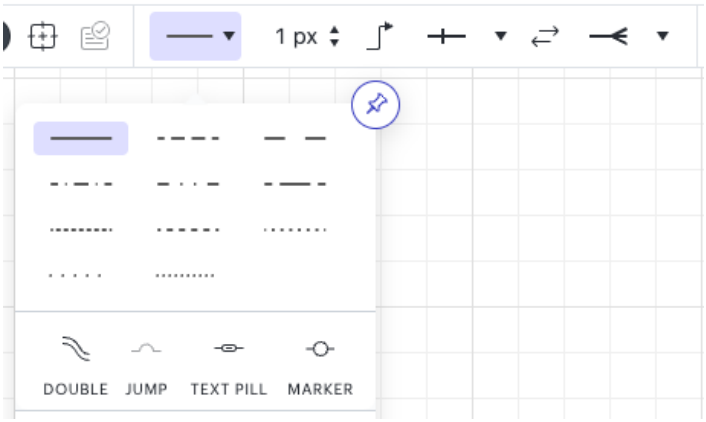


You can add or remove fields by clicking on the entity and using the right-hand Entity panel to make any changes:

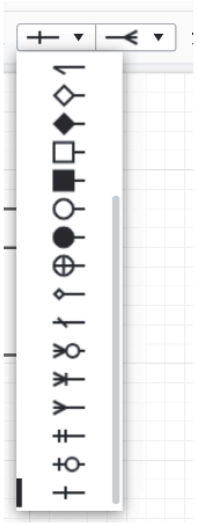


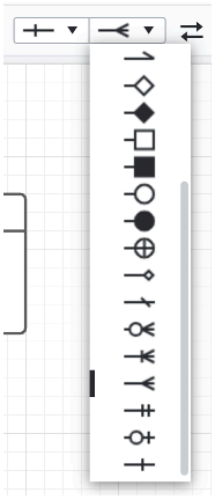
<u>After you have added your entities</u>, you need to add the relationship lines. Click one of the dots in a entity and drag it to the other entity to add a relationship:

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:

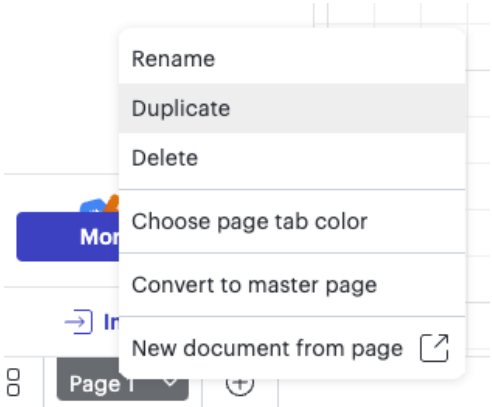




Double click the relationship line to add a label:

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.

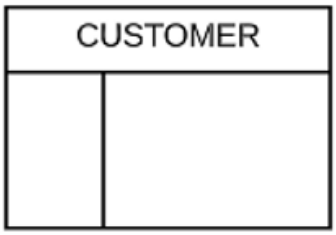
You should use the "Rename" option on a tab to ensure it is named appropriately. When building a model at the end of each significant step (e.g. adding entities and keys) you should duplicate the tab before moving to the next step. You can then move back a step if you need to.

Please note 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*.**

A3-2 Unit Entity Relationship Diagram Standards

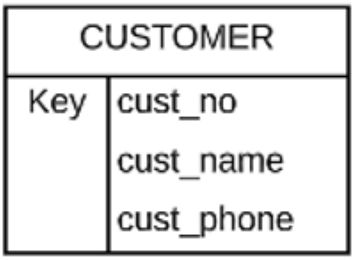
Your models must conform to the following standards. For assessed work, failure to meet these requirements will incur grade penalties:

a. Entities must be indicated via the ENTITY shape:



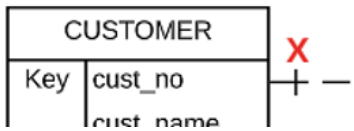
Entity names must not be pluralised and must not include spaces or hyphens (-).

