

CPSC 304 Project Cover Page

Milestone #: 4

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Group Number: 36

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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

Repository

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e

Note: The commits from the user listed as UBC Student are from Dylan Chiu.

SQL Script

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/sql/start.sql

README

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/README.md

Project Description

The project is a web application modeling a database for a fictional racing game. The application models characters, cars, special abilities, power-ups, races, tournaments, locations and race tracks.

The project allows users to accomplish the following actions:

- Insertion: Create tournaments
- Deletion: Delete characters
- Update: Update cars
- Selection: Search for results that match conditions from user input
- Projection: View all cars with selected attributes
- Join: View the races each location has
- Aggregation with Group By: Find the number of characters in each skill level
- Aggregation with Having: Find the maximum stat value of a car for each car class
- Nested Aggregation with Group By: Find the average duration for each type of power-up.
- Division: Find the characters who have participated in all tournaments.

The following schema changes were made to improve readability

- The attribute Number in Characters was renamed to ID.
- The CharactersParticipateInRaces relation was renamed to CharactersInRaces.
- The CharactersParticipateInTournaments relation was renamed to CharactersInTournaments

Relational Schema

Cars (Make: string, Model: string, Colour: string, Class: string, Speed: int, Handling: int, Acceleration: int, **CharacterName**: string)

MAKE	MODEL	COLOUR	CLASS	SPEED	HANDLING	ACCELERATION	CHARACTERNAME
Nissan	370Z	Black	Drift	60	80	75	Aloy
Bmw	M4	Blue	Sport	80	34	47	Cloud Strife
Mercedes	SLS	Silver	Sport	88	48	50	Crash Bandicoot
Acuna	NSX	Red	Drift	55	84	88	Isabelle
Subaru	WRX	Purple	Drift	75	77	76	Mario
Toyota	GT86	Turquoise	Drift	49	80	90	Master Chief
Mercedes	G-Wagon	Pink	Off-Road	78	53	80	
Lamborghini	Urus	Yellow	Off-Road	80	42	87	Solid Snake
McLaren	720S	Orange	Sport	94	30	42	Sonic the Hedgehog
Audi	R8	Light Blue	Sport	85	52	40	Aloy
Bmw	X5	Black	Off-Road	68	75	80	Mario
Pagani	Zonda	Black	Super	90	85	89	Cloud Strife
Koenigsegg	Jesko	Silver	Super	99	99	99	Mario

Characters (Name: string, ID: int, SkillLevel: string) (Number needs to be unique)

CKs: Number

NAME	ID	SKILLLEVEL
Aloy	1	Novice
Cloud Strife	2	Proficient
Crash Bandicoot	3	Competent
Isabelle	4	Novice
Mario	5	Expert
Master Chief	6	Expert
Princess Zelda	7	Proficient
Solid Snake	8	Novice
Sonic the Hedgehog	9	Expert

9 rows selected.

SpecialAbilities (Name: string, Effect: string, **CharacterName**: string)

NAME	EFFECT	CHARACTERNAME
Focus	Makes the character immune from negative power-ups from opponents	Aloy
Finishing Touch	Can be activated once in a race to decrease the speed of all opponent cars by 50 for 20s	Cloud Strife
Speed Shoes	Permanently increases car speed by 15	Crash Bandicoot
Duration Boost	Permanently doubles the duration of all consumed power-ups	Isabelle
Fire Flower	Can be activated up to 3 times in a race to spin out opponent cars	Mario
Fortune Pill	50% chance of increasing car speed by 10	Mario
Spartan Sprint	Permanently increases car speed by 20	Master Chief
Magic	Permanently increases all car stats by 5	Princess Zelda
Cardboard box	Can be activated up to 3 times to become invisible from other characters for 10s	Solid Snake
Spin Dash	Permanently increases car speed and acceleration by 10	Sonic the Hedgehog

10 rows selected.

Tournaments (Name: string, Trophy: string) (Trophy needs to be unique)

CKs: Trophy

NAME	TROPHY
American Cup	Diamond Eagle Statue
Drift Championship	Gold Medal
European Cup	Gold Cup
Pan-American Championship	Gold Plaque
World Championship	Diamond Globe Statue

Races (Name: string, Difficulty: string)

NAME	DIFFICULTY
Circuit 1	Easy
Circuit 2	Normal
Circuit 3	Normal
Circuit 4	Hard
Circuit 5	Expert
Time Trial 1	Easy
Time Trial 2	Normal
Time Trial 3	Normal
Time Trial 4	Hard
Time Trial 5	Expert
10 rows selected.	

