

PROJECT PHASE - 3

TEAM NUMBER: 12

TEAM MEMBERS:

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RELATIONAL MODEL

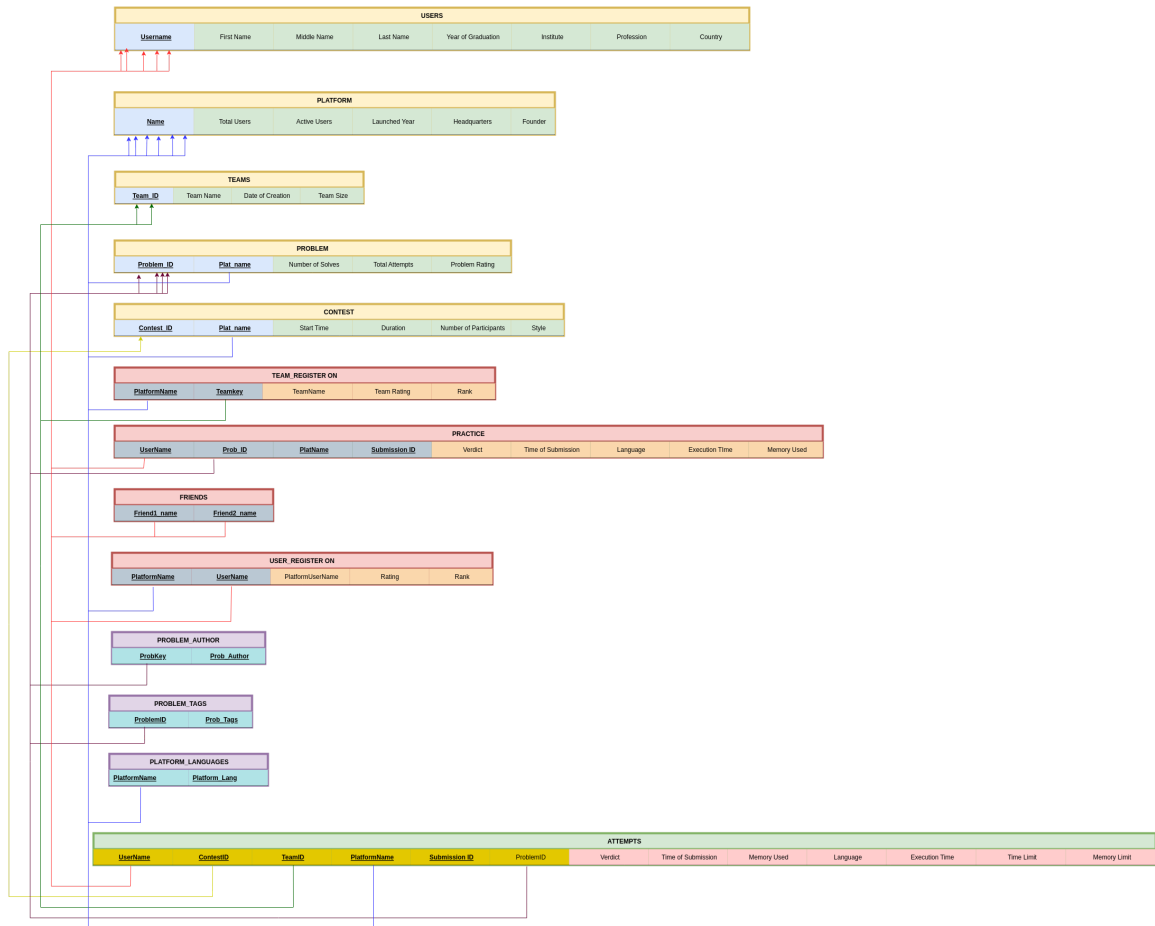
Steps taken to convert the ER diagram to the Relational Model are :

1. Created separate relations for the strong entities **USERS**, **PLATFORM** and **TEAMS** with primary keys as **Username**, **Name** and **Team ID** respectively.
2. For weak entities like **PROBLEM** we include the foreign key **Plat_Name** of the owner entity. Similarly for the entity **CONTEST**, we include **Plat_Name** as the foreign key. The primary key for these weak entities is a combination of foreign key with the partial key of that entity.
3. For mapping of 1:N relationship type **HOST**, we made sure to include the primary key of **PLATFORM** as the foreign key to **PROBLEMS** which was at the N side of the relationship type.
4. For mapping of M:N relationship types, we include the primary keys of the participating entities as foreign keys along with the other descriptive attributes of the relationship. This is achieved by including the following foreign keys in the respective relations:
 - **USER_REGISTER ON** : **Plat_Name** and **TeamID** as foreign keys
 - **TEAM_REGISTER_ON**: **Username** and **ProbID** as foreign keys
 - **FRIENDS**: **Friend1_name** and **Friend2_name** as foreign keys
5. For the Multi-valued attributes we create a separate relation which includes the primary key of the respective entity as a foreign key along with an attribute that contains the

multiple values associated with that attribute. The primary key of this relation is a combination of the above two attributes. This is achieved in the following way:

- **PROBLEM_AUTHOR:** `ProbKey` as foreign key and `Prob_Author` as attribute containing multiple values
 - **PROBLEM_TAGS:** `ProblemID` as foreign key and `Prob_Tags` as attribute containing multiple values
 - **PROBLEM_LANGUAGES:** `PlatformName` as foreign key and `Platform_Lang` as attribute containing multiple values
6. For the mapping of the Quaternary relationship type `ATTEMPS` we include the primary keys of all the four participating entities such as `UserName` , `ContestID` , `TeamID` , `ProblemID` along with `PlatformName` . The primary key of this relation is a combination of all the foreign keys along with the primary key `SubmissionID` among the descriptive attributes of the relationship.(Here, we haven't included `Problem`)

