Prac #5
Using MySQL Workbench for Creating a Database Model (I)
(Creating the physical schema of the database model)

- **Learning outcomes and objectives**

  Student will be able to:
  - build a conceptual model into logical model in MySQL Workbench,
  - implement the logical model into physical schema using the "Forward Engineering" process in MySQL Workbench, and
  - apply the "Reverse Engineering" process for documenting a database and to share the data model with others.

- **Pre-requisites**

  You are assumed to have completed previous pracs (Prac 1, 2 and 3) in order to be familiar with necessary features of MySQL Workbench for creating full version of ERDs.

  You are assumed the detailed knowledge of ER notation and ERD. Chapter 3 &4 from Coronel-Morris textbook, which explains relational database models and ER modeling are also required reading.

- **Connecting MySQL Workbench to MySQL Server**

  For previous prac activities, it was not essentially required to have your MySQL Workbench fully connected to MySQL server. However, to proceed the prac in this week, you need to complete the connection to the MySQL server from MySQL Workbench.

  Before starting this Prac #5, please refer to the document "Prc #0 – Getting Started" to complete and test the connection process.

Reminder Note for University lab (Townsville/Cairns) computer users

Follow the instructions as below:

1. Run 'Server Initialiser'. You can run this only once for each computer. Do not close the window and simply minimise the window for your convenience.
2. Run 'Server Start'. You can run this only once for each logging-in on the computer. Do not close the window and simply minimise the window for your convenience.
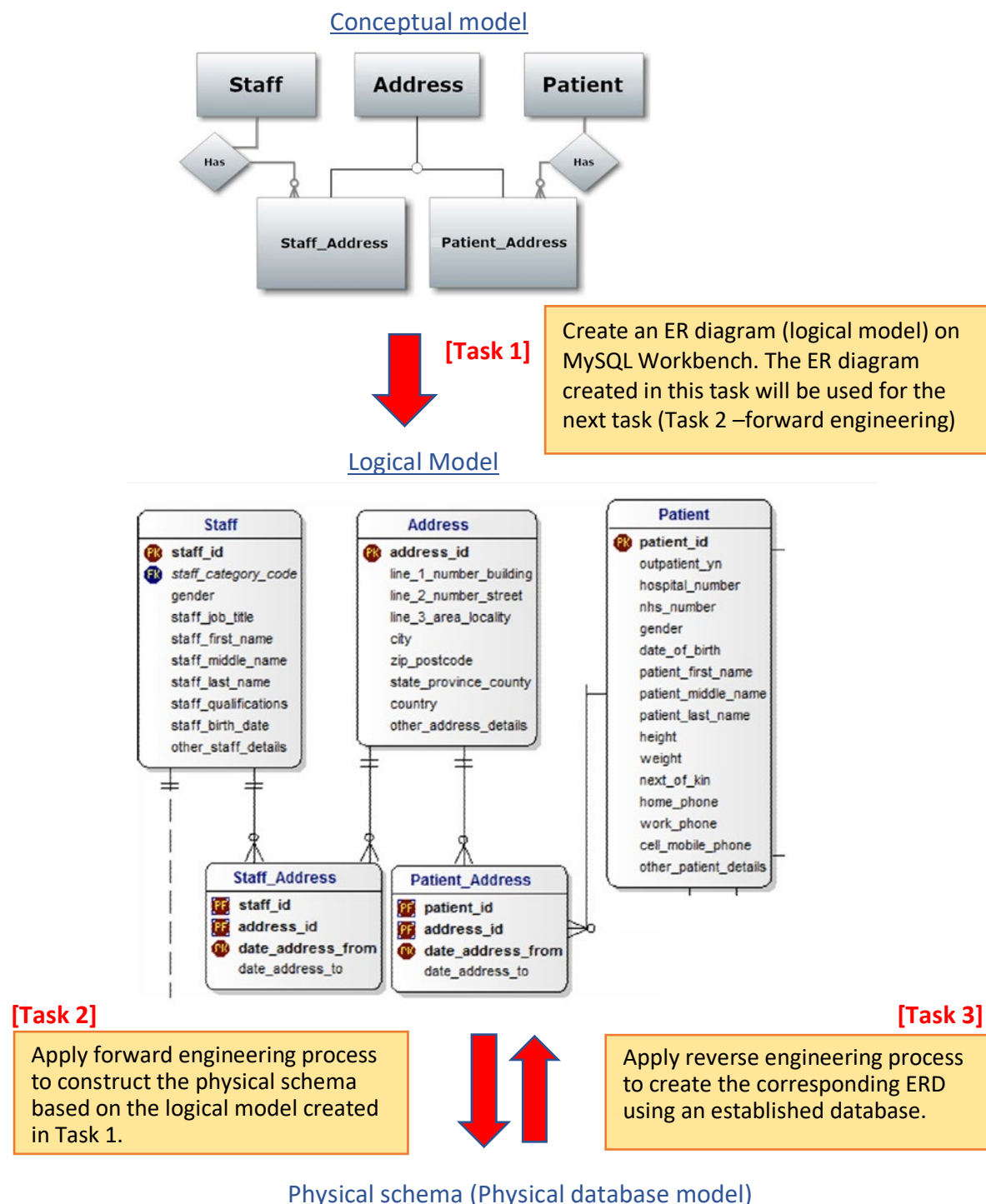3. Run MySQL Workbench.

After completing this prac (Prac #5), you are required to submit the following result files from each task to be marked off via LearnJCU submission box (under Week 5 Prac folder):

- Task 1: xxx.mwb (initial ERD)
- Task 2: xxx.sql (Database dump file you generated using forward engineering)

Task Overview

The first task of this section is to build the following conceptual model into logical model. We will then implement the logical model into physical schema using the "forward engineer" process in MySQL Workbench. Additionally, we will learn how to apply "reverse engineer" process on MySQL Workbench to get an ER model from an established physical schema.

