



# Populating & Querying Your Database

## Overview

In this assignment, you will navigate the full lifecycle of database management, starting with the setup and configuration of a new database in cPanel. With a focus on data integrity, you will learn to create tables with primary key, not null, unique, check, and foreign key constraints. Once your database is populated, you will dive into querying, mastering the art of retrieving, filtering, and aggregating data using SQL commands and operators. Finally, you will document your journey, detailing the steps taken to ensure data accuracy and consistency, and showcasing your database's structure, population, and insights extracted through SQL queries. Through this comprehensive experience, you will develop a robust understanding of database management principles and practices.

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## Part III: Querying Your Database

- **Single-Relation Queries**
  - Use the **SELECT** clause to retrieve specific columns or all columns from a single table.
  - Use the **FROM** clause to specify the table from which you want to retrieve data.
  - Apply the **WHERE** clause with comparison and logical operators to filter rows based on specific conditions.
  - Employ arithmetic operators (+, -, \*, /) to perform calculations within your queries.
  - Use the **ORDER BY** clause to sort query results based on specified column(s).
- **Multiple-Relation Queries**
  - Perform joins (i.e., **INNER JOIN**, **LEFT JOIN**, **RIGHT JOIN**, **FULL OUTER JOIN**) to combine data from multiple tables based on related columns.
  - Use the **NATURAL JOIN** to join tables based on columns with the same name.
  - Apply aggregate functions (i.e., **SUM**, **AVG**, **COUNT**, **MIN**, **MAX**) to calculate summary statistics across groups of data.
  - Use the **GROUP BY** clause to group query results based on one or more columns.
  - Apply aggregate functions alongside **GROUP BY** to perform group-level calculations.

- Use the **HAVING** clause to filter group-level results based on aggregate function results.
- **Executing Queries**
  - Write SQL queries that leverage the above-mentioned commands and operators to extract meaningful insights from your database.
  - Test your queries in a SQL environment.
  - Verify the accuracy and relevance of query results by cross-referencing them with the expected outcomes.

## Part IV: Documentation

You will detail the steps taken to ensure data accuracy, demonstrate database population, and showcase meaningful insights extracted from the database.

1. Describe how you ensured that each table in your database includes appropriate integrity constraints to enforce data accuracy and consistency, and how you performed data validation checks when inserting data. Include details on:

- Implementing primary key constraints to uniquely identify each record.
- Applying not null constraints to essential attributes.
- Enforcing unique constraints to ensure attribute distinctiveness.
- Setting check constraints to enforce specific conditions on attribute values.
- Maintaining referential integrity through foreign key constraints.

Your description should outline the steps taken during the table creation process to ensure data integrity and accuracy, as well as the validation checks performed during data insertion.

The tables that represent the main entity sets in our ER diagram—*Characters*, *Locations*, *Props*, and *Users*—ensure data integrity through an ID primary key attribute. This allows multiple characters with identical names, races, and other identifying attributes to exist without issue, which will happen when there are characters re-used across multiple worlds. The tables representing lesser entity sets and relationship sets—*Contains*, *Creatures*, *NPCs*, *Players*, and *PlayingIn*—instead rely on foreign keys to ensure data integrity. Since the foreign keys are exclusively tied to the primary keys of other tables, there is not any risk of records that are not uniquely identifiable. Employing so many foreign key constraints also assists with data consistency because any change that would create an inconsistency would violate one of the foreign key constraints in place.

A majority of attributes are provided with a not null constraint because many of the attributes are crucial to playing the game on the user's end. For example, the *Prop* table has the

attributes *quantity* and *owner* to represent how many of an item there is and who owns it. The not null constraint is applied to *quantity* because it is important to know the quantity of an object, there can't be an undefined number of gold coins. However, the *owner* attribute can be null because not every item is owned by someone.

Since a majority of our data are simple strings or numbers, most of the checks will be on a user's permissions, rather than the data they are trying to input. For example, the *Characters* table includes the attributes *description*, *gmNotes*, and *partyNotes*. All of these are strings describing a given character, but who can access and edit them is different between each attribute. The *description* can be read by both the game master and players, but only the game master can edit it; *gmNotes* can be read and edited only by the game master; and *partNotes* can be read by both the game master and players, but only the players can edit it. Therefore, as long as users are inputting proper strings, the validation checks will be primarily concerned with the user's credentials, rather than what they are inputting.

