CPSC 304 Project Cover Page

Milestone #: 4

Date: 12/01/2023

Group Number: 60

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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

Description

Our project involves designing a database to represent a system that manages games of various types, tracks player statistics, supports player profiles, and leaderboard tracking for each game. We are aiming to model how a company might want to handle and track data related to the games they provide and the players that play them. For example, game platforms such as Steam that host different amounts of games, and players can access it all in one place.

Our project accomplished our goal of completing an end-to-end system that allowed the user to "sign-in" to the game management system, then access their profile and see all the games that are available to them. They can explore greater information about the game they want to play such as the Developer Company, or Publisher.

Current Schema

The current schema differs from our original ER diagram outlined in Milestone 1 due to a few small adjustments and two significant changes. The larger modifications include the merging of two entities, removal of a many-to-many relationship, and the decomposition of an entity.

The smaller differences include the addition of attributes aimed to specifically identify the entity and serve as their primary key. An example would be introducing the key 'PlayerID' to uniquely determine a Player. Another adjustment involved the relationship between Publisher and Game, originally defined to be many-to-many with a participation constraint on the side of the Game. Although this constraint could be maintained after learning more about assertions in the SQL module, through further consideration, we decided to model the relationship as a one-to-many relationship such that a Game only has one Publisher, reflecting the typical real-world scenario where a game is published by a single company. As well, we previously did not have a partial key for our weak entity, so we identified that to be the "rank" attribute.

Upon further discussion regarding the behaviour and intent behind the PlayerProfile entity, we discovered its redundancy. As the entity PlayerProfile had only one non-recursive relationship with Player, which had both a key and participation constraint denoting exactly one, merging PlayerProfile and Player seemed much more logical. We could do this because Player and PlayerProfile are one-to-one. Additionally, the combination of these two entities works well because a Player only has one PlayerProfile across all Games, meaning that PlayerProfile never interacts with other relations directly than itself or Player. Thus, the first change is the removal of the entity PlayerProfile. After merging the two entities, the self-referencing relationship that PlayerProfile had became a self-referencing relationship for Player between Player 1 and Player 2.

The second difference between our original and current schema is the removal of the relationship between DeveloperCompany and Publisher. In game production, it is not necessarily the case that a developing company works for the publisher or vice versa, as seen with independent contracting companies. Therefore, in order to more accurately model real-world relationships between these companies, we decided that removing the relationship would enhance comprehensibility and generalize the representation of our schema to the real-world.

The last modification is the decomposition of the table Game into two relations that satisfy 3NF, Game and Genre. To make a more meaningful decomposition into 3NF, we added another functional dependency to Game: ageRestriction and MultiplayerGame: serverRegion. Now, we created a meaningful dependency as Genre and Server determines what the ageRestriction of a game will be and serverRegion determines what the voiceChatProvider will be. For example, violent horror games will have an ageRestriction of R for Restricted, while a

farming RPG will have an ageRestriction or rating of E for Everyone. Another example is that if an 'America-1001' server would be provided by a voice chat 'Voices'.

Schema Screenshots and Data

Schema:

Publisher (<u>publisherID</u>, publisherName)

Genre (genre, ageRestriction)

Game (gameID, title, genre, releaseDate, platform)

SinglePlayerGame (gameID, difficulty)

Server (<u>serverRegion</u>, voiceChatProvider)

MultiplayerGame (gameID, serverRegion)

Leaderboard (<u>leaderboardID</u>, visibility, timeFrame, **gameID**)

DeveloperCompany (<u>developerID</u>, developerName, hqCity)

Player (<u>playerID</u>, playerEmail, dateOfBirth, rank, avatar, bio)

Statistic (**playerID**, rank, score)

Team (teamID, creationDate)

DeveloperGame (<u>developerID</u>, <u>gameID</u>)

PublisherGame (publisherID, gameID)

LeaderboardStatistic (<u>leaderboardID</u>, <u>playerID</u>, <u>rank</u>)

GameTeam (gameID, teamID)

TeamPlayer (**playerID**, **teamID**)

GamePlayer (playerID, gameID)

Friend (playerID1, playerID2)

Tuples in each Relation:

Publisher (<u>publisherID</u>, publisherName)

```
PUBLISHERID PUBLISHERNAME

1 Ink Splatter Press
2 Game Publishers
3 Wonderful Whimsy
4 Reach for the Stars
5 Midnight Flourish
```

Genre (genre, ageRestriction)