The overall procedure is summarised through the following diagram. As you can see in the diagram, this section consists of three tasks:
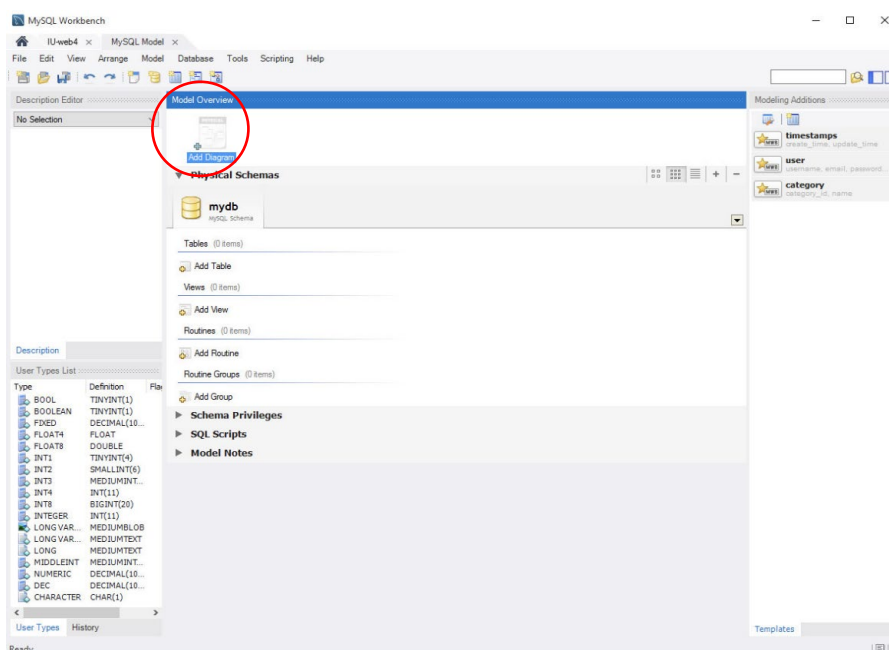

Conceptual model

[Task 1] Create an ER diagram (logical model) on MySQL Workbench. The ER diagram created in this task will be used for the next task (Task 2 –forward engineering)

Logical Model

[Task 2] Apply forward engineering process to construct the physical schema based on the logical model created in Task 1.

[Task 3] Apply reverse engineering process to create the corresponding ERD using an established database.

Physical schema (Physical database model)

[Task 1]

Creating ER diagram on Workbench (building the conceptual model into logical model)

1. Establish a database connection to your local server (most of you may have named the server connection as "MyFirstConnection" or any default name. You can click the connection generated in your MySQL Workbench.
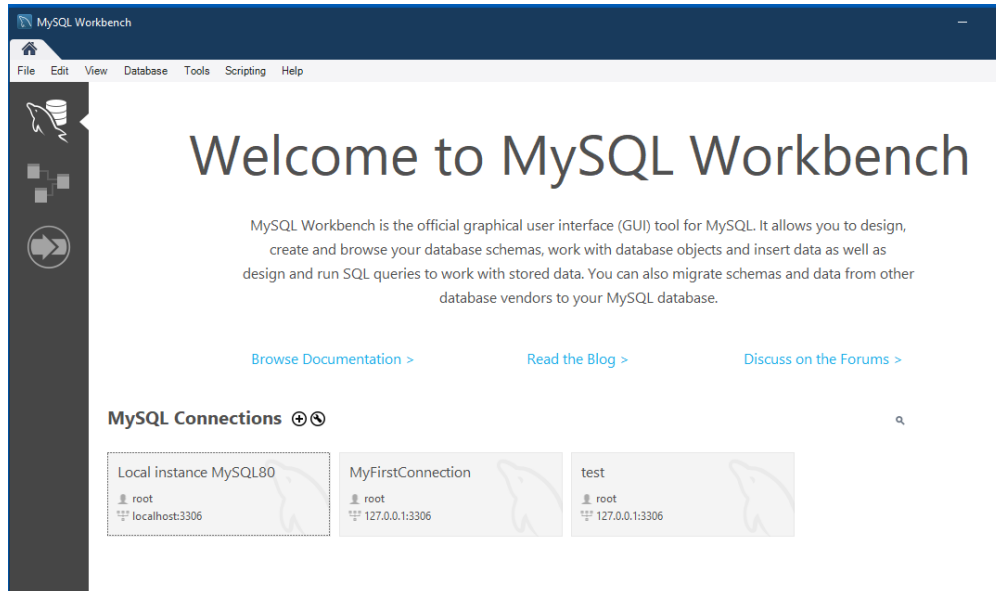
2. Create an ER diagram. You already learned how to create an ER diagram through previous pracs (Prac #1 and #2), but here the process is summarised again for your information.
   - Go to File -> New Model or Press Ctrl + N
   - Double-click on Add Diagram and you will be taken to the ER canvas from where you can start creating an ER diagram
   - The drawing canvas for the EER that opened in MySQL workbench is used to draw the table and add the relationships between the tables
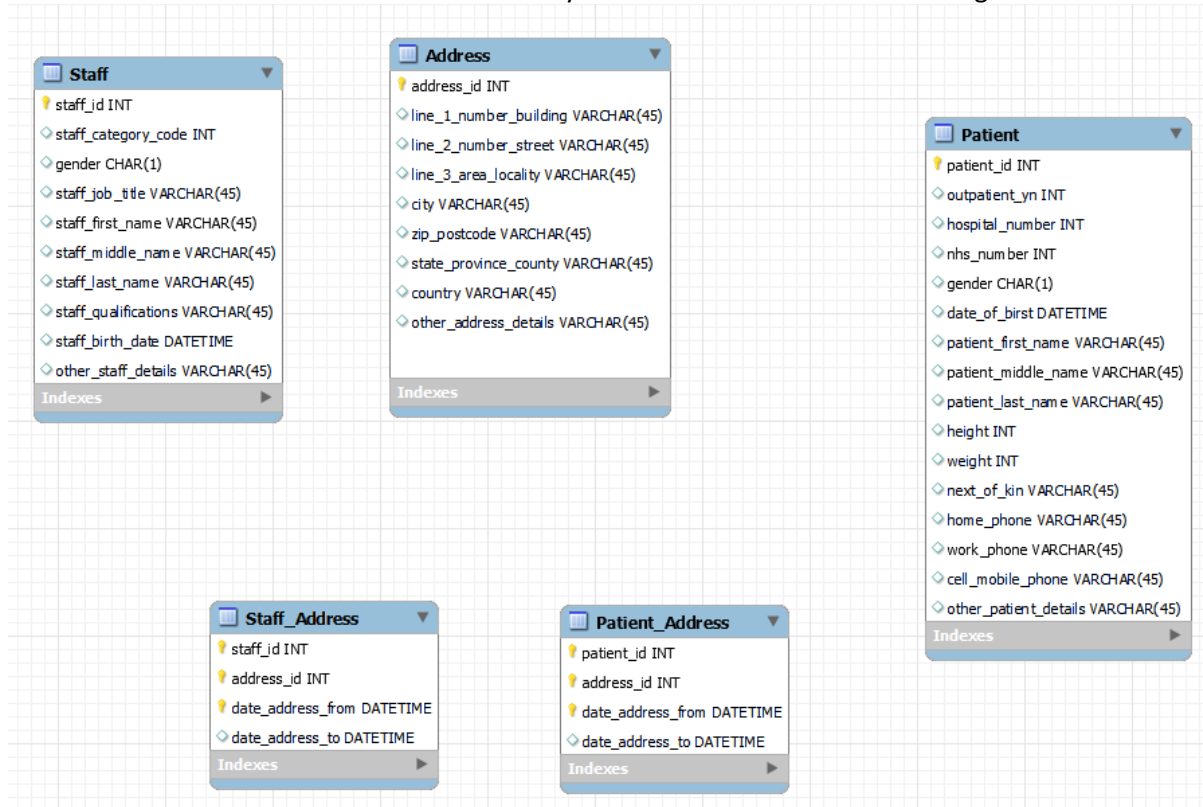   - Rename your schema to any name you want to make up your own (e.g. joanne_db).

