University of British Columbia, Vancouver
Department of Computer Science

CPSC 304 Project Cover Page

Milestone #: 4

Date: Dec 1, 2023

Group Number: 115

Name	Student Number	CS Alias (Userid)	Preferred E-mail Address
Ayush Vora	96718192	q0v8x	avora21@student.ubc.ca
Wrik Steven Sen	53382818	t2f7p	coolkidwrik@gmail.com
Max Xu	27226976	i3b6k	maxzixiaoxu@gmail.com

By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)

In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia

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Project Summary:

A database of data on stars, planets, planetary systems, and astronomical entities. This includes a collection of classifications. It provides a user interface for clients to interact and query with celestial objects.

Final Schema Differences:

Change the Schema for moon:

Before: Moon (**id**, **planetId**, radius)

After: Moon (**id**, planetId, radius)

This was because planetId was not a necessary foreign key.

Schema:

GalaxyType (shape, TYPE)

BlackHoleMass (massType, mass)

StarTemperature (temperature, TYPE)

AsteroidComposition (composition, TYPE)

Galaxy (id, SIZE, **TYPE**)

BlackHole (id, radius, **mass**, **galaxyID**)

Asteroid (id, **composition**, **galaxyID**)

PlanetarySystem (id, TYPE, age, **galaxyID**)

Planet (id, declination, rightAscension, mass, radius, TYPE, **planetarySystemId**)

Satellite (id, **planetId**, mass)

Meteor (**id**, **planetEnteredID**)

Moon (**id**, planetId, radius)

Nebula (id, TYPE, magnitude, **galaxyID**)

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Star (id, declination, rightAscension, mass, radius, **temperature**, luminosity, **planetarySystemID**)

Data Screenshots:

Galaxy:

Retrieved data from the table:

ID	SIZE	TYPE
Andromeda	220000	Spiral
Milky Way	87400	Spiral
Sombrero	60000	Peculiar
Triangulum	60000	Spiral
Whirlpool	50000	Spiral
ESO 243-49	50000	Spiral
Virgo A	60000	Elliptical

Galaxy Type:

Retrieved data from the table:

SHAPE	TYPE
Peculiar	Peculiar
Spiral	Spiral
Elliptical	Elliptical
Lenticular	Lenticular
Seyfert	Seyfert

Star:

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Retrieved data from the table:

ID	DECLINATION	RIGHTASCENSION	MASS	RADIUS	TEMPERATURE	LUMINOSITY	PLANETARYSYSTEMID
Kepler 22	48	19	1	1	5596	1	Kepler 22
Lalande 21185	36	11	0	0	3547	0	Lalande 21185
Proxima Centauri	-63	14	0	0	2992	0	Proxima Centauri
Sun	10	14	1	1	5772	1	Solar System
TRAPPIST-1	-5	23	0	0	2566	0	TRAPPIST-1
Big-Chungus-ONE	-4	27	0	0	5772	0	C.K.Wrik-System
Big-Chungus-TWO	-6	30	1	0	2566	0	C.K.Wrik-System

Star Temperature:

Retrieved data from the table:

TEMPERATURE	TYPE
2566	M-Type
2992	M-Type
3547	M-Type
5596	G-Type
5772	G-Type

Planet:

Retrieved data from the table:

ID	DECLINATION	RIGHTASCENSION	MASS	RADIUS	TYPE	PLANETARYSYSTEMID
Earth	0	0	1	6378	Terrestrial	Solar System
Jupiter	268	18	318	69911	Gas Giant	Solar System
Kepler 22B	-48	19	2	6378	Terrestrial	Kepler 22
Saturn	41	3	95	58232	Gas Giant	Solar System
Uranus	257	17	15	25362	Ice Giant	Solar System
Planet-Ayush	258	20	16	25362	Gas Giant	C.K.Wrik-System
Planet-Max	259	30	17	25362	Ice Giant	C.K.Wrik-System

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Satellite:

Retrieved data from the table:

ID	PLANETID	MASS
Europa	Jupiter	0
Ganymede	Jupiter	0
Miranda	Uranus	0
Moon	Earth	0
Titan	Saturn	0

Moon:

Retrieved data from the table:

ID	PLANETID	RADIUS
Moon	Earth	1737
Ganymede	Jupiter	2634
Miranda	Uranus	236
Titan	Saturn	2575
Europa	Jupiter	1561

Asteroid:

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Retrieved data from the table:

ID	COMPOSITION	GALAXYID
Aarhus	Chondrite	Milky Way
Vermillion	Pallasite	Milky Way
Qidong	O Chondrite	Milky Way
Yamato 000593	Achondrite	Milky Way
Hoba	Iron	Milky Way
Asteroid1	Chondrite	Triangulum
Asteroid2	Pallasite	Triangulum
Asteroid3	O Chondrite	Triangulum
Asteroid4	Achondrite	Triangulum
Asteroid5	Iron	Triangulum
Asteroid6	Achondrite	Whirlpool
Asteroid7	Iron	Whirlpool