GENRE	AGERESTRICTION
FPS Shooter	T
Adventure RPG	E
Action RPG	A
MOBA	T
Strategy	E

```
GAMEID TITLE
GENRE RELEASEDA PLATFORM
    1 Maple Story
Adventure RPG 10-OCT-23 iOS
      2 League of Legends
               10-OCT-23 Microsoft Windows
MORA
      3 Valorant
10-OCT-23 Microsoft Windows
FPS Shooter
 GAMEID TITLE
             RELEASEDA PLATFORM
 4 TeamFight Tactics
           10-OCT-23 Microsoft Windows
      5 Genshin Impact
              10-OCT-23 Microsoft Windows
      6 The Witcher 3: Wild Hunt
            10-0CT-23 PC
Adventure RPG
 GAMEID TITLE
GENRE RELEASEDA PLATFORM
     7 Assassins Creed Valhalla
Action RPG
            10-0CT-23 Xbox
      8 The Legend of Zelda: Breath of the Wild
               10-OCT-23 Nintendo Switch
     9 Cyberpunk 2077
Action RPG
          10-OCT-23 PC
```

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation

12 test
FPS Shooter 30-NOV-23 PC
```

SinglePlayerGame (gameID, difficulty)

DIFFICULTY	GAMEID
6	6
8	7
10	8
9	9
3	10
10	12

Server (<u>serverRegion</u>, voiceChatProvider)

SERVERREGION	VOICECHATPROVIDER
America-1001	Voices
America-1002	VoicePro
America-1003	TeamSpeak
America-1004	Noise
America-1005	Mumble

MultiplayerGame (gameID, serverRegion)

```
GAMEID SERVERREGION

1 America-1001
2 America-1002
3 America-1003
4 America-1004
5 America-1005
```

Leaderboard (<u>leaderboardID</u>, visibility, timeFrame, **gameID**)

```
LEADERBOARDID VISIBILITY TIMEFRAME

1 1 2023-10-12 - 2023-10-19
1 2 1 2023-10-12 - 2023-10-19
2 3 1 2023-10-12 - 2023-10-19
3 LEADERBOARDID VISIBILITY TIMEFRAME

GAMEID

GAMEID

4 0 2023-10-12 - 2023-10-19
4 5 1 2023-10-12 - 2023-10-19
5 6 1 2023-10-12 - 2023-10-19
6
```

