CP5804 Database Systems

Week 2: Lab activities

Using MySQL Workbench for ER Modelling

- **Learning outcomes and objectives**

  Student will be able to create Entity-Relation diagrams (ERD) in MySQL Workbench;

- **Pre-requisites**

  If you have not installed MySQL Workbench as instructed in Week 1 Lab activity, please complete the Week 1 Lab activity before starting this week Lab activity. You are assumed the basics of ER notation and ERD. Chapter 2 and 3 from Coronel-Morris textbook, which explains database models is also required reading. This tutorial assumes that you've read those, but if you have not studied those, please go and understand those topics before moving forward with this document.

- **Start MySQL Workbench**

  For this lab activity, it is not essential for you to connect MySQL server to MySQL Workbench, thus you do not need to concern about the connection at this stage if you have done it yet. (You will need to connect to server before starting the next week (Week 3) lab activity).
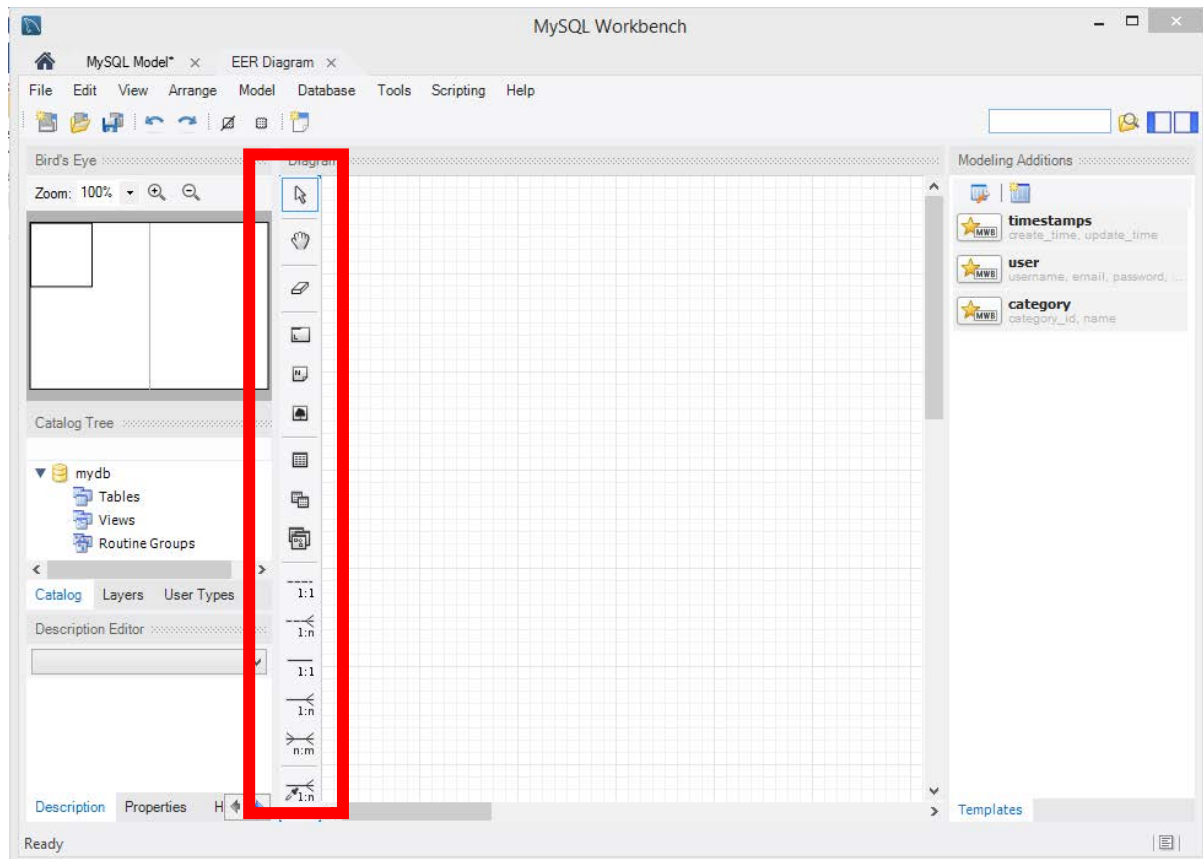
  For this lab, simply start MySQL Workbench, then the starting window may look like the image captured as below.
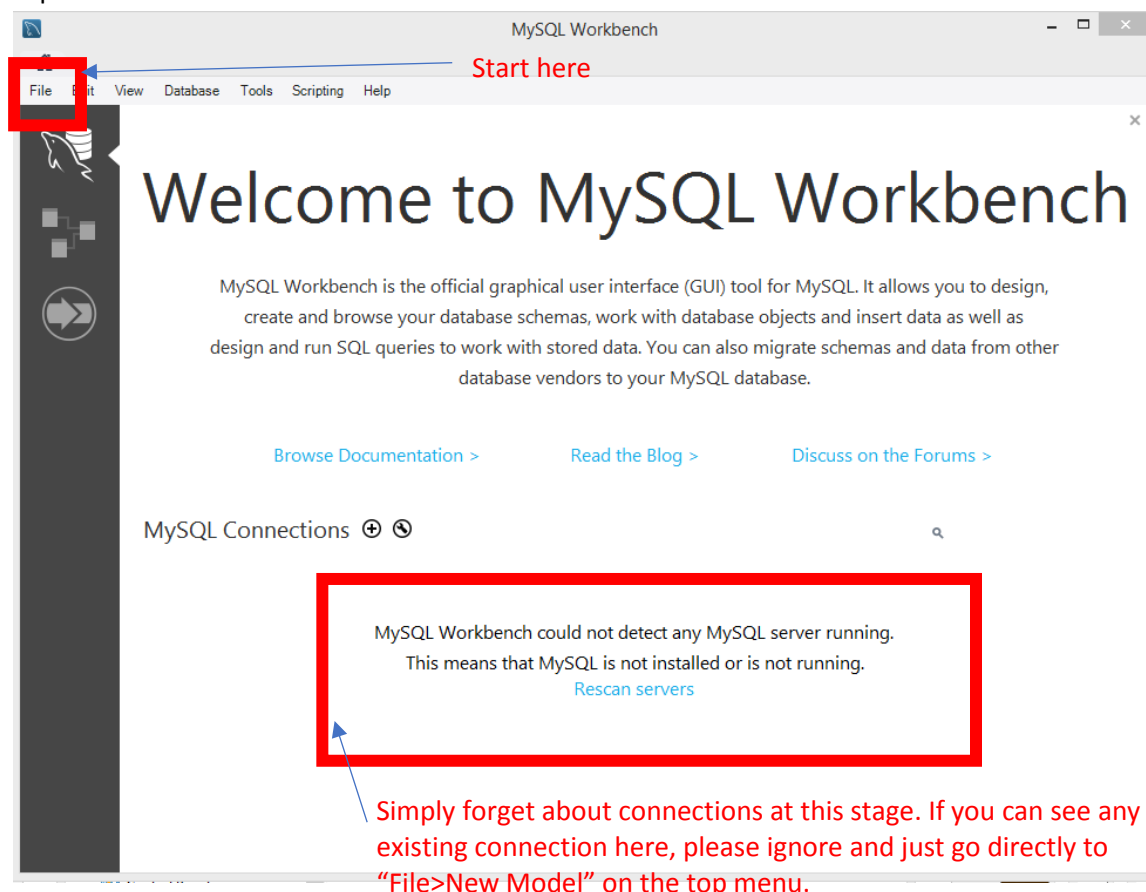
- **Start a New ER-Diagram Drawing**

