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:

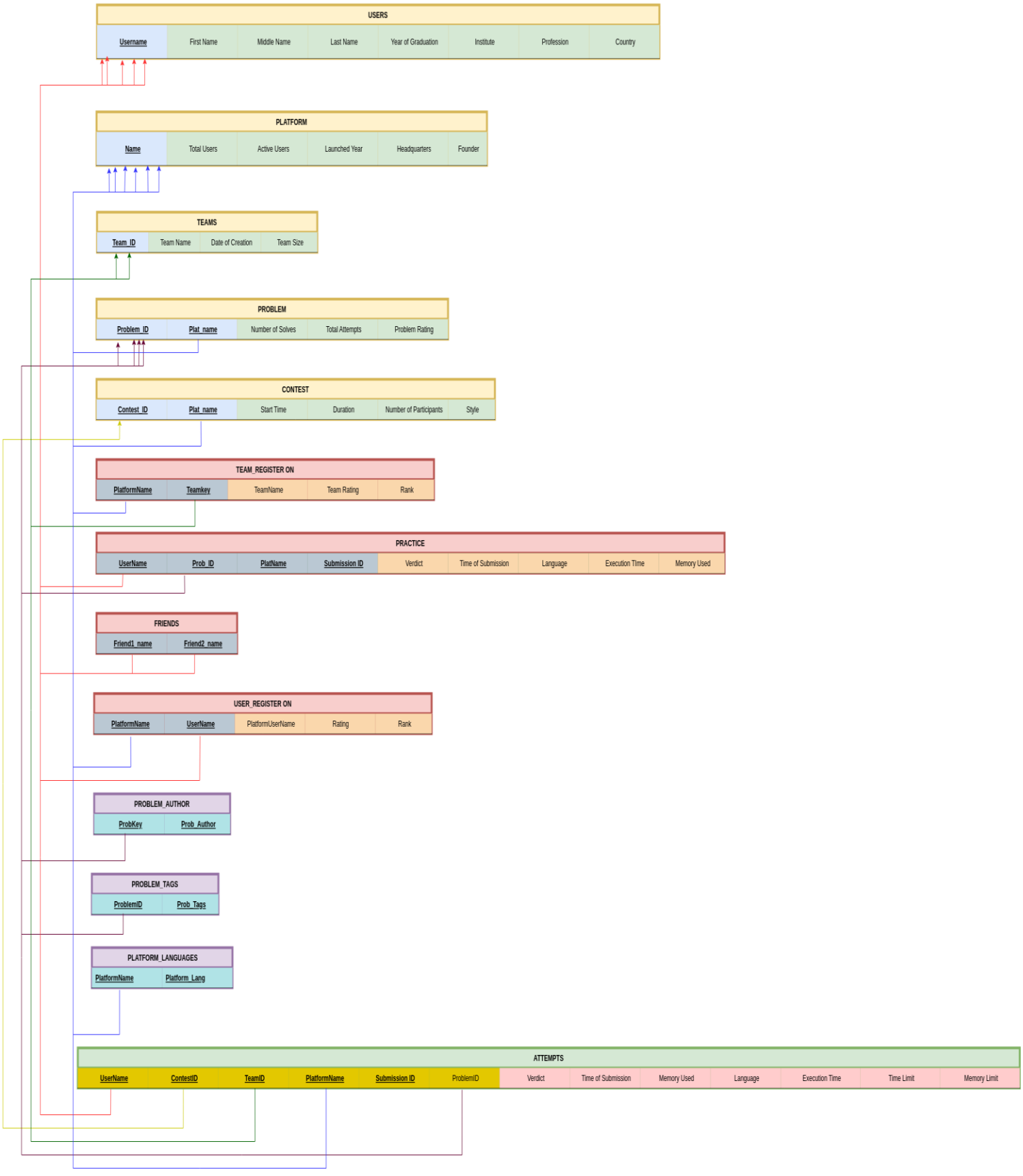
- **USER_REGISTER ON:** Plat_Name and TeamID as foreign keys
- **TEAM_REGISTER_ON**: Username and ProbID as foreign keys
- **FRIENDS**: Friend1_name and Friend2_name as foreign keys