```
LEADERBOARDID VISIBILITY TIMEFRAME

GAMEID

7 1 2023-10-12 - 2023-10-19

8 1 2023-10-12 - 2023-10-19

8 9 0 2023-10-12 - 2023-10-19

9

LEADERBOARDID VISIBILITY TIMEFRAME

GAMEID

GAMEID

10 1 2023-10-12 - 2023-10-19

10 1 2023-10-12 - 2023-10-19
```

DeveloperCompany (developerID, developerName, hqCity)

DEVELOPERID	DEVELOPERNAME	HQCITY
1	Awesome Games	Calgary
2	Cool Games	Vancouver
3	Machine Games	Toronto
4	Riot	LA
5	Blizzard	NYC

Player (playerID, playerEmail, dateOfBirth, rank, avatar, bio)

, , ,	, ,	, ,
PLAYERID PLAYEREMAIL		RANK
AVATAR		
BIO		
1 grace@gmail.com /path/to/avatar1.jpg Gamer, explorer, and thrill-seeker.	10-0CT-02	1
2 sophie@gmail.com /path/to/avatar2.jpg Casual gamer	23-0CT-02	2
PLAYERID PLAYEREMAIL		RANK
AVATAR		
BIO		
<pre>3 audrey@gmail.com /path/to/avatar3.jpg competitive.</pre>	20-NOV-03	3
4 jane@gmail.com /path/to/avatar4.jpg	30-APR-03	4

PLAYERID PLAYEREMAIL	DATEOFBIR	RANK
AVATAR		
BIO		
live laugh love.		
5 sam@gmail.com /path/to/avatar5.jpg i will win	10-MAY-03	5

Statistic (playerID, rank, score)

PLAYERID	RANK	SCORE
1	200	49988
2	7	2020204
3	1	8000878
4	20	4482748
5	9000	434

Team (teamID, creationDate)

TEAMID	CREATIOND
1	10-MAY-03
_	07-JUN-18
	14-JAN-21
	13-DEC-22
5	10-MAY-13

${\sf DeveloperGame}\;(\underline{{\sf developerID}},\,\underline{{\sf gameID}})$

DEVELOPERID	GAMEID
1	1
1	2
2	3
2	4
3	5
3	6
4	7
4	8
5	9
5	10

 $PublisherGame\ (\underline{\textbf{publisherID}},\ \underline{\textbf{gameID}})$

PUBLISHERID	GAMEID
1	1
1	2
2	
2	4
3	5
3	6
4	7
4	8
5	9
5	10

 $LeaderboardStatistic \ (\underline{\textbf{leaderboardID}}, \ \underline{\textbf{playerID}}, \ \underline{\textbf{rank}})$

RA	ID	PLAY	LEADERBOARDID
2	1		1
	2		2
	3		3
	4		4
90	5		5

 ${\sf GameTeam}~(\underline{\textbf{gameID}},~\underline{\textbf{teamID}})$

GAMEID	TEAMID
1	1
1	2
2	3
2	4
2	5

TeamPlayer (playerID, teamID)

PLAYERID	TEAMID
1	1
1	2
1	5
2	1
2	2
3	3
3	4
3	5
4	4
5	4

 $GamePlayer (\underline{\textbf{playerID}}, \, \underline{\textbf{gameID}})$

PLAYERID	GAMEID
1	1
2	1
3	1
4	
	1
5	1
5	2
5	3
5	4
5	5
5	6
5	7
PLAYERID	GAMEID
5	8
5	9
5	10

Friend (playerID1, playerID2)

PLAYERID1	PLAYERID2
1	2
2	3
3	4
4	5
5	3

SQL Queries

d. A list of all SQL queries used and where it can be found in the code (i.e., file name and line number(s)). For SQL query requirements, check the rubric listed on Canvas for Milestone 4. e. Screenshots demonstrating the functionality of each query using the GUI. We want to see a before/during/after progression of events.

For example, the before screenshot would be what data is in the table before you run the query, the during screenshot(s) is how the query is triggered using the GUI, and the after screenshot is what data is in your table afterwards.

Please label each set of screenshots with the name of the query it is meant to address (e.g., "Insert Operation"). You need only to include screenshots for the required queries – if you implemented more than what was required, screenshots are not needed for those extra queries.

INSERT (Game)

File: appService.js

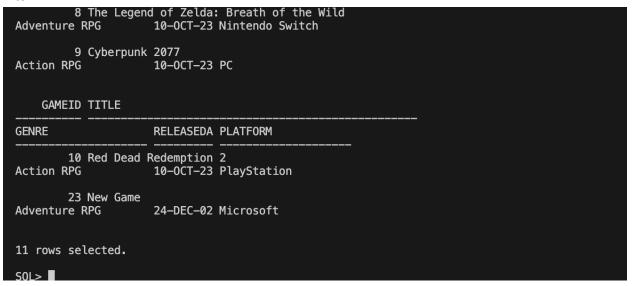
Line: 132

	RELEASEDA	
1 Maple Sto		
Adventure RPG	10-0CT-23	iOS
2 League of MOBA	_	Microsoft Windows
3 Valorant FPS Shooter	10-0CT-23	Microsoft Windows
GAMEID TITLE		
GENRE	RELEASEDA	PLATFORM
4 TeamFight	Tactics	Microsoft Windows
5 Genshin In Adventure RPG		Microsoft Windows
6 The Witche Adventure RPG		
GAMEID TITLE		
GENRE	RELEASEDA	PLATFORM
7 Assassins Action RPG		
8 The Legend Adventure RPG		: Breath of the Wild Nintendo Switch
9 Cyberpunk Action RPG		PC
GAMEID TITLE		
	RELEASEDA	
10 Red Dead I		

GAMEID T	ITLE	
GENRE	RELEASEDA	PLATFORM
10 R	ed Dead Redemption	2
Action RPG	10-OCT-23	PlayStation

Filter Games:	Sel	You have selected:	
	Add Game	Enter text here Delete Game	
Please fill ou	t the informa	tion below to Add You	Desired Game:
	Game ID:	23	
	Title:	New Game	
	Genre:	Adventure RPG	
	Release Date:	24-12-2002	
	Platform:	Microsoft	
		Add Game	
Suc	cess. Check the ti	uple in Query Available Game	- Tables

After:



DELETE

File: appService.js

Line: 155

Before: Game (gameID, title, genre, releaseDate, platform)

```
GAMEID TITLE
GENRE RELEASEDA PLATFORM
1 Maple Story
Adventure RPG 10-OCT-23 iOS
      2 League of Legends
                10-OCT-23 Microsoft Windows
     3 Valorant
ooter 10-OCT-23 Microsoft Windows
FPS Shooter
  GAMEID TITLE
         RELEASEDA PLATFORM
 4 TeamFight Tactics
Strategy 10-OCT-23 Microsoft Windows
      5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows
       6 The Witcher 3: Wild Hunt
Adventure RPG 10-OCT-23 PC
  GAMEID TITLE
  7 Assassins Creed Valhalla
      8 The Legend of Zelda: Breath of the Wild
                10-OCT-23 Nintendo Switch
      9 Cyberpunk 2077
Action RPG 10-OCT-23 PC
```

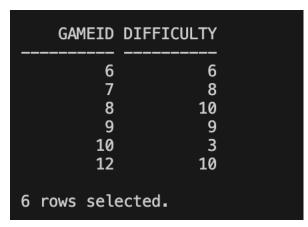
```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation

12 test
FPS Shooter 30-NOV-23 PC
```

(Single Player Game)





Please fill out the information below to Add Your Desired Game:



After:

select * from game; GAMEID TITLE GENRE RELEASEDA PLATFORM 1 Maple Story Adventure RPG 10-0CT-23 iOS 2 League of Legends MOBA 10-OCT-23 Microsoft Windows 3 Valorant FPS Shooter 10-OCT-23 Microsoft Windows GAMEID TITLE RELEASEDA PLATFORM GENRE 4 TeamFight Tactics Strategy 10-OCT-23 Microsoft Windows 5 Genshin Impact Adventure RPG 10-0CT-23 Microsoft Windows 6 The Witcher 3: Wild Hunt Adventure RPG 10-0CT-23 PC GAMEID TITLE RELEASEDA PLATFORM GENRE 7 Assassins Creed Valhalla Action RPG 10-0CT-23 Xbox 8 The Legend of Zelda: Breath of the Wild Adventure RPG 10-0CT-23 Nintendo Switch 9 Cyberpunk 2077 Action RPG 10-0CT-23 PC GAMEID TITLE RELEASEDA PLATFORM GENRE 10 Red Dead Redemption 2 Action RPG 10-OCT-23 PlayStation

10 rows selected.

GAMEID	DIFFICULTY	. , . ,
6 7	6 8	
8	10	
9	9	
10	3	

(Single Player Game)

UPDATE

File: appService.js

289, 306

Before:

PLAYERID PLAYEREMAIL	DATEOFBIR	RANK
AVATAR		
віо		
1 grace@gmail.com /path/to/avatar1.jpg Gamer, explorer, and thrill-seeker.	10-0CT-02	
2 sophie@gmail.com /path/to/avatar2.jpg Casual gamer	23-0CT-02	
PLAYERID PLAYEREMAIL	DATEOFBIR	RANK
AVATAR		
BIO		
3 audrey@gmail.com /path/to/avatar3.jpg competitive.	20-NOV-03	
4 jane@gmail.com /path/to/avatar4.jpg	30-APR-03	4

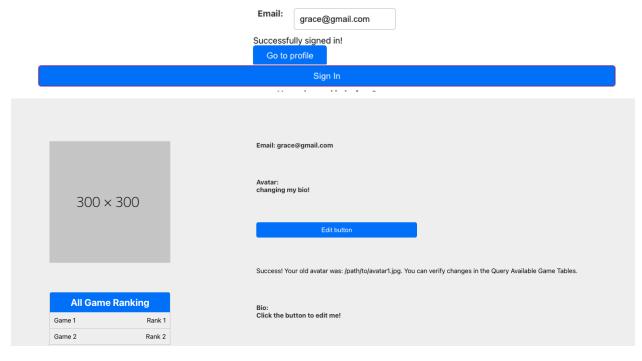
PLAYERID PLAYEREMAIL	DATEOFBIR	RANK
AVATAR		
BIO		
live laugh love.		
5 sam@gmail.com /path/to/avatar5.jpg i will win	10-MAY-03	

Here are all your accounts, choose one to sign in and you can further modify your profiles!

id	email	date	rank	avatar	bio		
1	grace@gmail.com	2002-10-10T07:00:00.000Z	1	/path/to/avatar1.jpg	Gamer, explorer, and thrill-seeker.		
2	2 sophie@gmail.com 2002-10-23T07:00:00.000Z 2 /path/to/avatar2.jpg Casual gamer						
3	3 audrey@gmail.com 2003-11-20T08:00:00.000Z 3 /path/to/avatar3.jpg competitive.						
4	jane@gmail.com	2003-04-30T07:00:00.000Z	4	/path/to/avatar4.jpg	live laugh love.		
5	sam@gmail.com	2003-05-10T07:00:00.000Z	5	/path/to/avatar5.jpg	i will win		
	Email: grace@gmail.com						
	Sign In						
	Never logged in before?						

Here are all your accounts, choose one to sign in and you can further modify your profiles!

id	email	date	rank	avatar	bio
1	grace@gmail.com	2002-10-10T07:00:00.000Z	1	/path/to/avatar1.jpg	Gamer, explorer, and thrill-seeker.
2	sophie@gmail.com	2002-10-23T07:00:00.000Z	2	/path/to/avatar2.jpg	Casual gamer
3	audrey@gmail.com	2003-11-20T08:00:00.000Z	3	/path/to/avatar3.jpg	competitive.
4	jane@gmail.com	2003-04-30T07:00:00.000Z	4	/path/to/avatar4.jpg	live laugh love.
5	sam@gmail.com	2003-05-10T07:00:00.000Z	5	/path/to/avatar5.jpg	i will win



After:

PLAYERID PLAYEREMAIL	DATEOFBIR	RANK
AVATAR		
BIO		
1 grace@gmail.com changing my bio! Gamer, explorer, and thrill—seeker.	 10-0CT-02	1
2 sophie@gmail.com /path/to/avatar2.jpg Casual gamer	23-0CT-02	2
PLAYERID PLAYEREMAIL	DATEOFBIR	RANK
 AVATAR		

In this update query, we have made a deliberate decision to restrict the update options available. Specifically, a user is now only able to update their biography and avatar. This choice stems from recognizing that modifications of a player's email and date of birth tend to be impractical and unavailable across many platforms. Furthermore, we choose to enforce this logical limitation within our database to ensure that it aligns with the real-world practices.

SELECTION (WHERE Clause)

File: appService.js

Line: 338