- Add tables to the drawing panel
- Create a new table and change the table name to **Staff** and then add the column names as shown below.
- **staff_id** is the primary key hence the **PK** is checked and **NN** is for NOT NULL
- Also check the **AI**checkmark for AUTO INCREMENT. This is only applicable for primary keys that are INT type.
- The other column names just like the given model should be added.
- Similarly, add other tables in the same way.

- The tables would like this once they have been created in the canvas grid.

- Now it is time to add relationships

Let's create a 1:M relationship between two tables: Patients and Patient_Address.
There are two different ways of creating the relationship.

1. If you have not created an attribute which will be used as a foreign key in the table (Patient_Address), an easy way is to click the 1:n relationship icon from the left panel, the Patient_Address table (M side) and then the Patients table (1 side) consecutively. This action will trigger MySQL Workbench to add a foreign key attribute automatically to the Patient_Address table by referencing (automatically) to the primary key of the Patients table. You exercised this way in previous pracs so far.
(Please note that in this prac, you already created attributes to be used for foreign keys in your model thus you should not follow this way !!)

2. If you have already created the foreign key attribute (patient_id) in the Patient_Address table manually (as you have done in this prac), you may apply another way of creating a relationship as in the following instructions.

- Double click on the Patient_Address table and at the bottom of the screen press the Foreign Keys tab.

- Give it any name – for example as shown in the screenshot above you can name it patient_address_to_patient
- The referenced table is the one which has the Primary key column – in this case it's the Patients table. Double click on referenced table and select from the dropdown.

- Check mark the patient_id column and then in the referenced column select patient_id (this is from the Patients table)
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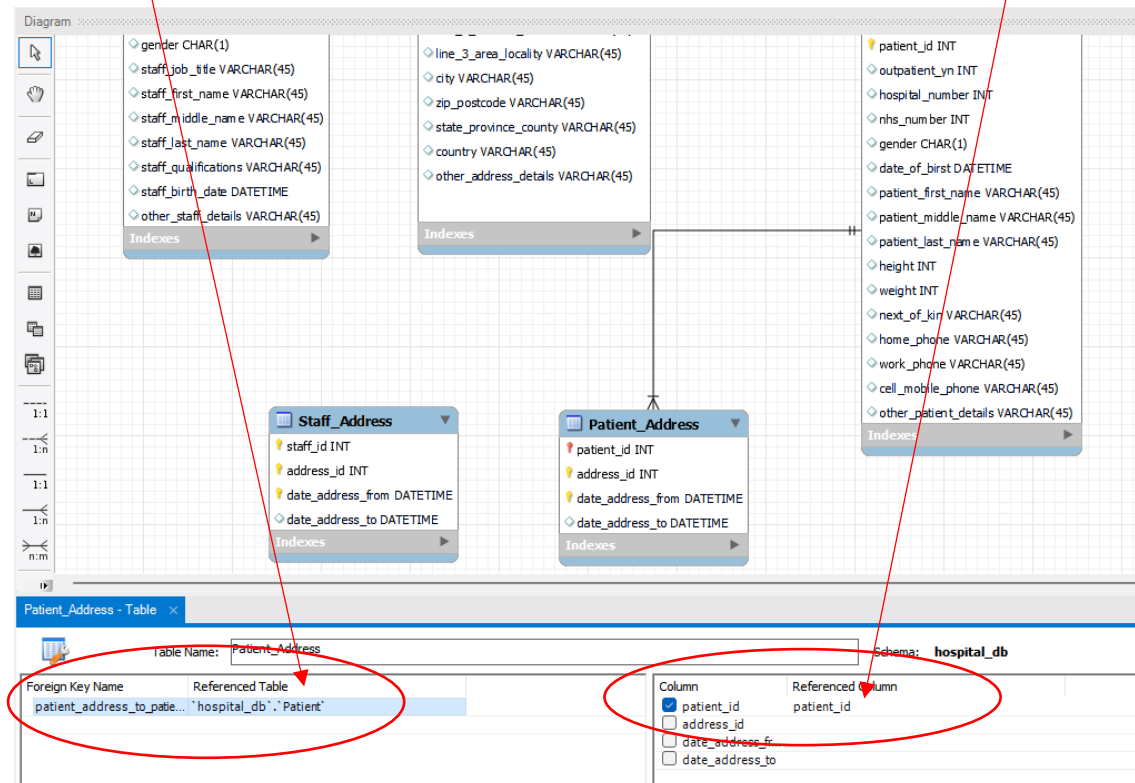
There is second foreign key (address_id) in the Patient_Address table. Thus, we need to create another relationship to the Addresses table.
- Give it a name – patient_address_to_address
- Select the referenced table as Addresses. Then checkmark address_id and in the referenced column select the address_id
- This will create the 1-to-many relationships between Address and Patient_Address table