2. Include screenshots of EACH table in your database. You can use the **Browse** tab and take a screenshot of the data that is displayed. This will demonstrate that you have successfully populated the database.

| Table      | Action | Rows | Type   | Collation       | Size      | Overhead |
|------------|--------|------|--------|-----------------|-----------|----------|
| Characters |        | 10   | InnoDB | utf8_unicode_ci | 32.0 KiB  | -        |
| Contains   |        | 6    | InnoDB | utf8_unicode_ci | 48.0 KiB  | -        |
| Creatures  |        | 2    | InnoDB | utf8_unicode_ci | 32.0 KiB  | -        |
| Locations  |        | 8    | InnoDB | utf8_unicode_ci | 16.0 KiB  | -        |
| NPCs       |        | 5    | InnoDB | utf8_unicode_ci | 32.0 KiB  | -        |
| Players    |        | 3    | InnoDB | utf8_unicode_ci | 48.0 KiB  | -        |
| PlayingIn  |        | 5    | InnoDB | utf8_unicode_ci | 64.0 KiB  | -        |
| Props      |        | 5    | InnoDB | utf8_unicode_ci | 48.0 KiB  | -        |
| Users      |        | 5    | InnoDB | utf8_unicode_ci | 16.0 KiB  | -        |
| 9 tables   | Sum    | 49   | InnoDB | utf8_unicode_ci | 336.0 KiB | 0 B      |

Showing rows 0 - 9 (10 total, Query took 0.0001 seconds.)

```
SELECT * FROM `Characters`
```

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

| <input type="checkbox"/> Show all      | Number of rows: | 25                 | Filter rows: | Search this table                  | Sort by key:                                 | None                       |
|--|-----------------|--------------------|--------------|------------------------------------|--|----------------------------|
| <input type="checkbox"/> Extra options |                 |                    |              |                                    |  |                            |
| ID                                     | isAt            | name               | race         | description                        | gmNotes                                      | partyNotes                 |
| 1                                      | 2               | Wilhelm Riquet     | human        | thief                              | Passion for animals                          | Played by Steve            |
| 2                                      | 4               | Commodore Stephahk | human        | Recruitment officer at Fort Hranic | Rat who let attackers into fort              | Weirdly chill guy          |
| 3                                      | 4               | Renly Gokel        | human        | Recruit specializing in alchemy    | Harmless?                                    | He is an evil terrorist    |
| 4                                      | 2               | Horacio Garzon     | human        | wine artisan                       | Passion for grapes                           | Played by George           |
| 5                                      | 2               | Jovi               | Ka'Tavin     | Animal sold in Siwanilua           | Will be used to train 'Ride' skill           | Bought by Wilhelm          |
| 6                                      | 4               | Olver Thumbless    | human        | Recruit who has no thumbs          | Dies in Hranic Raid                          | His name is now 'Nubs'     |
| 7                                      | 5               | Xiarkydoth         | spider       | Spider in Myrantahl Forests        | Beast Aliyra encounters?                     |                            |
| 8                                      | 2               | Leon Septar        | human        | Bouncer, detective                 | Passion for sneaking                         | Played by Henry            |
| 9                                      | 5               | Aliyra Maastehr    | ghord        | Apothecary from Ghordeiol          | Wife to Ephram and Mother to Obream and Ilen |                            |
| 10                                     | 4               | Chef Mya           | human        | Chef at Fort Hranic                | Head chef                                    | Falls in love with Wilhelm |

Showing rows 0 - 5 (6 total, Query took 0.0001 seconds.)

SELECT \* FROM `Contains`

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 ▾ Filter rows: Search this table Sort by key: None ▾

Extra options

| container | containee |
|-----------|-----------|
| 6         | 1         |
| 6         | 2         |
| 6         | 3         |
| 6         | 4         |
| 6         | 5         |
| 4         | 7         |

Showing rows 0 - 1 (2 total, Query took 0.0002 seconds.)

SELECT \* FROM `Creatures`

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 ▾ Filter rows: Search this table Sort by key: None ▾

Extra options

| ID | population |
|----|------------|
| 5  | 1          |
| 7  | 1          |

Showing rows 0 - 7 (8 total, Query took 0.0002 seconds.)