```
GAMEID TITLE
         RELEASEDA PLATFORM
   1 Maple Story
2 10-0CT-23 iOS
Adventure RPG
      2 League of Legends
                  10-OCT-23 Microsoft Windows
FPS Shooter 10-0CT-23 Microsoft Windows
 GAMEID TITLE
     RELEASEDA PLATFORM
 4 TeamFight Tactics
Strategy 10-OCT-23 Microsoft Windows
      5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows
       6 The Witcher 3: Wild Hunt
Adventure RPG 10-0CT-23 PC
 GAMEID TITLE
        RELEASEDA PLATFORM
GENRE
7 Assassins Creed Valhalla
Action RPG 10-OCT-23 Xbox
      8 The Legend of Zelda: Breath of the Wild
ure RPG 10-OCT-23 Nintendo Switch
Adventure RPG
       9 Cyberpunk 2077
            10-0CT-23 PC
Action RPG
```

```
GAMEID TITLE

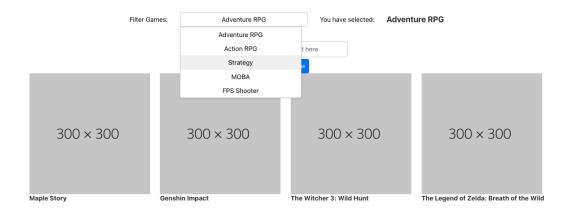
GENRE RELEASEDA PLATFORM

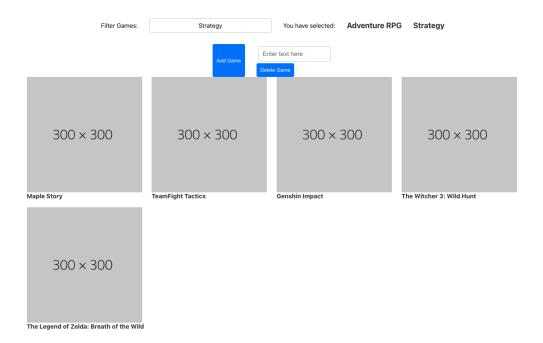
10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation

12 test

FPS Shooter 30-NOV-23 PC
```







After: Unchanged Relation

```
GAMEID TITLE
GENRE RELEASEDA PLATFORM
GENRE
1 Maple Story
Adventure RPG 10-OCT-23 iOS
        2 League of Legends
10-OCT-23 Microsoft Windows
MOBA
      3 Valorant
ooter 10-OCT-23 Microsoft Windows
FPS Shooter
  GAMEID TITLE
      RELEASEDA PLATFORM
GENRE
       4 TeamFight Tactics
Strategy
               10-OCT-23 Microsoft Windows
5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows
6 The Witcher 3: Wild Hunt
Adventure RPG 10-OCT-23 PC
```

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

7 Assassins Creed Valhalla
Action RPG 10-OCT-23 Xbox

8 The Legend of Zelda: Breath of the Wild
Adventure RPG 10-OCT-23 Nintendo Switch

9 Cyberpunk 2077
Action RPG 10-OCT-23 PC

GAMEID TITLE

GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation
```

JOIN

File: appService.js

Line: 436

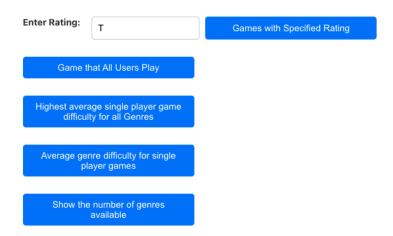
Before:

Genre (genre, ageRestriction)

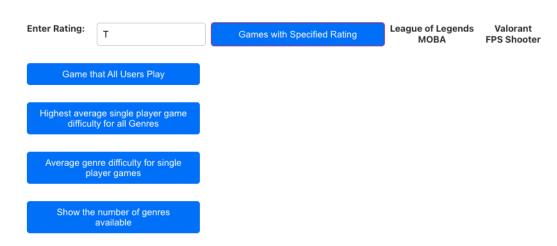
•	 •	<u> </u>
	GENRE	AGERESTRICTION
	FPS Shooter	Т
	Adventure RPG	E
	Action RPG	Α
	MOBA	Т
	Strategy	E

```
GAMEID TITLE
GENRE RELEASEDA PLATFORM
1 Maple Story
Adventure RPG 10-OCT-23 iOS
      2 League of Legends
         10-OCT-23 Microsoft Windows
MOBA
     3 Valorant
poter 10-OCT-23 Microsoft Windows
FPS Shooter
 GAMEID TITLE
GENRE RELEASEDA PLATFORM
 4 TeamFight Tactics
Strategy 10-OCT-23 Microsoft Windows
      5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows
      6 The Witcher 3: Wild Hunt
Adventure RPG 10-0CT-23 PC
```

Statistics



Statistics



After: Unchanged Relations

Genre (genre, ageRestriction)

GENRE	AGERESTRICTION
FPS Shooter	Т
Adventure RPG	E
Action RPG	A
MOBA	Т
Strategy	E

Game (gameID, title, genre, releaseDate, platform)

```
GAMEID TITLE
GENRE
                 RELEASEDA PLATFORM
1 Maple Story
Adventure RPG 10-OCT-23 iOS
       2 League of Legends
10-OCT-23 Microsoft Windows
      3 Valorant
opter 10-OCT-23 Microsoft Windows
FPS Shooter
  GAMEID TITLE
GENRE RELEASEDA PLATFORM
GENRE
  4 TeamFight Tactics
                 10-OCT-23 Microsoft Windows
       5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows
       6 The Witcher 3: Wild Hunt
Adventure RPG 10-0CT-23 PC
```

AGGREGATION - GROUP BY

File: appService.js

Line: 360

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

1 Maple Story
Adventure RPG 10-OCT-23 iOS

2 League of Legends
MOBA 10-OCT-23 Microsoft Windows

3 Valorant
FPS Shooter 10-OCT-23 Microsoft Windows

GAMEID TITLE

GENRE RELEASEDA PLATFORM

4 TeamFight Tactics
Strategy 10-OCT-23 Microsoft Windows

5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows

6 The Witcher 3: Wild Hunt
Adventure RPG 10-OCT-23 PC
```

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

7 Assassins Creed Valhalla
Action RPG 10-OCT-23 Xbox

8 The Legend of Zelda: Breath of the Wild
Adventure RPG 10-OCT-23 Nintendo Switch

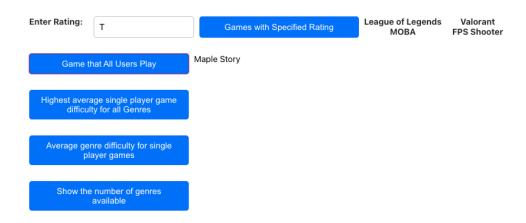
9 Cyberpunk 2077
Action RPG 10-OCT-23 PC

GAMEID TITLE

GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation
```

Statistics



After: Unchanged Relations

```
GAMEID TITLE
GENRE
                   RELEASEDA PLATFORM
1 Maple Story
Adventure RPG 10-OCT-23 iOS
        2 League of Legends
10-OCT-23 Microsoft Windows
        3 Valorant
ter 10-OCT-23 Microsoft Windows
FPS Shooter
   GAMEID TITLE
GENRE RELEASEDA PLATFORM
GENRE
       4 TeamFight Tactics
                     10-OCT-23 Microsoft Windows
Strategy
        5 Genshin Impact
re RPG 10-OCT-23 Microsoft Windows
Adventure RPG
        6 The Witcher 3: Wild Hunt
re RPG 10-OCT-23 PC
Adventure RPG
```