RELATIONAL MODEL



1st NORMAL FORM

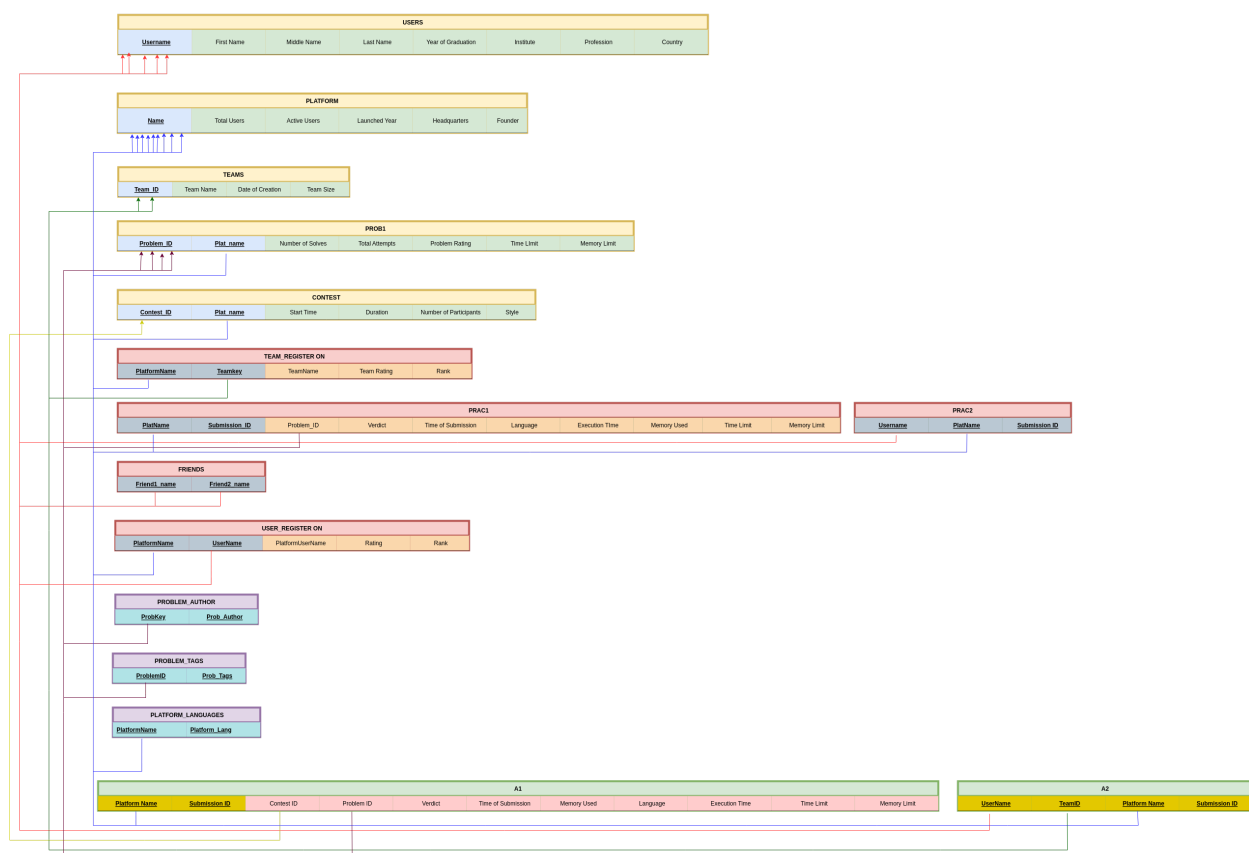
- For creating the relational model, we had already split the multi-valued attributes such as **PROBLEM_AUTHOR**, **PROBLEM_TAGS** and **PLATFORM_LANGUAGES** into separate relations. Also we had simplified the compound attribute **Name** under the entity **USERS** into **FirstName**, **MiddleName** and **LastName**. This is already in the 1st Normal Form and hence no changes needed to be made here.

2nd NORMAL FORM

- For the relation **Practice**, the attributes **Platform Name** and **Submission ID** can uniquely tell us information about **Problem_ID**, **Verdict**, **Time of Submission**, **Language**, **Execution Time**, **Memory Used**, **Time Limit** and **Memory Limit**. However they cannot tell the information about the CPstalk username.

- We have split **Practice** into two tables **Prac1** and **Prac2** to normalize it into 2NF.
- For the relation Attempts, the attributes **Platform Name** and **Submission ID** can uniquely tell us information about **Contest ID**, **Problem_ID**, **Verdict**, **Time of Submission**, **Language**, **Execution Time**, **Memory Used**, **Time Limit** and **Memory Limit**. However they cannot tell the information about the **CPstalk username** and **Team ID**
- We have split **Attempts** into two tables **A1** and **A2** to normalize it into 2NF.

2nd NORMAL FORM



3rd NORMAL FORM

- In the relation schema **Prac1**, attributes **Problem_ID** and **Platform_Name** which together is a non-key attribute can determine **Time_Limit** and **Memory Limit**, so we can normalize **Prac1** by decomposing it into two 3NF relation schemas **Prac1** and **Prac3**

- In the table **A1**, attributes **Problem_ID** and **Platform_Name** which together is a non-key attribute can determine **Contest_ID**, **Time_Limit** and **Memory Limit**, so we can normalize **A1** by decomposing it into two 3NF relation schemas **A1** and **A2**

3rd NORMAL FORM