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.

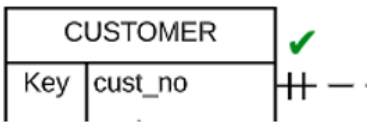


c. Relationship lines must include a label, a verb to describe the relationship e.g., places (as a general rule try to name these relationships in the 1:M direction).

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.

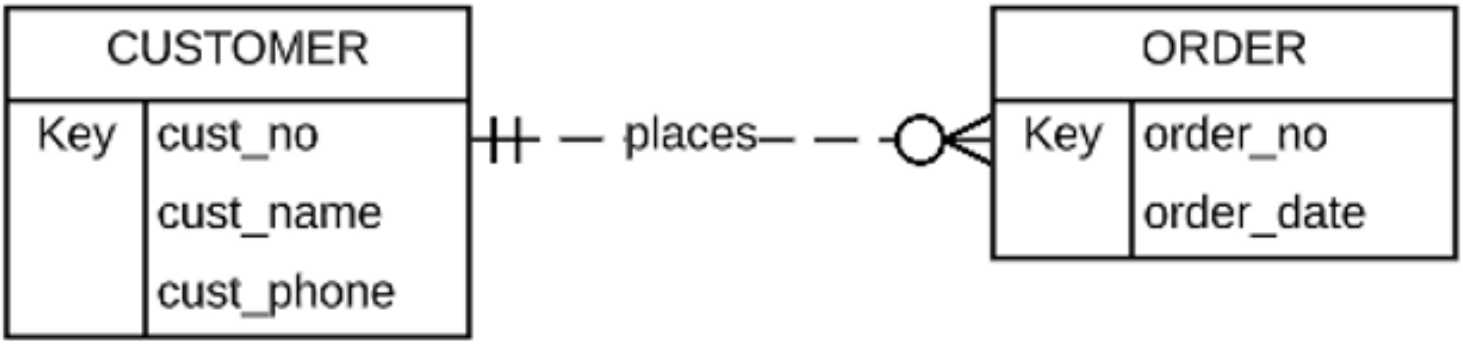


two lines must be shown as indicated below:



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**.

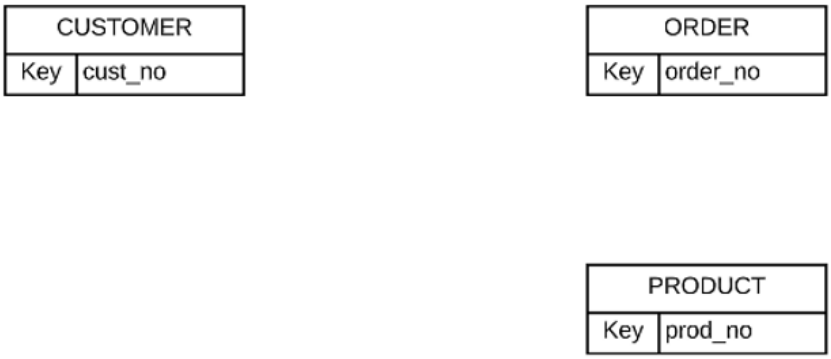
A3-3 Drawing an ER Diagram Using Lucidchart