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

7 Assassins Creed Valhalla
Action RPG 10-OCT-23 Xbox

8 The Legend of Zelda: Breath of the Wild
Adventure RPG 10-OCT-23 Nintendo Switch

9 Cyberpunk 2077
Action RPG 10-OCT-23 PC

GAMEID TITLE

GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation
```

AGGREGATION - HAVING

File: appService.js

Line: 181

Before:

SinglePlayerGame (gameID, difficulty)

DIFFICULTY	GAMEID
6	6
8	7
10	8
9	9
3	10

GAMEID TITLE

GENRE RELEASEDA PLATFORM

1 Maple Story
Adventure RPG 10-OCT-23 iOS

2 League of Legends
MOBA 10-OCT-23 Microsoft Windows

3 Valorant
FPS Shooter 10-OCT-23 Microsoft Windows

GAMEID TITLE

GENRE RELEASEDA PLATFORM

4 TeamFight Tactics
Strategy 10-OCT-23 Microsoft Windows

5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows

6 The Witcher 3: Wild Hunt
Adventure RPG 10-OCT-23 PC

GAMEID TITLE

GENRE RELEASEDA PLATFORM

7 Assassins Creed Valhalla
Action RPG 10-OCT-23 Xbox

8 The Legend of Zelda: Breath of the Wild
Adventure RPG 10-OCT-23 Nintendo Switch

9 Cyberpunk 2077
Action RPG 10-OCT-23 PC

GAMEID TITLE

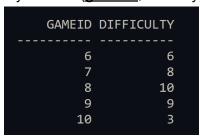
GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation

Statistics

Enter Rating:	Games w	rith Specified Rating	League of Legends MOBA	Valorant FPS Shooter
Game that All Users Play	Maple Story			
Highest average single player game difficulty for all Genres	8			
Average genre difficulty for single player games	Adventure RPG 8	Action RPG 6.6666666666666667		
Show the number of genres available				

After: Unchanged Relations SinglePlayerGame (gameID, difficulty)



```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

1 Maple Story
Adventure RPG 10-OCT-23 iOS

2 League of Legends
MOBA 10-OCT-23 Microsoft Windows

3 Valorant
FPS Shooter 10-OCT-23 Microsoft Windows

GAMEID TITLE

GENRE RELEASEDA PLATFORM

4 TeamFight Tactics
Strategy 10-OCT-23 Microsoft Windows

5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows

6 The Witcher 3: Wild Hunt
Adventure RPG 10-OCT-23 PC
```

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

7 Assassins Creed Valhalla
Action RPG 10-OCT-23 Xbox

8 The Legend of Zelda: Breath of the Wild
Adventure RPG 10-OCT-23 Nintendo Switch

9 Cyberpunk 2077
Action RPG 10-OCT-23 PC

GAMEID TITLE

GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation
```

NESTED AGGREGATION

File: appService.js

Line: 194

Before: SinglePlayerGame (gameID, difficulty)

GAMEID	DIFFICULTY	
6	6	
7	8	
8	10	
9	9	
10	3	

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

1 Maple Story
Adventure RPG 10-OCT-23 iOS

2 League of Legends
MOBA 10-OCT-23 Microsoft Windows

3 Valorant
FPS Shooter 10-OCT-23 Microsoft Windows

GAMEID TITLE

GENRE RELEASEDA PLATFORM

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Strategy 10-OCT-23 Microsoft Windows

5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows

6 The Witcher 3: Wild Hunt
Adventure RPG 10-OCT-23 PC
```

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

7 Assassins Creed Valhalla
Action RPG 10-OCT-23 Xbox

8 The Legend of Zelda: Breath of the Wild
Adventure RPG 10-OCT-23 Nintendo Switch

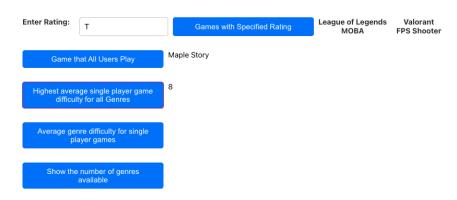
9 Cyberpunk 2077
Action RPG 10-OCT-23 PC

GAMEID TITLE

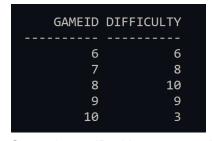
GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation
```

Statistics



After: Unchanged Relations SinglePlayerGame (gameID, difficulty)



```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

1 Maple Story
Adventure RPG 10-OCT-23 iOS

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MOBA 10-OCT-23 Microsoft Windows

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FPS Shooter 10-OCT-23 Microsoft Windows

GAMEID TITLE

GENRE RELEASEDA PLATFORM

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```