SELECT \* FROM `Locations`

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 ▾ Filter rows: Search this table Sort by key: None ▾

Extra options

| ↔→  | ▼ ID | name                         | description                                      | gmNotes  | partyNotes                                   |
|---|------|------------------------------|--|--|--|
| <input type="checkbox"/> <a href="#">Edit</a> <a href="#">Copy</a> <a href="#">Delete</a> | 1    | Kua Lorantene                | Desert nation ruled by the Kua Lorantene peoples | Under control of the foreign power Hrace         | People have venomous spikes                  |
| <input type="checkbox"/> <a href="#">Edit</a> <a href="#">Copy</a> <a href="#">Delete</a> | 2    | Siwanilua                    | Wealthy city ruled by Queen Yttrilyna            | Hrace has soft control over the Queen            | The royalty are rich but the people are poor |
| <input type="checkbox"/> <a href="#">Edit</a> <a href="#">Copy</a> <a href="#">Delete</a> | 3    | Hanging Gardens of Azkenilua | Wonder built to the Goddess Azkenilua            | Pilgrimage site                                  | They do not grow grapes here                 |
| <input type="checkbox"/> <a href="#">Edit</a> <a href="#">Copy</a> <a href="#">Delete</a> | 4    | Hranic Fort                  | Military island off the coast of Kua Lorantene   | Session start. Raided by Kua Lorantene attackers | Renly is here and he must be dangerous...    |
| <input type="checkbox"/> <a href="#">Edit</a> <a href="#">Copy</a> <a href="#">Delete</a> | 5    | Ghordeiol                    | Northern country also soft controlled by Hrace   | Potential site for future campaigns              |  |
| <input type="checkbox"/> <a href="#">Edit</a> <a href="#">Copy</a> <a href="#">Delete</a> | 6    | The World                    | This is the big world that contains everything   | The good and evil happens here                   |  |
| <input type="checkbox"/> <a href="#">Edit</a> <a href="#">Copy</a> <a href="#">Delete</a> | 7    | Barracks                     | Barracks in a fort, weapons and stuff            |  |  |
| <input type="checkbox"/> <a href="#">Edit</a> <a href="#">Copy</a> <a href="#">Delete</a> | 8    | Completely Unrelated World   | This world doesn't have anything yet             |  |  |

Showing rows 0 - 4 (5 total, Query took 0.0001 seconds.)

SELECT \* FROM `NPCs`

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all

Number of rows: 25

Filter rows: Search this table

Sort by key:

None

Extra options

ID opinions

- 2 Cooperative with Hrace, indifferent to recruits
- 3 Friendly facade, secretly plotting destruction
- 6 Eager to prove himself despite disability
- 9 Caring and knowledgeable, misses her family
- 10 Warm and welcoming, develops feelings for Wilhelm

Showing rows 0 - 2 (3 total, Query took 0.0001 seconds.)

SELECT \* FROM `Players`

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all

Number of rows: 25

Filter rows:

Search this table

Sort by key:

None

Extra options

ID level playedBy

- 1 3 Steve
- 4 3 George
- 8 3 Henry

Showing rows 0 - 4 (5 total, Query took 0.0002 seconds.)

SELECT \* FROM `PlayingIn`

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all

Number of rows: 25

Filter rows:

Search this table

Sort by key:

None

Extra options

user plays world role

- |               |      |   |        |
|---------------|------|---|--------|
| Steve         | 1    | 6 | player |
| George        | 4    | 6 | player |
| Henry         | 8    | 6 | player |
| George        | NULL | 8 | gm     |
| GM Individual | NULL | 6 | gm     |

Showing rows 0 - 4 (5 total, Query took 0.0001 seconds.)

```
SELECT * FROM `Props`
```

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 | Filter rows: Search this table | Sort by key: None

Extra options

|                          | ID | isln | name          | description                                    | gmNotes                            | partyNotes                 | itemType   | rarity   | quantity | owner |
|--------------------------|----|------|---------------|--|------------------------------------|----------------------------|------------|----------|----------|-------|
| <input type="checkbox"/> | 1  | 2    | Venom Spike   | A spike harvested from a Kua Lorantene warrior | Can be used as a poison weapon     | Found in Siwanilua market  | Weapon     | Uncommon | 3        | 1     |
| <input type="checkbox"/> | 2  | 4    | Alchemy Kit   | A set of tools for brewing potions             | Belongs to Renly                   | Confiscated after the raid | Tool       | Common   | 1        | 3     |
| <input type="checkbox"/> | 3  | 2    | Grape Wine    | A fine bottle of Siwaniluan wine               | Horacio made this himself          | Worth good money           | Consumable | Common   | 5        | 4     |
| <input type="checkbox"/> | 4  | 4    | Fort Manifest | A list of all recruits at Hranc Fort           | Contains evidence against Stephahk | We need to get this        | Document   | Rare     | 1        | 2     |
| <input type="checkbox"/> | 5  | 1    | Desert Cloak  | A cloak that blends into sand                  | Useful for desert travel           | Bought in Kua Loranta      | Armor      | Common   | 1        | 8     |