Meteor:

Retrieved data from the table:

ID	PLANETENTEREDID
Aarhus	Earth
Hoba	Earth
Qidong	Earth
Vermillion	Earth
Yamato 000593	Earth

Black Hole:

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Retrieved data from the table:

ID	RADIUS	MASS	GALAXYID
Sagittarius A*	32	4154000	Milky Way
Cygnus X-1	21	21	Milky Way
HLX-1	0	90000	ESO 243-49
M87*	815932000000	2400000000000	Virgo A
SS 433	19	26	Milky Way

Black Hole Mass:

Retrieved data from the table:

MASSTYPE	MASS
Supermassive	4154000
Stellar	21
Intermediate	90000
Supermassive	2400000000000
Stellar	26

Nebula:

Retrieved data from the table:

ID	TYPE	MAGNITUDE	GALAXYID
Cat's Eye Nebula	Planetary	10	Milky Way
Dumbbell Nebula	Planetary	8	Milky Way
Helix Nebula	Bright Planetary	8	Milky Way
M2-09	Planetary	15	Milky Way
Ring Nebula	Planetary	9	Milky Way

Planetary System:

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Retrieved data from the table:

ID	TYPE	AGE	GALAXYID
Kepler 22	Ordered	7	Milky Way
Lalande 21185	Ordered	8	Milky Way
Proxima Centauri	Ordered	5	Milky Way
Solar System	Ordered	5	Milky Way
TRAPPIST-1	Similar	8	Milky Way
C.K.Wrik-System	Similar	10	Whirlpool

List of SQL Queries:

Queries in file admin.php:

Insert Operation:

1. Line 348-`"INSERT INTO Galaxy VALUES ('$id', $size, '$galaxyType')";`
2. Line 360-`"INSERT INTO Moon VALUES ('$satelliteId', '$planetId', $radius)";`
3. Line 362-`"INSERT INTO Satellite VALUES ('$satelliteId', '$planetId', $mass)";`
4. Line 373-`"INSERT INTO Asteroid VALUES ('$asteroidId', '$composition', '$galaxyID')";`
5. Line 382-`"INSERT INTO PlanetarySystem VALUES ('$systemId', '$systemType', $age, '$galaxyID')";`
6. Line 394-`"INSERT INTO Planet VALUES ('$planetId', $declination, $rightAscension, $mass, $radius, '$planetType', '$planetarySystemId')";`

7. Line 401-`"INSERT INTO Meteor VALUES ('$meteorId', '$planetEnteredId')";`
8. Line 410-`"INSERT INTO Nebula VALUES ('$nebulaId', '$nebulaType', $nebulaMagnitude, '$galaxyID')";`
9. Line 423-`"INSERT INTO Star VALUES ('$starId', $declination, $rightAscension, $mass, $radius, $temperature, $luminosity, '$planetarySystemID')";`
10. Line 432-`"SELECT * FROM BlackHoleMass WHERE id = '$mass'";`
11. Line 443-`"INSERT INTO BlackHoleMass VALUES ('$massType', '$mass')";`
12. Line 447-`"INSERT INTO BlackHole VALUES ('$blackHoleId', $radius, $mass, '$galaxyID')";`

Delete Operation:

1. Line: 322 - `"DELETE FROM $type WHERE id = '$id'";`

Update Operation:

1. Line: 283 - `"UPDATE Galaxy SET \"SIZE\" = $newSize, \"TYPE\" = '$newType' WHERE id = '$id'";`
2. Line: 289 - `"UPDATE Satellite SET planetId = '$newPlanetId', mass = $newMass WHERE id = '$id'";`
3. Line: 292(this is to check, not update)- `"SELECT * FROM Moon WHERE id = '$id'";`
4. Line: 297-`"UPDATE Moon SET planetId = '$newPlanetId' WHERE id = '$id'";`

View Operation:

1. Line 474-`"SELECT * FROM $selectedType"`

Queries in file home.php:

Selection:

Line 217

```
$query = "SELECT $selectString FROM Galaxy WHERE \"SIZE\" $comparison $galaxySize";
```

Line 223

```
$query = "SELECT $selectString FROM Galaxy WHERE \"TYPE\" = $galaxyType";
```

Line 229

```
$query = "SELECT $selectString FROM Galaxy WHERE \"SIZE\" $comparison
$galaxySize AND \"TYPE\" = $galaxyType";
```

Projection:

Line 217

```
$query = "SELECT $selectString FROM Galaxy WHERE \"SIZE\" $comparison
$galaxySize";
```

Line 219

```
$query = "SELECT $selectString FROM Galaxy";
```

Line 223

```
$query = "SELECT $selectString FROM Galaxy WHERE \"TYPE\" = $galaxyType";
```

Line 225

```
$query = "SELECT $selectString FROM Galaxy";
```

Line 229

```
$query = "SELECT $selectString FROM Galaxy WHERE \"SIZE\" $comparison
$galaxySize AND \"TYPE\" = $galaxyType";
```