Circuits (RaceName: string, NumberOfLaps: int)

RACENAME	NUMBEROFLAPS
Circuit 1	2
Circuit 2	3
Circuit 3	1
Circuit 4	5
Circuit 5	7

TimeTrials (**RaceName**: string, Allotted Time: int)

RACENAME	ALLOTTEDTIME
Time Trial 1	150
Time Trial 2	135
Time Trial 3	240
Time Trial 4	100
Time Trial 5	80

Locations_1 (**Name**: string, **Season**: string)

NAME	SEASON
Germany	Summer
Japan	Winter
United States	Autumn
Brazil	Summer
United Kingdom	Spring
France	Summer
Belgium	Winter
7 rows selected.	

Locations_2 (**Season**: string, Weather: string)

SEASON	WEATHER
Summer	Sunshine
Winter	Snow
Autumn	Fog
Spring	Rain

RaceTracks (Name: string, Terrain: string, **LocationName**: string)
(locationName cannot be null)

NAME	TERRAIN	LOCATIONNAME
Nurburgring	Hill Climb	Germany
Nosriring	Street Circuit	Germany
Hockenheimring	Permanent Circuit	Germany
Suzuka Circuit	Permanent Circuit	Japan
Fuji Speedway	Speedway	Japan
Tsukuba	Permanent Circuit	Japan
Sao Paulo	Street Circuit	Brazil
Interlagos	Permenent Circuit	Brazil
Ultra4 UK	Off Road	United Kingdom
Knockhill	Hill Climb	United Kingdom
Indianapolis Motor	Speedway	United States
Laguna Seca	Permanent Circuit	United States
Daytona	Permanent Circuit	United States
Sebring	Permanent Circuit	United States
Le Mans	Permanent Circuit	France
La Chatre	Street Circuit	France
Brussels	Street Circuit	Belgium
Spa-Francorchamps	Permanent Circuit	Belgium

18 rows selected.

PowerUps_1 (Name: string, **Effect**: string, Duration: int, Rarity: string)

NAME	EFFECT	DURATION	RARITY
Banana	Causes the user car to spin out.	3	Common
Green Shell	Can be launched by a character to spin out an opponent car.	5	Rare
EMP	Causes the user car to turn off	2	Common
Nitrous Oxide	Temporarily increases car acceleration by 30	10	Rare
Ghost	Makes the car invisible to other cars	5	Very Rare
Lightning	Causes all opponents to lose their power-ups	1	Very Rare
Jerrycan	Temporarily increases car speed by 10	5	Common
Steering Wheel	Temporarily increases car handling by 20	2	Common

PowerUps_2 (Effect: string, Type: string)

EFFECT	TYPE
Causes the user car to spin out.	Offensive
Can be launched by a character to spin out an opponent car.	Offensive
Causes the user car to turn off	Offensive
Temporarily increases car acceleration by 30	Status
Makes the car invisible to other cars	Defensive
Causes all opponents to lose their power-ups	Offensive
Temporarily increases car speed by 10	Status
Temporarily increases car handling by 20	Status

8 rows selected.

CharactersInRaces (CharacterName: string, RaceName: string)

CHARACTERNAME	RACENAME
Aloy	Circuit 1
Aloy	Time Trial 2
Cloud Strife	Circuit 4
Crash Bandicoot	Time Trial 4
Isabelle	Circuit 5
Mario	Circuit 1
Mario	Time Trial 5
Master Chief	Time Trial 1
Princess Zelda	Time Trial 3
Solid Snake	Time Trial 2
Sonic the Hedgehog	Circuit 3
11 rows selected.	

CharactersInTournaments (CharacterName: string, TournamentName: string)

CHARACTERNAME	TOURNAMENTNAME
Aloy	American Cup
Aloy	Drift Championship
Aloy	European Cup
Aloy	Pan-American Championship
Aloy	World Championship
Crash Bandicoot	Drift Championship
Isabelle	European Cup
Mario	American Cup
Mario	Drift Championship
Mario	European Cup
Mario	Pan-American Championship
Mario	World Championship
Princess Zelda	American Cup
Sonic the Hedgehog	World Championship
14 rows selected.	