Showing rows 0 - 4 (5 total, Query took 0.0002 seconds.)

```
SELECT * FROM `Users`
```

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 | Filter rows: Search this table | Sort by key: None

Extra options

|                          | username         | password    |
|--------------------------|------------------|-------------|
| <input type="checkbox"/> | George           | password456 |
| <input type="checkbox"/> | GM Individual    | password000 |
| <input type="checkbox"/> | Henry            | password789 |
| <input type="checkbox"/> | No Friends Larry | password000 |
| <input type="checkbox"/> | Steve            | password123 |

3. Five SQL queries were written to extract meaningful insights from the database. Each query serves a distinct purpose and uses different SQL clauses and operators including:

- A query leveraging SELECT, FROM, and WHERE clauses with comparison and logical operators to filter rows based on specific conditions.

This query will select all characters in the game that are humans. The expected result should display Wilhelm, Stephahk, Renly, Horacio, Olver, Leon, and Mya. This could be used for creating a plot element that only applies to humans, for example there could be a city where humans are discriminated against, and it would be helpful to easily know what characters are humans.

SELECT \* FROM `Characters` WHERE race = 'human';

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 | Filter rows: Search this table | Sort by key: None

Extra options

|                          | ID | isAt | name               | race  | description                        | gmNotes                         | partyNotes                 |
|--------------------------|----|------|--------------------|-------|------------------------------------|---------------------------------|----------------------------|
| <input type="checkbox"/> | 1  | 2    | Wilhelm Riquet     | human | thief                              | Passion for animals             | Played by Steve            |
| <input type="checkbox"/> | 2  | 4    | Commodore Stephahk | human | Recruitment officer at Fort Hranic | Rat who let attackers into fort | Weirdly chill guy          |
| <input type="checkbox"/> | 3  | 4    | Renly Gokel        | human | Recruit specializing in alchemy    | Harmless?                       | He is an evil terrorist    |
| <input type="checkbox"/> | 4  | 2    | Horacio Garzon     | human | wine artisan                       | Passion for grapes              | Played by George           |
| <input type="checkbox"/> | 6  | 4    | Olver Thumbless    | human | Recruit who has no thumbs          | Dies in Hranic Raid             | His name is now 'Nubs'     |
| <input type="checkbox"/> | 8  | 2    | Leon Septar        | human | Bouncer, detective                 | Passion for sneaking            | Played by Henry            |
| <input type="checkbox"/> | 10 | 4    | Chef Mya           | human | Chef at Fort Hranic                | Head chef                       | Falls in love with Wilhelm |

Check all | With selected:  Edit  Copy  Delete  Export

- A query employing arithmetic operators (+, -, \*, /) to perform calculations within the queries.

This query will find all items in the database with a quantity over 3. This should return only the Venom Spike and Grape Wine items. This could be used to balance game item rewards, using this knowledge to avoid rewarding players with items that are already common in the world.

Showing rows 0 - 1 (2 total, Query took 0.0001 seconds.)

SELECT name, quantity FROM `Props` WHERE quantity >= 3;

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 | Filter rows: Search this table | Sort by key: N

Extra options

| name        | quantity |
|-------------|----------|
| Venom Spike | 3        |
| Grape Wine  | 5        |

- A query performing join expressions to combine data from multiple tables.

This query should return every character's name and location. This should return Wilhelm at Siwanilua, Stephahk at Hranic Fort, and so on. This can be used to easily track the locations of characters in the game, which becomes very difficult in a game with many moving pieces.