  To start a new drawing, go to "File>New Model". Double click on "Add Diagram"
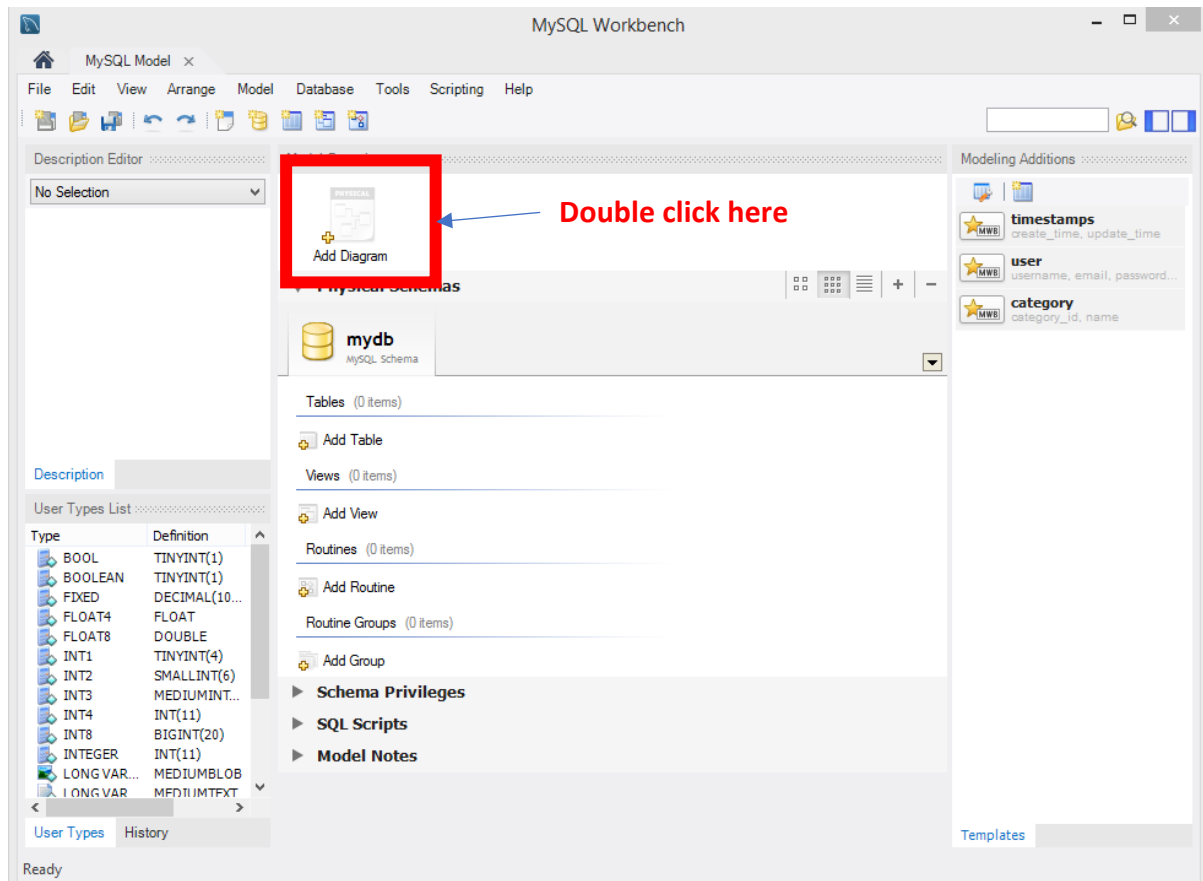
- **Basic Operations**

  From the left panel of the Diagram window (shown in red box above).

  1. **The arrow icon** is to select object and move them around

  2. **The hand icon** is to move the model around in the diagram

  3. **The eraser icon** is to delete the object from the model

  4. **The layer icon** is to add a new to the diagram and create separation between levels of abstraction in the model.

  5. **The text object icon** is used to create a new text object to describe something in the ER diagram.

  6. **The image icon**: is used to add an image to the diagram. This is used to add logo etc. to the image and is not used in the creation of the physical schema.

  7. **The new table icon**: is used to create a new entity/table in the schema. Go ahead and select this icon and then click on the drawing area. You will see a table1 appear, like shown in the next screenshot. Right-click on it and select Edit table1. If you get an error in this step, close workbench and start it again. The read-only mode should be disabled and will allow you to edit tables and diagrams.