TournamentsIncludeRaces (**TournamentName**: string, **RaceName**: string)

TOURNAMENTNAME	RACENAME
American Cup	Circuit 3
American Cup	Time Trial 3
Drift Championship	Circuit 2
European Cup	Circuit 5
Pan-American Championship	Circuit 4
World Championship	Circuit 1
World Championship	Circuit 2

7 rows selected.

RaceTracksHostRaces (**RaceTrackName**: string, **RaceName**: string)

RACETRACKNAME	RACENAME
Brussels	Circuit 1
Brussels	Circuit 3
Daytona	Circuit 5
Fuji Speedway	Circuit 1
Fuji Speedway	Circuit 5
Hockenheimring	Circuit 3
Hockenheimring	Time Trial 4
Indianapolis Motor	Circuit 3
Interlagos	Circuit 1
Interlagos	Time Trial 2
Knockhill	Circuit 3
Knockhill	Time Trial 2
La Chatre	Circuit 2
Laguna Seca	Circuit 1
Laguna Seca	Time Trial 1
Le Mans	Circuit 5
Le Mans	Time Trial 5
Nosriring	Circuit 2
Nurburgring	Circuit 1
Nurburgring	Time Trial 5
Sau Paulo	Circuit 4
Sau Paulo	Time Trial 4
Sebring	Time Trial 2
Spa-Francorchamps	Time Trial 2
Suzuka Circuit	Circuit 2
Suzuka Circuit	Time Trial 3
Tsukuba	Time Trial 4
Ultra4 UK	Circuit 5
Ultra4 UK	Time Trial 5

29 rows selected.

RacesHavePowerUps (RaceName: string, PowerUpName: string)

RACENAME	POWERUPNAME
-----	-----
Circuit 1	Banana
Circuit 1	EMP
Circuit 1	Green Shell
Circuit 1	Steering Wheel
Circuit 2	Banana
Circuit 2	EMP
Circuit 2	Nitrous Oxide
Circuit 2	Steering Wheel
Circuit 3	Banana
Circuit 3	EMP
Circuit 3	Green Shell
Circuit 3	Lightning
Circuit 3	Steering Wheel
Circuit 4	Banana
Circuit 4	EMP
Circuit 4	Nitrous Oxide
Circuit 4	Steering Wheel
Circuit 5	Banana
Circuit 5	EMP
Circuit 5	Ghost
Circuit 5	Green Shell
Circuit 5	Steering Wheel
Time Trial 1	Banana
Time Trial 1	EMP
Time Trial 1	Nitrous Oxide
Time Trial 1	Steering Wheel
Time Trial 2	Banana
Time Trial 2	EMP
Time Trial 2	Green Shell
Time Trial 2	Steering Wheel
Time Trial 3	Banana
Time Trial 3	EMP
Time Trial 3	Nitrous Oxide
Time Trial 3	Steering Wheel
Time Trial 4	Banana
Time Trial 4	EMP
Time Trial 4	Green Shell
Time Trial 4	Lightning
Time Trial 4	Steering Wheel
Time Trial 5	Banana
Time Trial 5	EMP
Time Trial 5	Ghost
Time Trial 5	Nitrous Oxide
Time Trial 5	Steering Wheel

Queries: Insert Operation

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/insert_handler.php

Create a tournament.

```
// :bind1, :bind2 = user-selected tournament name, trophy name
INSERT INTO Tournaments VALUES (:bind1, :bind2);

// :bind1, :bind2 = user-selected tournament name, race name
INSERT INTO TournamentsIncludeRaces VALUES (:bind1, :bind2);
```

Motorsport

Main Menu

Tournament Creator

Enter text for the name and trophy of the tournament.

Name:

Trophy:

Select races from the list below to include in the tournament.

- ☒ Circuit 1
- ☐ Circuit 2
- ☒ Circuit 3
- ☐ Circuit 4
- ☐ Circuit 5
- ☐ Time Trial 1
- ☒ Time Trial 2
- ☐ Time Trial 3
- ☒ Time Trial 4
- ☐ Time Trial 5

Create

Tournament	Trophy
American Cup	Diamond Eagle Statue
Drift Championship	Gold Medal
European Cup	Gold Cup
Pan-American Championship	Gold Plaque
World Championship	Diamond Globe Statue
Cup	whatever

Tournament	Race
Cup	Circuit 1
Cup	Circuit 3
Cup	Time Trial 2
Cup	Time Trial 4

Queries: Delete Operation

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/delete_handler.php

Delete a character.

```
// :bind1 = user-selected character name
DELETE FROM Characters WHERE Name = :bind1
```