After this step, your ERD should look like shown below.
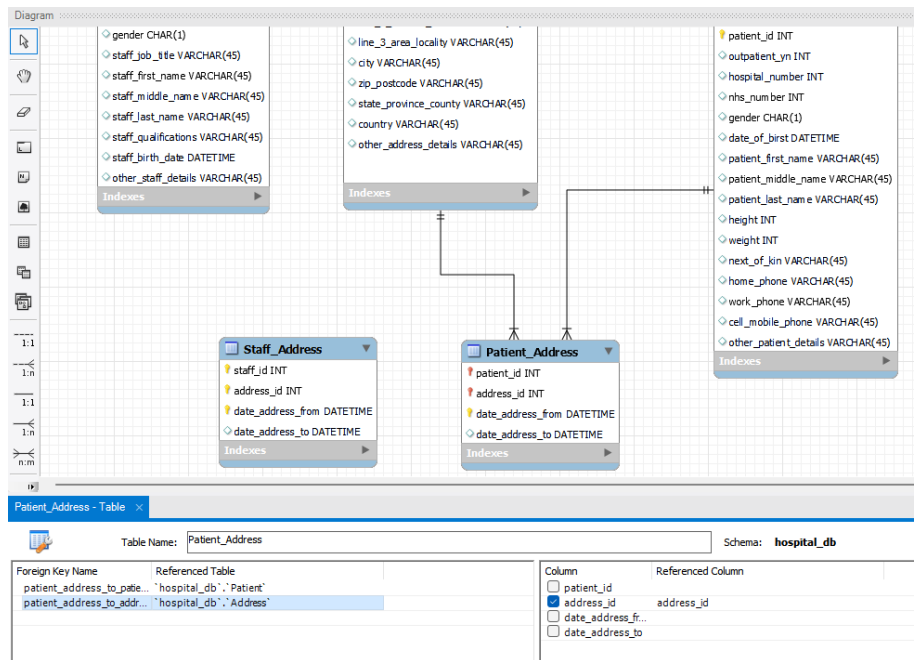
Do the same with the Staff_Address table like shown below.
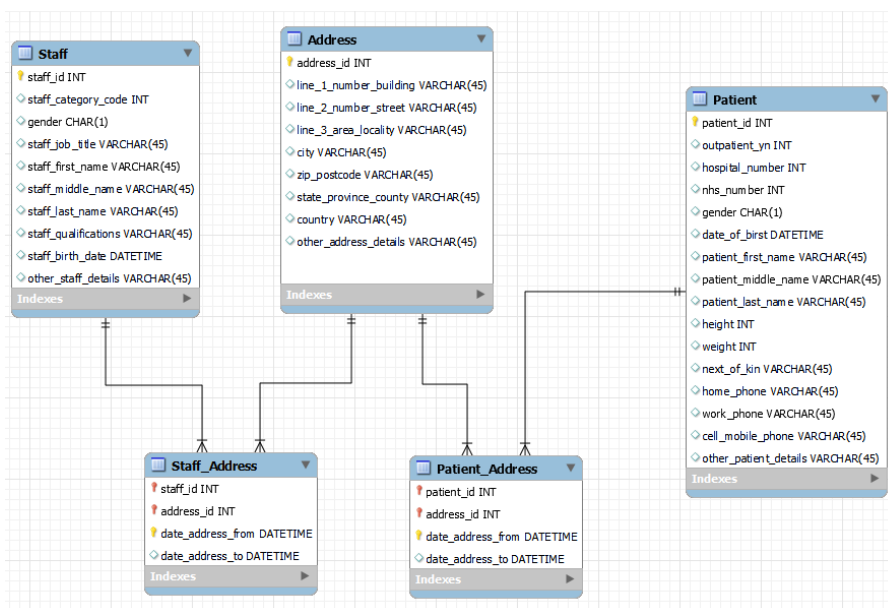
- Click File -> Save model and save the mwb file for future reference. (You are required to submit this file for this prac Task #1)

[Task 2]

Forward Engineering (implementing the logical model into physical database schema)