Join: Lines 241-244

```
$query = "SELECT Planet.*, PlanetarySystem.galaxyID
```

```
            FROM Planet

            JOIN PlanetarySystem ON Planet.planetarySystemID =
PlanetarySystem.id

            WHERE PlanetarySystem.galaxyID = '$id'";
```

Aggregation with Group By: Line 253

```
$query = 'SELECT "TYPE", AVG(magnitude) AS "Average Magnitude" FROM Nebula
GROUP BY "TYPE"';
```

Aggregation with Having: Lines 264-268

```
$query = "SELECT BlackHoleMass.massType, avg(radius) as \"Average Radius\"

            FROM (BlackHole JOIN BlackHoleMass ON BlackHoleMass.mass =
BlackHole.mass)

            GROUP BY BlackHoleMass.massType

            HAVING avg(radius) $inequality $number

            ORDER BY avg(radius)";
```

Nested Aggregation with Group By: Lines 277-283

```
$query = 'SELECT GalaxyID, SUM(Count) AS "Number of Stars"

            FROM PlanetarySystem

            JOIN (SELECT planetarySystemID AS psid,
COUNT(planetarySystemID) AS Count

                FROM Star
```

```
                GROUP BY planetarySystemID)

            ON PlanetarySystem.id = psid

            GROUP BY GalaxyID';
```

Division: Lines 293- 297

```
$query = 'SELECT Galaxy.id FROM Galaxy

            JOIN Asteroid ON Galaxy.id = Asteroid.galaxyID

            JOIN AsteroidComposition ON Asteroid.composition =
AsteroidComposition.composition

            GROUP BY Galaxy.id

            HAVING COUNT(DISTINCT AsteroidComposition.composition) =
(SELECT COUNT(*) FROM AsteroidComposition)';
```

Functionality Screenshots:

For Data Before, see the screenshots above with all the data tables.

Selection	
During:	Choose a type: Find Galaxies Submit Filter by Size: Greater than 60000 Filter by Type: Select Columns: Type: Size: Submit

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After:

ID	SIZE	TYPE
Andromeda	220000	Spiral
Milky Way	87400	Spiral

Projection

During:

Choose a type: Find Galaxies Submit

Filter by Size: Greater than
Filter by Type:

Select Columns:

Type: Size: Submit

After:

ID	TYPE
Andromeda	Spiral
Milky Way	Spiral
Sombrero	Peculiar
Triangulum	Spiral
Whirlpool	Spiral
ESO 243-49	Spiral
Virgo A	Elliptical

Join

During:

Choose a type: All Planets in Galaxy Submit

Enter a Galaxy ID to view all planets in that galaxy: Milky Way Submit

After:

Retrieved data from the table:

ID	DECLINATION	RIGHTASCENSION	MASS	RADIUS	TYPE	PLANETARYSYSTEMID	GALAXYID
Earth	0	0	1	6378	Terrestrial	Solar System	Milky Way
Jupiter	268	18	318	69911	Gas Giant	Solar System	Milky Way
Kepler 22B	-48	19	2	6378	Terrestrial	Kepler 22	Milky Way
Saturn	41	3	95	58232	Gas Giant	Solar System	Milky Way
Uranus	257	17	15	25362	Ice Giant	Solar System	Milky Way

Aggregation with Group By

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<table>
<tr><td>During:</td><td>Choose a type: Average Magnitude of Nebula Types Submit

Click the button to view the average Magnitude of all types of Nebulae: Submit</td></tr>
<tr><td>After:</td><td><table><tr><th>TYPE</th><th>Average Magnitude</th></tr><tr><td>Planetary</td><td>10.5</td></tr><tr><td>Bright Planetary</td><td>8</td></tr></table></td></tr>
<tr><td colspan="2">Aggregation with Having</td></tr>
<tr><td>During:</td><td>Get all black hole types comapred with the Radius:
Radius is: Greater than 1
Submit</td></tr>
<tr><td>After:</td><td><table><tr><th>MASSTYPE</th><th>Average Radius</th></tr><tr><td>Stellar</td><td>20</td></tr><tr><td>Supermassive</td><td>407966000016</td></tr></table></td></tr>
<tr><td colspan="2">Nested Aggregation with Group By</td></tr>
<tr><td>During:</td><td>Choose a type: Average Stars per Galaxy Submit

Press to view the average number of stars per galaxy: Submit</td></tr>
<tr><td>After:</td><td><table><tr><th>GALAXYID</th><th>Number of Stars</th></tr><tr><td>Whirlpool</td><td>2</td></tr><tr><td>Milky Way</td><td>5</td></tr></table></td></tr>
<tr><td colspan="2">Division</td></tr>
</table>

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During:	Choose a type: Galaxies with Every Asteroid Composition Submit Press to view the galaxies that have every type of asteroid: Submit
After:	Retrieved dat **ID** Milky Way Triangulum