Before:

Motorsport	Main Menu
Character Deletion	
Select a character from the list below to delete it.	
<input type="text" value="Cloud Strife"/>	<input type="button" value="Delete"/>

After:

Motorsport	Main Menu
Character Deletion	
Select a character from the list below to delete it.	
<input type="text" value="Aloy"/>	<input type="button" value="Delete"/>

Characters
Aloy
Crash Bandicoot
Isabelle
Mario
Master Chief
Princess Zelda
Solid Snake
Sonic the Hedgehog

Queries: Update Operation

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/update_handler.php

Update a car

```
// :bind1, :bind2, :bind3, :bind4, :bind5, :bind6 = user selected
// make, model, colour, speed, handling, acceleration
UPDATE Cars
SET Colour = :bind3, Speed = :bind4, Handling = :bind5,
    Acceleration = :bind6
WHERE make = :bind1 AND model = :bind2;
```

Before:

Tuning shop

Make	Model	Colour	Class	Speed	Handling	Acceleration	Character
Nissan	370Z	White	Drift	51	89	75	Aloy
BMW	M4	Blue	Sport	80	34	47	Cloud Strife
Mercedes	SLS	Silver	Sport	88	48	50	Crash Bandicoot
Acura	NSX	Red	Drift	55	84	88	Isabelle
Subaru	WRX	Purple	Drift	75	77	76	Mario
Toyota	GT86	Turquoise	Drift	49	80	90	Master Chief
Mercedes	G-Wagon	Pink	Off-Road	78	53	80	Princess Zelda
Lamborghini	Urus	Yellow	Off-Road	80	42	87	Solid Snake
McLaren	720S	Orange	Sport	94	30	42	Sonic the Hedgehog
Audi	R8	Light Blue	Sport	85	52	40	Aloy
BMW	X5	Black	Off-Road	68	75	80	Mario
Pagani	Zonda	Black	Super	90	85	89	Cloud Strife
Koenigsegg	Jesko	Silver	Super	99	99	99	Mario

After:

Enter the make and model of the car to tune.

Make:

Model:

Enter text for each of the attributes.

Colour:

Speed:

Handling:

Acceleration:

Make	Model	Colour	Class	Speed	Handling	Acceleration	Character
BMW	M4	White	Sport	1	2	3	Cloud Strife

After refreshing the web page:

Tuning shop

Make	Model	Colour	Class	Speed	Handling	Acceleration	Character
Nissan	370Z	White	Drift	51	89	75	Aloy
BMW	M4	White	Sport	1	2	3	Cloud Strife
Mercedes	SLS	Silver	Sport	88	48	50	Crash Bandicoot
Acura	NSX	Red	Drift	55	84	88	Isabelle
Subaru	WRX	Purple	Drift	75	77	76	Mario
Toyota	GT86	Turquoise	Drift	49	80	90	Master Chief
Mercedes	G-Wagon	Pink	Off-Road	78	53	80	Princess Zelda
Lamborghini	Urus	Yellow	Off-Road	80	42	87	Solid Snake
McLaren	720S	Orange	Sport	94	30	42	Sonic the Hedgehog
Audi	R8	Light Blue	Sport	85	52	40	Aloy
BMW	X5	Black	Off-Road	68	75	80	Mario
Pagani	Zonda	Black	Super	90	85	89	Cloud Strife
Koenigsegg	Jesko	Silver	Super	99	99	99	Mario

Queries: Selection Operation

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/selection_handler.php

Select a table, attribute, and condition

```
SELECT DISTINCT <attribute> FROM <table> WHERE <condition>;
```

Motorsport

[Main Menu](#)

Search

Select the category you to search in.

Cars

Here are the attributes of the categories you can choose. The chosen attribute should belong to the chosen category.

Cars - Make: string, Model: string, Colour: string, Class: string, Speed: int, Handling: int, Acceleration: int, CharacterName: string

Characters - Name: string, Number: int, SkillLevel: string

SpecialAbilities - Name: string, Effect: string, CharacterName: string

Tournaments - Name: string, Trophy: string

Races - Name: string, Difficulty: string

Enter the name of attribute you want to see.

For example: enter the attribute Make if you choose the category Cars.

Attribute:

Enter the name of attribute you want to see.

For example: enter the attribute Make if you choose the category Cars.