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

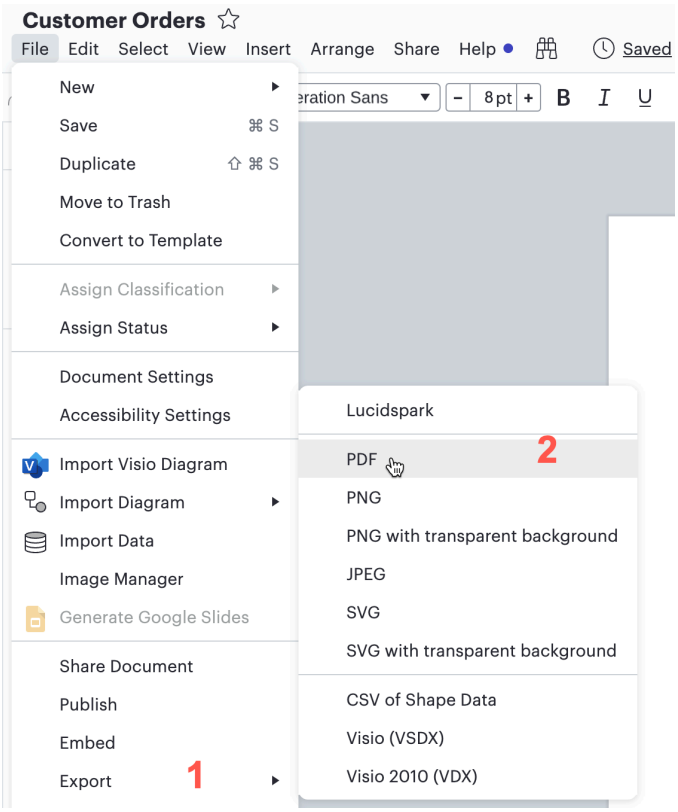
- CUSTOMER - customer number, name, address, phone number
- ORDER - order number, order date, total order value and for each product ordered the quantity ordered and the total line price
- PRODUCT - product number, product description and product unit price

Step 1: Add entities and key attributes.

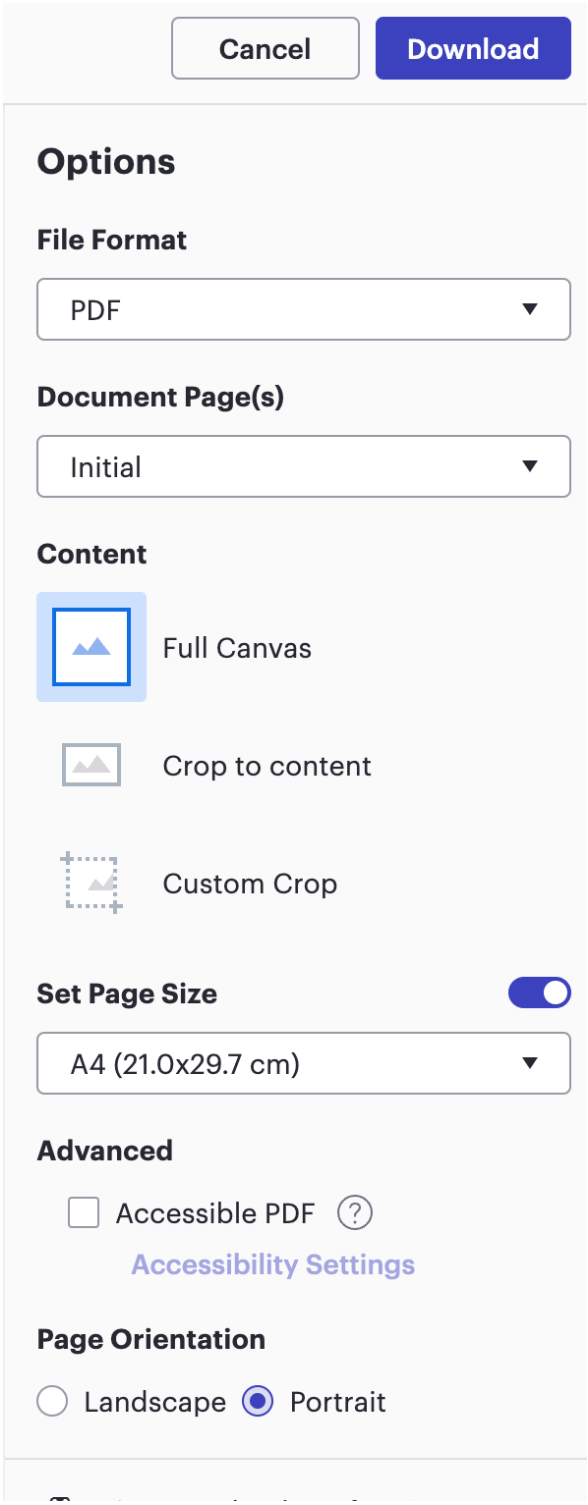
You should first draw an ERD that shows *entities and key attributes only*, as a preliminary analysis of the scenario you are modelling. An initial ERD using Lucidchart for the customer-orders scenario would be:



Prepare the ERD shown above using Lucidchart. Download the diagram (as a single page pdf file)



Use the settings:



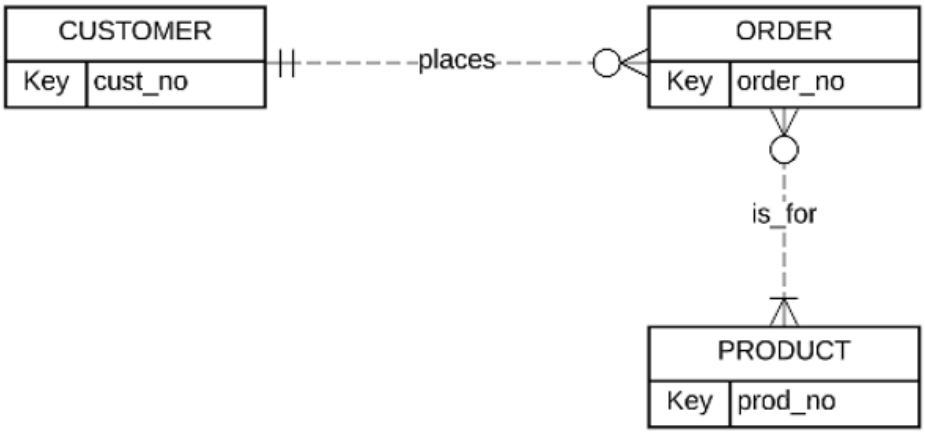
Save the download directly into your Applied 3 folder in your local repo as cust_orders.pdf, then add commit and push the file to the FIT GitLab server.

Where possible M:N relationships should be left on a conceptual model as they make the model simpler and easier to visualise. We only insert a bridging entity if forced to due to the requirement to save an attribute which is on the relationship.

Step 2: Add relationships.

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.

Our model with relationships added will have the form:



Download your new ER diagram into the Applied 3 folder in your local repo as cust_orders.pdf, then add, commit and push the file to the FIT GitLab server.

Note, as we have learnt, the way in which Git manages files (creates versions) means *you do not, and **MUST NOT**, give your downloads names such as cust_order.pdf, cust_orders2.pdf etc*. **Simply use the same name all the time, e.g., cust_order.pdf and overwrite the file in your local repo as you proceed. Git will manage the version control as you saw in your last applied lesson**.

Step 3: Add non-key attributes.

During this step, 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 work on your model, remember to download your ER diagram, using the same file name, into the Applied 3 folder in your local repo, then add commit and push the file to the FIT GitLab server. In this way you provide a development history and a mechanism where you can "back track" to an older model if necessary.

A3-4 Conceptual Modelling Exercise

Please ensure you save your downloaded PDF model versions for this task in your Applied 3 local repo folder (remember you must use only one filename for any given model, here, for example, property_rental.pdf). This task is important as it builds the skills you will need to complete the first task of Assignment 1, where you will need to build a conceptual model.

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 rental is arranged between the agency and one of the tenants. The only tenant details which are to be recorded in this system, are those of the tenant arranging the rental. 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 (e.g., 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's 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.

Using Lucidchart 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****.*

Important

You need to get into the habit of establishing a standard unit workflow of ensuring that all your Applied activities are pushed to your FIT GitLab repo. Regularly download your answer here as a PDF and add the files (stage), commit changes, and then push the changes to the FIT GitLab server.

Remember you should also use the Web UI (login to the web interface of the server) to check that your files are correctly being pushed and that your Git Author name is correct.