```
GAMEID TITLE

GENRE RELEASEDA PLATFORM

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Action RPG 10-OCT-23 Xbox

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Action RPG 10-OCT-23 PC

GAMEID TITLE

GENRE RELEASEDA PLATFORM

10 Red Dead Redemption 2
Action RPG 10-OCT-23 PlayStation
```

DIVISION

File: appService.js

Line: 392

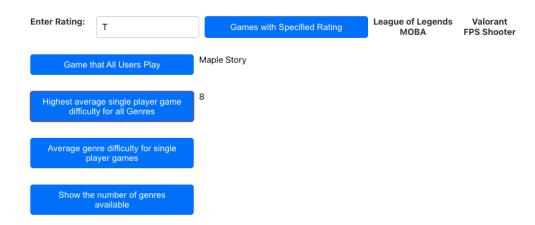
Before:

Genre (genre, ageRestriction)

GENRE	AGERESTRICTION
FPS Shooter	Т
Adventure RPG	E
Action RPG	Α
MOBA	Т
Strategy	E

```
GAMEID TITLE
         RELEASEDA PLATFORM
GENRE
    1 Maple Story
Adventure RPG 10-OCT-23 iOS
       2 League of Legends
MOBA
                10-OCT-23 Microsoft Windows
       3 Valorant
                10-OCT-23 Microsoft Windows
FPS Shooter
   GAMEID TITLE
GENRE RELEASEDA PLATFORM
   4 TeamFight Tactics
Strategy 10-OCT-23 Microsoft Windows
       5 Genshin Impact
Adventure RPG 10-OCT-23 Microsoft Windows
       6 The Witcher 3: Wild Hunt
Adventure RPG
                10-0CT-23 PC
```

Statistics



After: Unchanged Relations

Genre (genre, ageRestriction)

GENRE	AGERESTRICTION
FPS Shooter	T
Adventure RPG	E
Action RPG	A
MOBA	Т
Strategy	E

Game (gameID, title, genre, releaseDate, platform)

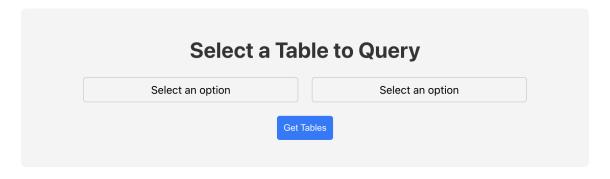
```
GAMEID TITLE
GENRE
                   RELEASEDA PLATFORM
      1 Maple Story
             10-OCT-23 iOS
Adventure RPG
       2 League of Legends
МОВА
                  10-OCT-23 Microsoft Windows
       3 Valorant
FPS Shooter
                 10-OCT-23 Microsoft Windows
   GAMEID TITLE
GENRE
                 RELEASEDA PLATFORM
      4 TeamFight Tactics
Strategy
                 10-OCT-23 Microsoft Windows
       5 Genshin Impact
Adventure RPG
                 10-OCT-23 Microsoft Windows
       6 The Witcher 3: Wild Hunt
Adventure RPG 10-0CT-23 PC
```

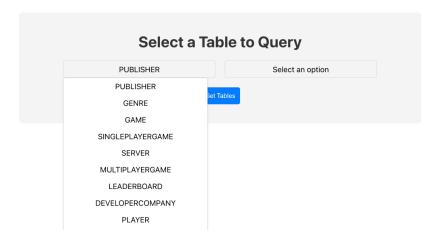
PROJECTION

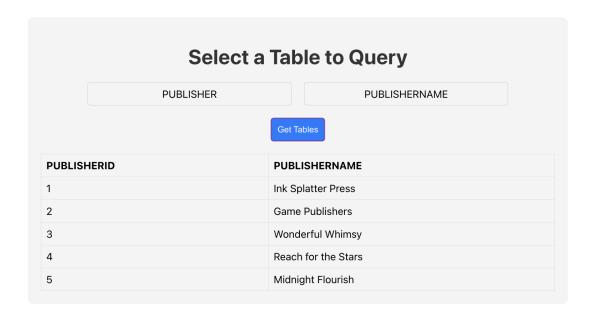
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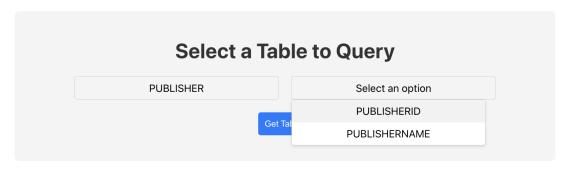
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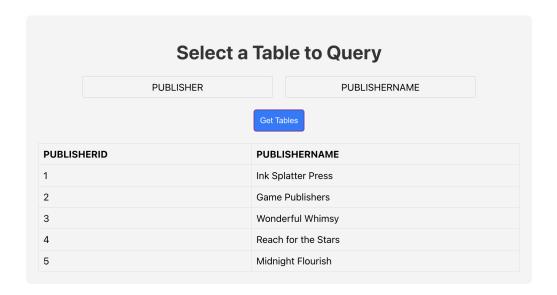
Before: Unchanged Relations During: Unchanged Relations











After: Unchanged Relations