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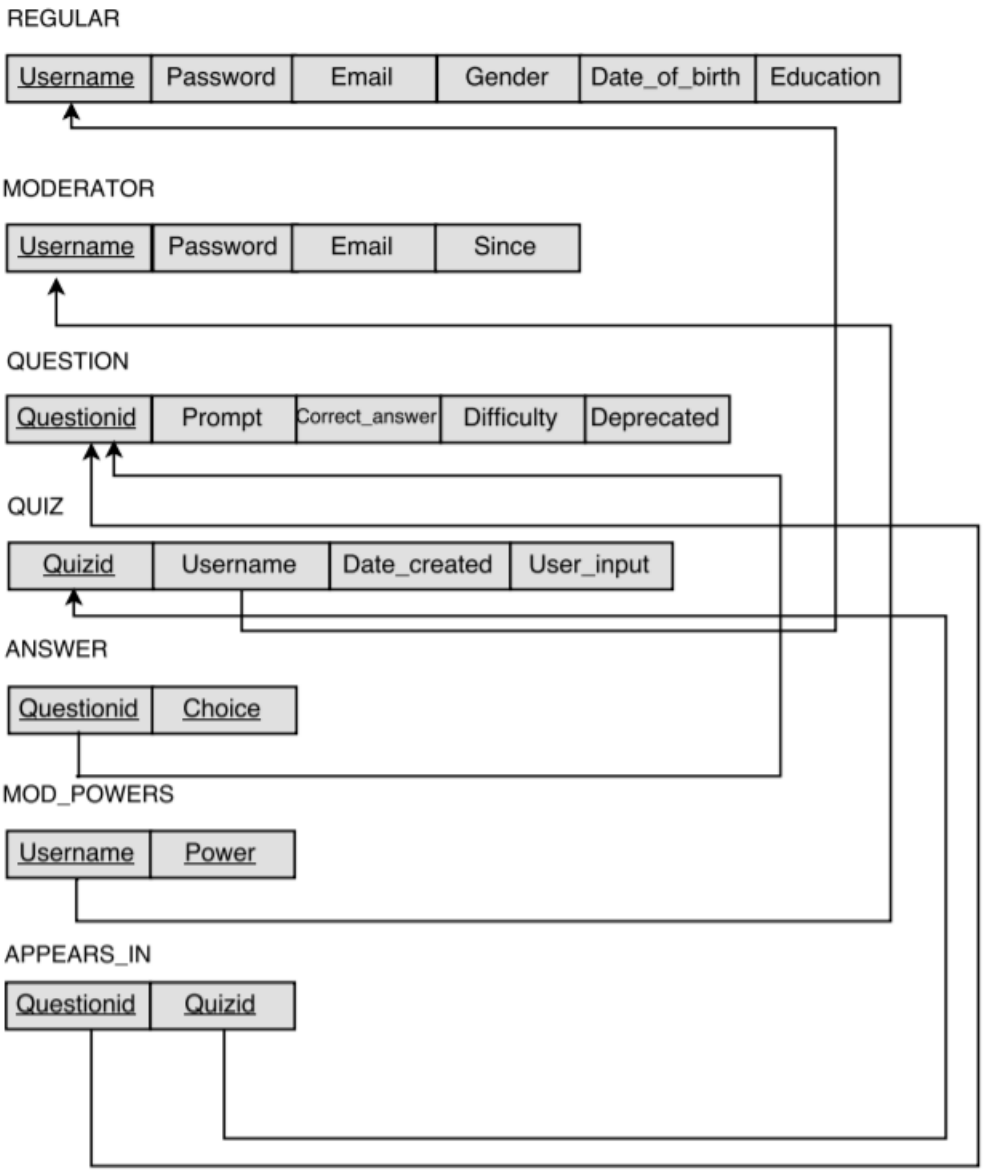
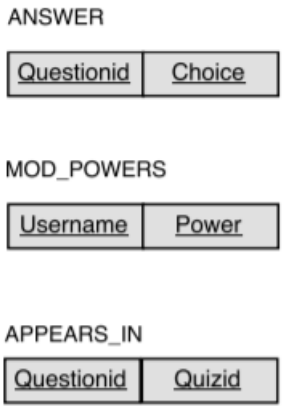
Task A: BCNF

This is our final schema after revision from Milestone 2:

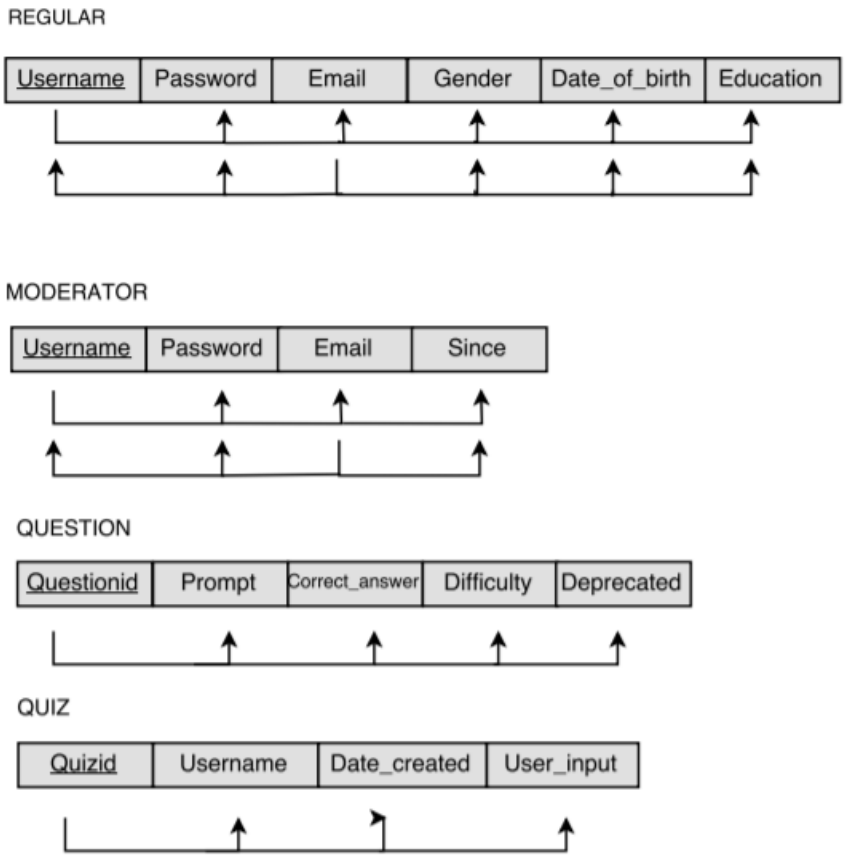


*Appears_in is the new relation that binds questions to quiz.
*The user_input attribute in Quiz is a big string that contains all user inputs and all answer times for the given quiz.

First, all two attribute relations are in BCNF, thus Answer, Mod_powers and Appears_in are in BCNF (for all, both attributes are also primary keys).



Regular, Moderator, Question and Quiz are the only interesting cases. The FDs are shown below:



Question, Quiz, Moderator and Regular relations are also in BCNF because they have no bad functional dependencies, which means no non-candidate attributes can map to another attribute.

For Regular, the primary key is username because it uniquely determines the password, email, gender, date of birth, and education. One username only has one of each attribute. However, the same password, gender, date of birth can apply to multiple users, thus these are all non-prime attributes. The same that is said about username can be said about email, as it is also a candidate key (only one email can be associated with one account). Since the FDs have their prime attributes map to all the non-prime attributes and nothing else, this relation is in BCNF.

The same logic can be said about Moderator. Since (the date the mod was created) can only occur once.

For Question, the primary key is the questionid because it uniquely determines the prompt, the correct answer, the difficulty and whether or not it is deprecated. One question can have only one prompt, one correct answer, one difficulty and one deprecated state. However, the same prompt can be mapped to different questions (just with different answers). The same correct answer can apply for many questions. Many questions can have the same difficulty. Many questions can be deprecated or not. Thus, questionid is the only prime attribute and the others are the non-prime attributes. Since this FD only has its prime attribute mapped to all the non-prime attributes and nothing else, this relation is in BCNF.

For Quiz, the primary key is the quizid because it uniquely determines who took the quiz (username), when it was created (date_created), and what input the user inputted for that quiz (user_input). One quiz can only be taken by one user since each quiz is unique, one time that it was created, and one user input. However, the same user can take multiple quizzes and multiple quizzes can be created at the same time. The only other attribute that can possibly be a prime attribute is user_input because the probability of two user_inputs being the same is next to zero. However, it wouldn't make sense to use something bizarre like that as a primary key.

Since all relations are in BCNF, no BCNF decomposition was necessary in this step.