Now, we want to implement this logical model into a physical schema using "Forward Engineer"
- Go to Database menu and then Forward Engineer
- Select the Stored Connection to the local server that you created earlier (e.g. MyFirstConnection).
- Press Next, Keep the defaults on the next screen and Press Next again, till you reach the message "Forward Engineer Finished Successfully".
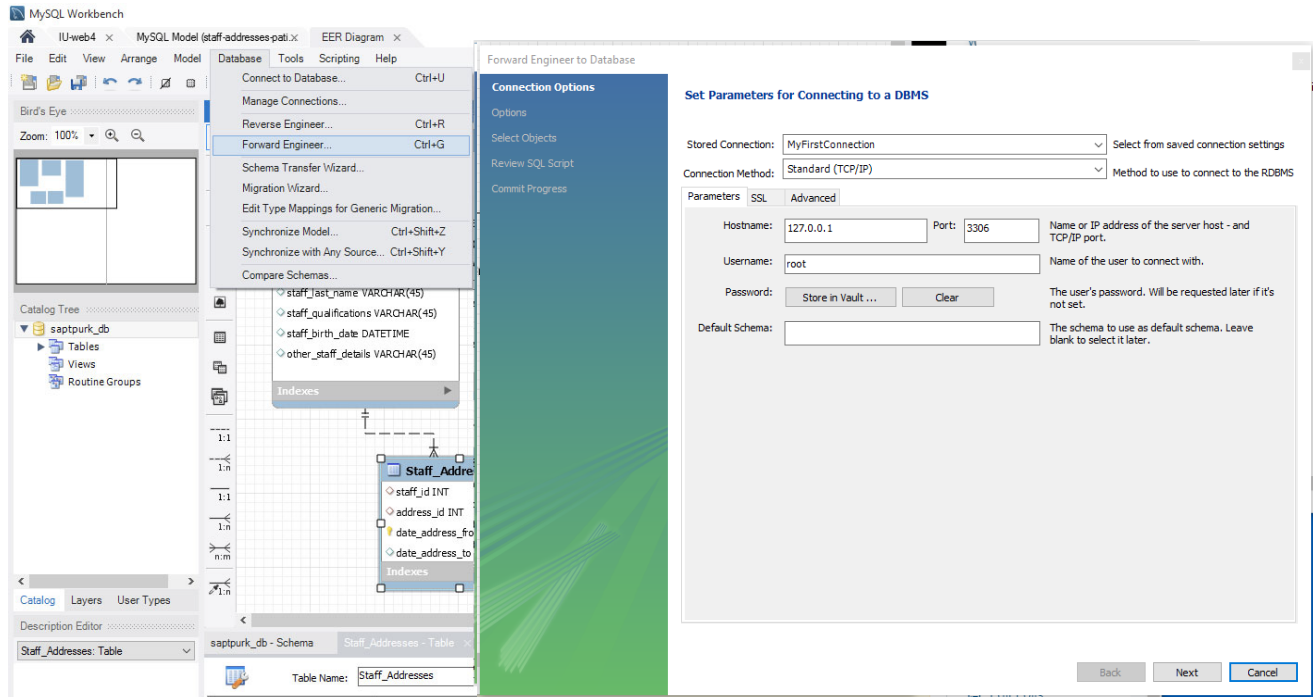
You'll see the screenshot as below.
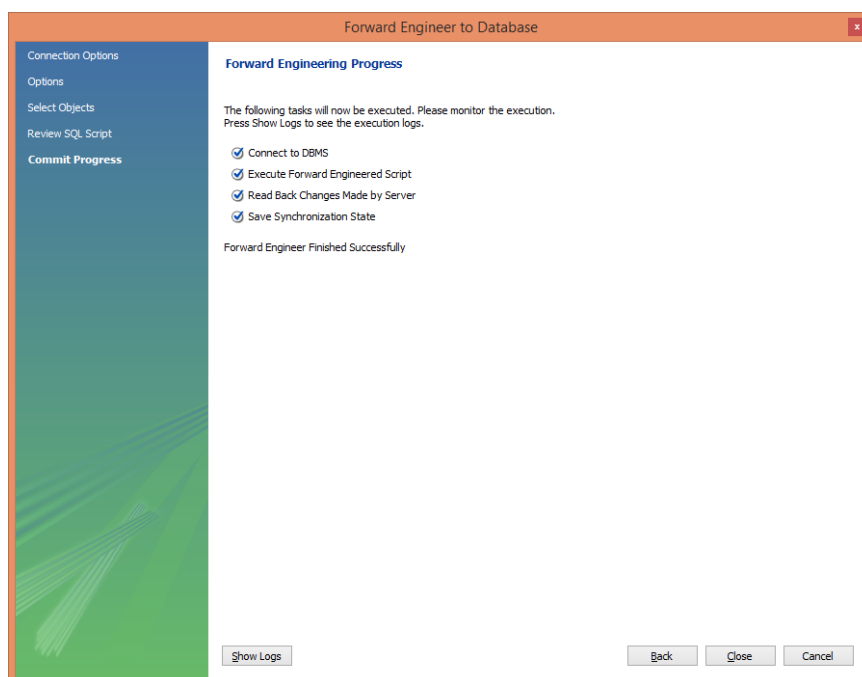
Press Close and continue to the next task (Task 3).
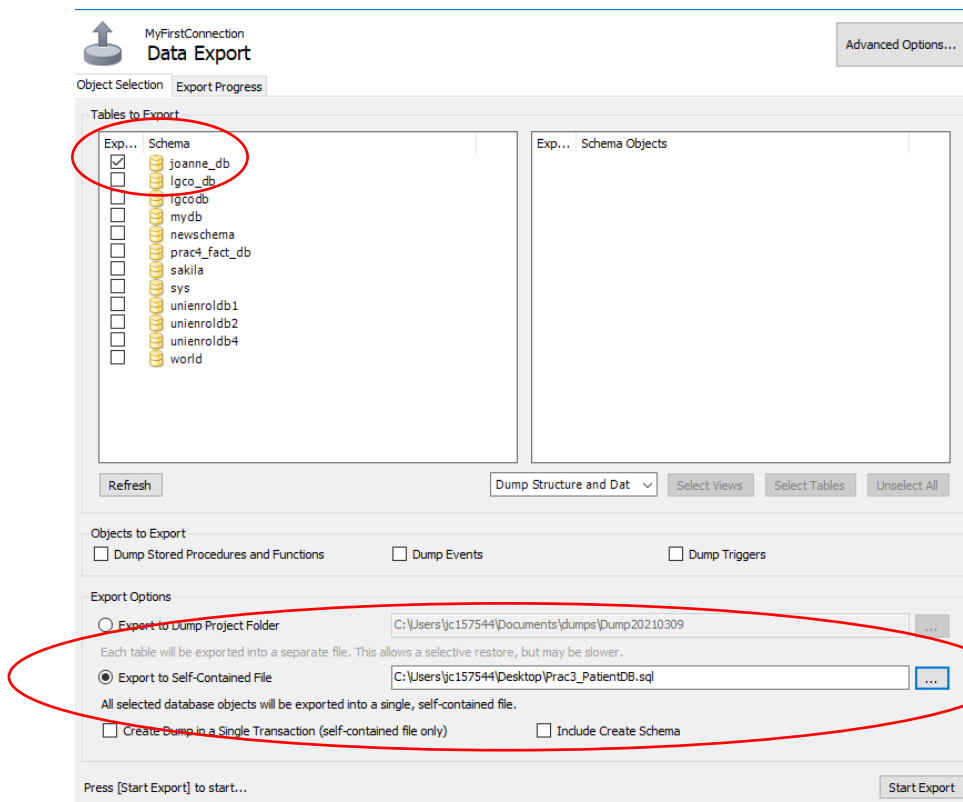
- **Backup your database**

  MySQL Workbench can export a backup of your database to a file on your local computer. This is also sometimes referred to as "data dump"

  We strongly recommend that you create regular backups of your database so it can be easily and quickly recovered in the unlikely event that your data is lost or becomes corrupted.