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



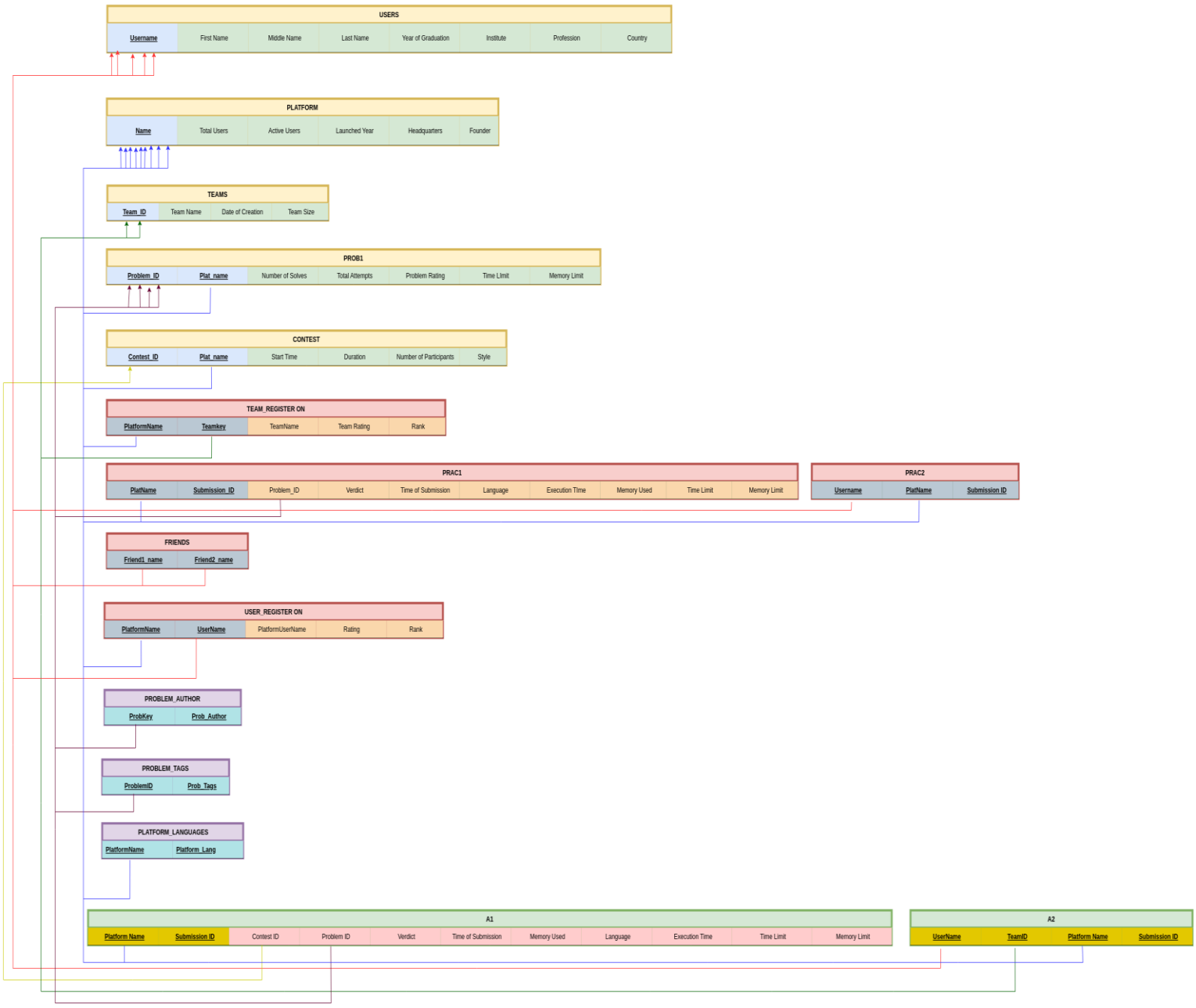
1st NORMAL FORM

- 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