  8. You can add column names, select types and perform other operations using the edit table tab that open at the bottom of the screen. At the stage, it is enough you edit the table name only.

9. **Relationship Icons:** is used to create a new relationship between two entities/tables.

Select one relationship (1:1 or 1:M) by clicking on the corresponding relationship icon. Then click on two tables one by one which you want to make related. (Note: In order to make the relationship between two tables, each table should have at least one attribute (PK) before the relationship is made). In particular, you will find that the foreign key is automatically created to the M side entity when you create a 1:M relationship. Feel free to change the attribute name (which is automatically created as default) to your own purpose if needed.

Once you create the relationship between two tables initially, explore various options you can set for the relationship by double-clicking over the relationship on the diagram panel (when the relationship line's colour is changed during the movement of the mouse over the relationship line). By exploring those options available under "Foreign Key" tab, you will be able to understand better about various specification details of a relationship you set like "Mandatory" or "Identifying".
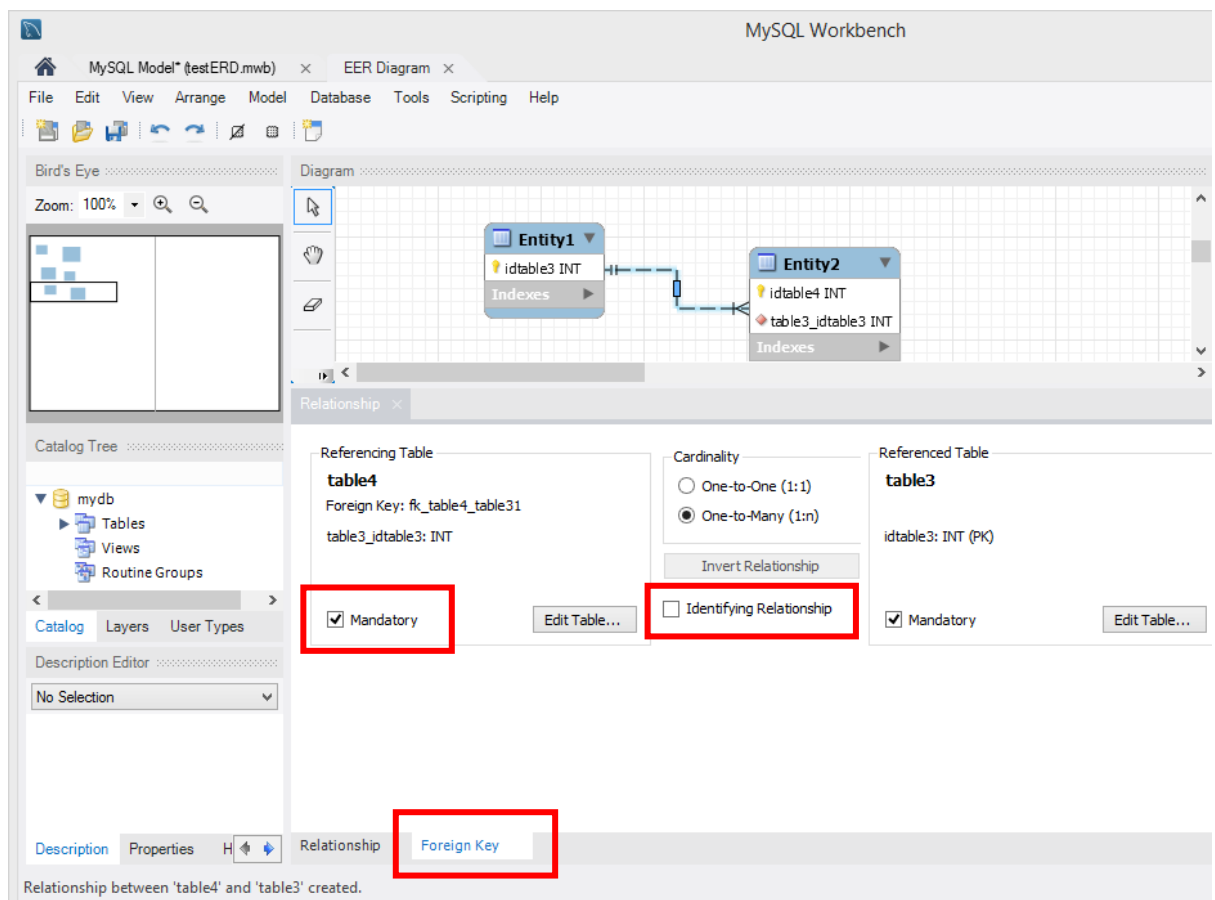
The following online videos may help you to get basic tutorial of creating basic ER diagrams on MySQL Workbench