  - Click the connection tab (not EER Diagram tab) on the top of Workbench showing multiple tabs you opened so far.

  - Click 'Data Export' under 'Server' on the top menu bar.
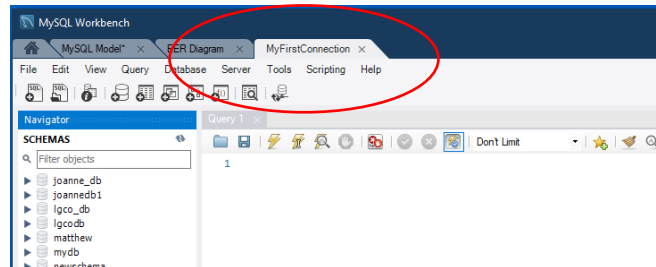
    You will see "Data Export" administration setting as shown in the following screenshot.

  - Select your database to export
  - Select "Export to Self-Contained File" option and set the location and file name to save the file. This selection will **create one single SQL file named XXX.sql**. Then, click Start Export. ➔ **You are required to submit this .sql file for this prac task #2**
  - This SQL file can be imported anytime or anywhere (someone else's computer) via MySQL Workbench (via 'Data Import' menu option under the Server menu)

  In particular if you use MySQL Workbench in the university lab computers, you may lose your work once you logged-out, so you have to back up your database and save it as .sql file in your own storage device (e.g. USB) not to risk losing your work.

- **Import your database**
  - To import your saved dump file into the any new connection or existing connection, Click 'Data Import' under 'Server' on the top menu bar. You will see "Data Import" administration setting as shown in the following screenshot.
  - Select 'Import from Self-Contained File' option and load the dump file you have (xxx.sql). Also set up default schema to be imported to by clicking 'New' button and name your new schema. After this setting, find and select the schema you created from the drop list of 'Default Target Schema'.
 - Click 'Start Import'
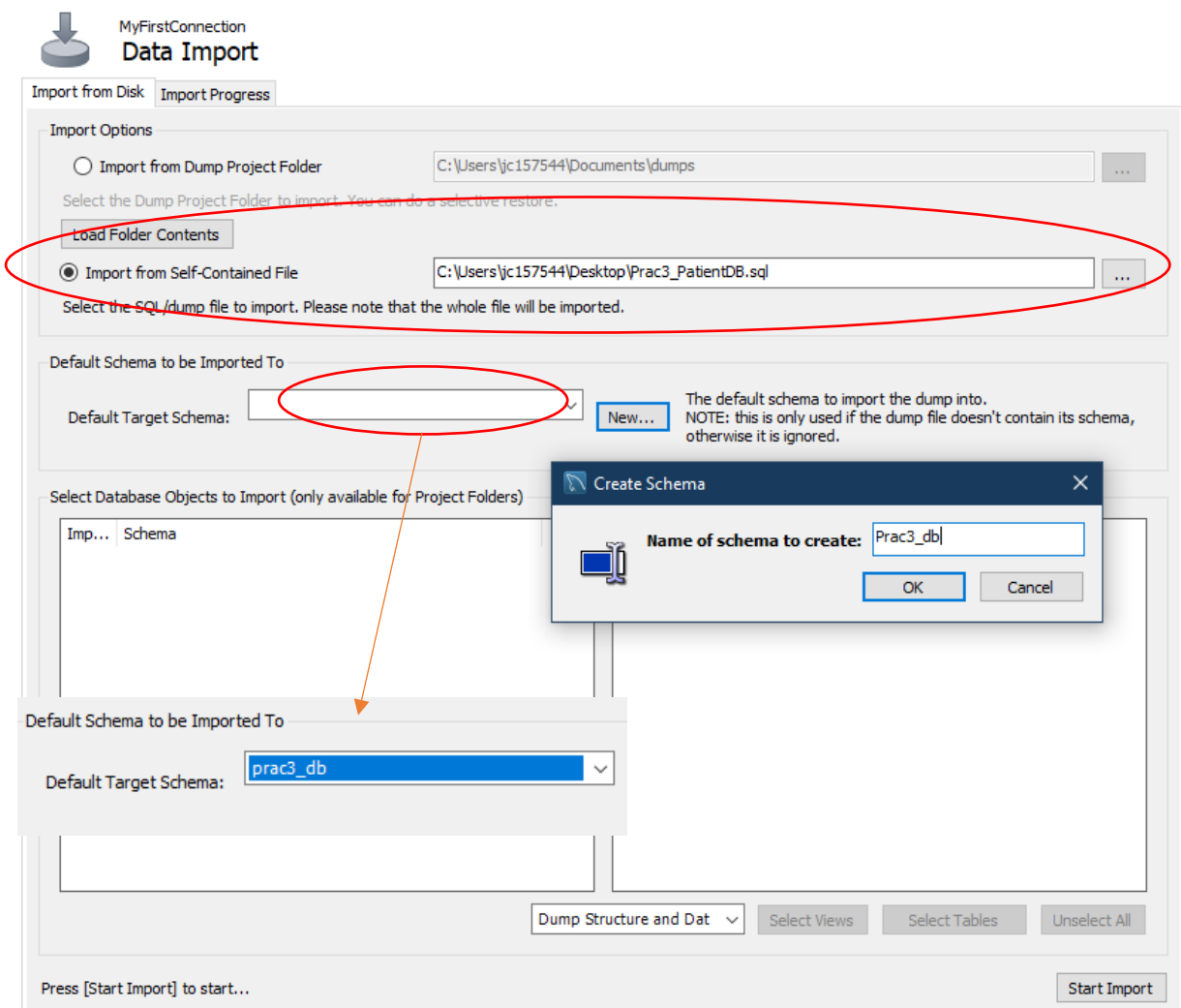
- To make sure that the database was imported correctly, you have to click refresh button on the list of SCHEMAS on the Navigator panel. Then you will find the new schema of your imported database is included in the schema list.
 (alternatively, right click and go to the Refresh All button)
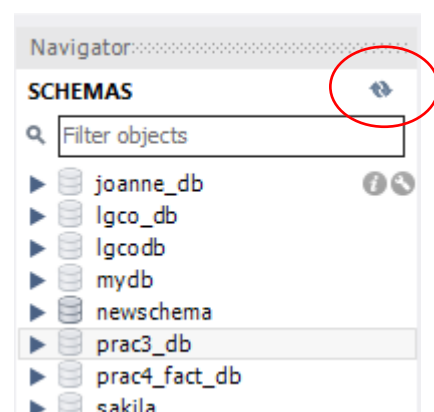
[Task 3]