Attribute:

Enter the conditions for the chosen category.

For example: enter "Speed > 5" if you choose the category Cars.

Multiple conditions can be entered using AND. For example: enter "Speed > 5 AND Colour = 'White'".

Condition:

Make

McLaren

Audi

Nissan

Mercedes

Acura

Koenigsegg

Queries: Projection Operation

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/projection_handler.php

Find which cars have which values for its attributes.

```
SELECT <user selected attributes> FROM CARS;
```

Garage

Select attributes and press submit to view all cars.

- ☒ Class
- ☐ Speed
- ☒ Handling
- ☐ Acceleration

Submit

Make	Model	Class	Handling
Nissan	370Z	Drift	89
BMW	M4	Sport	34
Mercedes	SLS	Sport	48
Acura	NSX	Drift	84
Subaru	WRX	Drift	77
Toyota	GT86	Drift	80
Mercedes	G-Wagon	Off-Road	53
Lamborghini	Urus	Off-Road	42
McLaren	720S	Sport	30

Queries: Join Operation

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/join_handler.php

Find all the races a location has

```
// :bind1 = user-selected location
SELECT RT.LocationName, RTHR.RaceName, RT.Name
FROM RaceTracks RT, RaceTracksHostRaces RTHR
WHERE RT.Name = RTHR.RaceTrackName AND RT.LocationName = :bind1;
```

Motorsport

Main Menu

Races

Select a location from the list below to view the races it contains.

Location	Race	Race Track
United States	Circuit 5	Daytona
United States	Circuit 3	Indianapolis Motor
United States	Circuit 1	Laguna Seca
United States	Time Trial 1	Laguna Seca
United States	Time Trial 2	Sebring

Queries: Aggregation with Group By

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/aggregation_with_group_by_handler.php

Find the number of characters in each skill level.

```
SELECT SkillLevel, COUNT(*)
FROM Characters
GROUP BY SkillLevel;
```

Motorsport

Main Menu

Character Stats

Press submit to view the number of characters in each skill level.

Submit

Skill Level	Count
Competent	1
Expert	3
Novice	3
Proficient	2

Queries: Aggregation with Having

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/aggregation_with_having_handler.php

Find the maximum speed, acceleration or handling of a car for each class with at least 2 cars.

```
SELECT Class, MAX(<user-selected car stat>)
FROM Cars
GROUP BY Class
HAVING COUNT(*) > 1;
```

Before:

MotorsportMain Menu

Car Stats

Select a car stat and press submit to determine its maximum value for each car class with at least 2 cars

Speed

Submit

After:

MotorsportMain Menu

Car Stats

Select a car stat and press submit to determine its maximum value for each car class with at least 2 cars

Handling

Submit

Class	Handling
Sport	52
Off-Road	75
Super	99
Drift	89

Queries: Nested Aggregation with Group By Operation

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/nested_aggregation_handler.php

Find the average duration for each power-up type where each power-up must be included in at least n races.

```
// :bind1 = number of races (n) selected by the user
SELECT P2.Type, ROUND(AVG(P1.Duration),2) as average
FROM PowerUps_1 P1, PowerUps_2 P2
WHERE P1.Effect = P2.Effect AND :bind1 <= (SELECT COUNT(*)
                                           FROM RacesHavePowerUps R
                                           WHERE R.PowerUpName = P1.Name)
GROUP BY P2.Type;
```

Before:

Motorsport	Main Menu
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Power-up Stats

Find the average duration for each type of power-up. Enter a value for the number of races a power-up must be included in to be included in the search.

After:

Motorsport	Main Menu
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Power-up Stats

Find the average duration for each type of power-up. Enter a value for the number of races a power-up must be included in to be included in the search.

Type	Average Duration [s]
Offensive	2.75
Defensive	5
Status	6

Queries: Division Operation

https://github.students.cs.ubc.ca/CPSC304-2022W-T1/project_i4v2b_q8p2k_y6o6e/blob/main/src/server/division_handler.php

Find the characters who have participated in all the tournaments.

```
SELECT C.Name
FROM Characters C
WHERE NOT EXISTS (SELECT T.Name
                  FROM Tournaments T MINUS SELECT CT.TournamentName
                  FROM CharactersInTournaments CT
                  WHERE CT.CharacterName = C.Name);
```

Motorsport

Main Menu

Tournament Stats

Press submit to list all the characters who have participated in all tournaments.

Submit

Characters
Aloy
Mario