https://www.youtube.com/watch?v=yq9iCb2JRHk&t=41s

https://www.youtube.com/watch?v=HusL582R2TY

If you want, you can use any other software tool which support drawing ERD using Crow's Foot notations. There are a number of tools available free or at some cost. Some of them are listed here:

- o Lucidchart https://www.lucidchart.com/pages/tour/ER_diagram_tool
- o MS Visio (The textbook Appendix A provides a basic guide to create ERD using MS Visio)
- o Smartdraw https://www.smartdraw.com/entity-relationship-diagram/er-diagram-tool.htm
- o Creately https://creately.com/plans

Please note that not all these tools are designed for the development of database, but just as an ER Diagram drawing tool. For the task to create ERDs (for the assessment items of this subject), you can feel free to use any ERD drawing tool you like to use.

- **Saving ERDs in MySQL Workbench**

Click "File -> Save model" and save the mwb file for future references (if needed).

(Note: do not forget to save the mwb file and store frequently and safely (in case you will need to edit further later or MySQL Workbench clashes unexpectedly))

You can also export your ERD as an image file by clicking "Export".

- **ERD Exercises**

Note: For the following exercises you do not need to create all attributes for the entities. Only list a couple of logical ones. Focus on the relationships between entities. You will need to carefully design components of your model considering the business rules provided. Such consideration may include deciding about "what essential attributes are included in each entity?", "Should the relationship be 1:1, 1:M or M:N?", "Should the relationship be identifying or non-identifying?" "Should the relationship on one entity side be optional or mandatory?" etc.

You are recommended to start drawing your draft ERD on the paper firstly before creating the more confirmed ERD using MySQL Workbench or other drawing tools.

You are required to draw ERDs for the following exercises and submit them to get marked off for this week's lab activity.

1. Given the following business rules, create the appropriate Crow's Foot ERD.
   - A company operates many departments
   - Each department employs one or more employees
   - Each of the employees may or may not have one or more dependents.
   - Each employee may or may not have an employment history.

2. Use the following business rules to create a Crow's Foot ERD. Present all appropriate connectivities and cardinalities in the ERD.

- A department employs many employees, but each employee is employed by one department.
- Some employees, known as "rovers," are not assigned to any department.
- A division operates many departments, but each department is operated by one division.
- An employee may be assigned 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 only one employee.
- One of the employees runs each division, and each division is run by only one employee.

(Hint: More than one relationship may be existing between two entities)

3. Create an ERD based on the Crow's Foot model, using the following requirements:
   - An INVOICE is written by a SALESREP. Each sales representative can write many invoices, but each invoice is written by a single sales representative.
   - The INVOICE is written for a single CUSTOMER. However, each customer can have many invoices.
   - An INVOICE can include many detail lines (LINE), which describe the products bought by the customer.
   - The product information is stored in a PRODUCT entity.
   - The product's vendor information is found in a VENDOR entity.

4. Create a Crow's Foot ERD, using the following business Rules.
   - A Team may or may not have a Player
   - A Player must belong to a Team
   - A Team may have many Players
   - A Player has only one Team
   - A Team may or may not have a Coach
   - A Coach must have a Team
   - A Team may have many Coaches
   - A Coach has only one Team
   - A Player must have a Parent
   - A Parent must have a Player
   - A Player may have up to 2 Parents
   - A Parent may have many Players