**Reverse Engineering (creating the ERD from the existing physical database)**
-   Go back to the MyFirstConnection at the very top.
-   If you don't see all the new tables, right click and go to the Refresh All button.
-   This is the physical schema with the tables that have been created through the process of Forward Engineering you have done in Task 2.
-   Close the MySQL Model and EER diagram tab from here. We will now move to the Reverse Engineer process. This process is to get an ER model from a physical schema. This process is used for documenting a database and to share the data model with others.
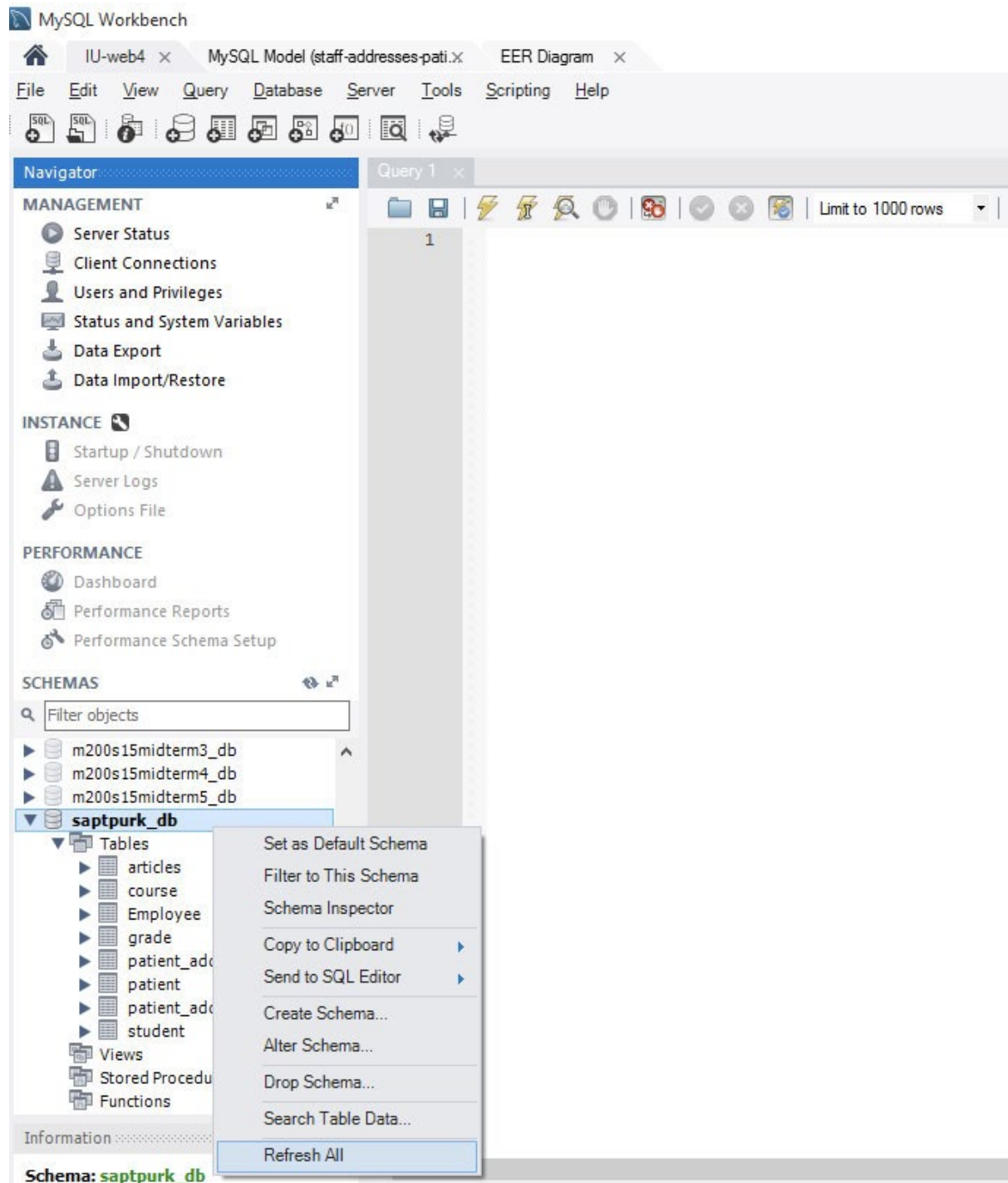
- Double click on your schema – xxx.db as you named such that it becomes bold
- Go to Database menu and click on Reverse Engineer
- Select your Stored Connection to the local server and press Next
- All Connections and schema retrieval should work and you will reach the screen having the message "Execution Completed Successfully". Press Next.
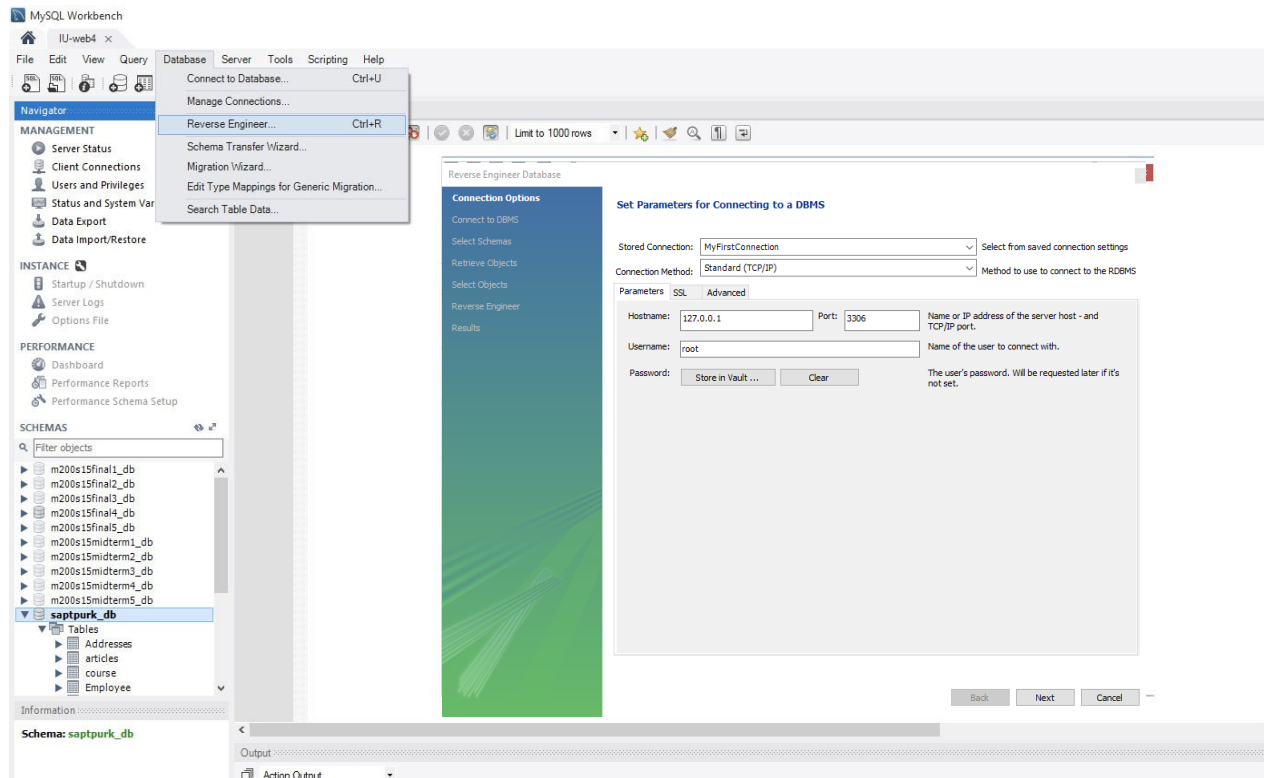
- On the next screen check mark the database schema you want to apply (xxx.db) and press Next
- Press Next on the following screen and then execute on the following screen.
- It should deploy the tables on the canvas grid, something like the next screen.
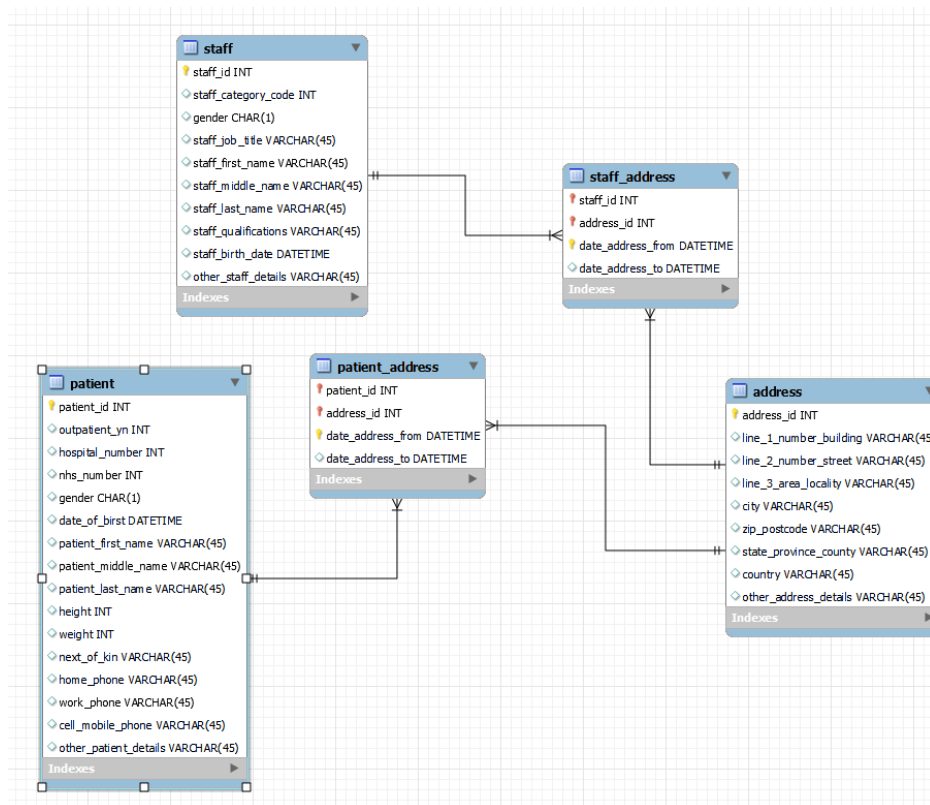
- This ER model might need arrangement of the tables to give it the same kind of look that you see here.
- Save this ER model as a file (xxx_reversed.mwb).

This ER model produced by the 'reverse engineer' process may look nearly same as the original ER mode you created in [Task 1] in this prac. Thus in general, you may feel that this reverse engineering process would not be necessary.

However, in most practices, the original ER model you had designed at the early stage may have been modified during your further working on physical database schema (after processed forward-engineering) for various reasons (e.g. modifying PKs or FKs, adding additional attributes, deleting existing attributes etc.). In this case, applying reverse-engineering process helps you produce the updated ERD easily (by automatic processing).

This is the end of Prac #5.

you are required to submit two result files to be marked off via LearnJCU submission box:

- Task 1: xxx.mwb (initial ERD) – 1.5 marks
- Task 2: xxx.sql (Database dump file you generated using forward engineering) – 1.5 marks

You are not required to submit the result file from Task 3. For marking, your marker will import your submitted xxx.sql (database dump file) to their Workbench and will apply 'reverse engineering' to

generate an ERD. If this importing and reverse engineering is all worked successfully by your tutor, you will get full marks for this prac.

Also, completing this section is essentially required to prepare for proceeding to the next Prac (Prac #6) tasks.