Showing rows 0 - 9 (10 total, Query took 0.0002 seconds.)

```
SELECT Characters.name, Locations.name FROM Characters JOIN Locations ON Characters.isAt = Locations.ID;
```

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 ▾ Filter rows: Search this table Sort by key: None ▾

**Extra options**

| name               | name        |
|--------------------|-------------|
| Wilhelm Riquet     | Siwanilua   |
| Commodore Stephahk | Hranic Fort |
| Renly Gokel        | Hranic Fort |
| Horacio Garzon     | Siwanilua   |
| Jovi               | Siwanilua   |
| Olver Thumbless    | Hranic Fort |
| Xiarkydoth         | Ghordeiol   |
| Leon Septar        | Siwanilua   |
| Aliyra Maastehr    | Ghordeiol   |
| Chef Mya           | Hranic Fort |

- A query using the GROUP BY clause and applying aggregate functions to perform group-level calculations.

This query should return the number of characters at each location in the game. This should return 4 characters at Siwanilua, 4 characters at Hranic Fort and 2 characters at Ghordeiol. This can be used to determine what locations to focus on when preparing for a game session, as it's more important to prepare the locations players are currently present in.

Showing rows 0 - 2 (3 total, Query took 0.0003 seconds.)

```
SELECT Locations.name, COUNT(Characters.ID) FROM Locations JOIN Characters ON Locations.ID = Characters.isAt GROUP BY Locations.name ORDER BY COUNT(Characters.ID);
```

Profiling [ Edit inline ] [ Edit ] [ Explain SQL ] [ Create PHP code ] [ Refresh ]

Show all | Number of rows: 25 ▾ Filter rows: Search this table

**Extra options**

| name        | COUNT(Characters.ID) |
|-------------|----------------------|
| Ghordeiol   | 2                    |
| Siwanilua   | 4                    |
| Hranic Fort | 4                    |

Show all | Number of rows: 25 ▾ Filter rows: Search this table

**Query results operations**

Print Copy to clipboard Export Display chart Create view

This query should display the average level of the party's characters. This should return 3, as all the PCs currently in the database are at level 3. This will be used to determine how powerful the party is in order to balance monster encounters.

The screenshot shows a MySQL query results page. At the top, a green bar displays the message "Showing rows 0 - 0 (1 total, Query took 0.0001 seconds.)". Below this, the SQL query "SELECT AVG(level) FROM Players;" is shown. A toolbar above the results includes options for Profiling, Edit inline, Edit, Explain SQL, Create PHP code, and Refresh. Below the toolbar, there are filters for Show all (unchecked), Number of rows (set to 25), and Filter rows (Search this table). An "Extra options" button is also present. The main result section shows a single row with the title "AVG(level)" and the value "3.0000". Another toolbar below this row includes Show all, Number of rows (set to 25), and Filter rows. At the bottom of the results area is a "Query results operations" toolbar with icons for Print, Copy to clipboard, Export, Display chart, and a magnifying glass.

Each SQL query is documented with its intended purpose, expected results, and the actual SQL query written.

4. The results of each SQL query are included showcasing the insights extracted from the database. Screenshots of the tables displaying the query results are provided.

## Submission

When you're finished, complete the following steps to submit your work:

- Export your document with responses as a **PDF file AND save it inside** your **documentation** folder. Refer to the following for documentation on how to do this:
  - [Google Docs](#) (*File → Download → PDF Document*)

- [Microsoft Word](#) (*File → Save As / Export → PDF*)
  - [Pages](#) (*File → Export To → PDF*)
- Inside your repo, create a folder named **db** and export your database as an **SQL file** into that folder. The file should include all SQL code used to create tables, insert data, and run other queries. Follow the steps in the [Exporting A Database section](#) to export your database into a single SQL file.
- All group members should then be able to pull this SQL file from the repo and upload it to their own cPanel accounts (see [Importing A Database section](#)).
- Upload all your changes to GitHub.
  - If you're using **GitHub Desktop (GUI)**, complete the [Uploading Changes \(GitHub Desktop\) section](#) to upload your changes from your local device to GitHub.
  - If you're using **Git (CLI)**, complete the [Uploading Changes \(GitHub CLI\) section](#) to upload your changes from your local device to GitHub.

\***ONE group member\*** must paste the URL of your GitHub repository in the provided textbox in Brightspace. Click the blue *Submit* button to successfully submit your work for this assignment.

## Grading Rubric

You can refer to the **Populating & Querying Your Database grading rubric** given in Brightspace for this assignment to find details on how your submission will be graded.