Project - 1 (First Deliverable)

Team Members:

1. **Akanksha Shukla (apshukla)**
2. **Gautam Verma (gverma)**
3. **Sumer Shende (sshende)**
4. **Udit Deshmukh (udeshmu)**

Relational Model

Table	Attribute	Attribute Description	Type	Key	Null Allowed
Exercises	ex_id	Exercise Id	int	Y	No
	ex_name	Exercise name	string	-	No
	ex_mode	Exercise Mode	string	-	No
	ex_start_date	Exercise start date	date	-	No
	ex_end_date	Exercise end date	date	-	No
	num_questions	Total questions in the exercise	int	-	No
	num_retries	Maximum retries allowed	int	-	No
	policy	Scoring policy of this exercise	string	-	No
Grad_Students	st_id	Student Id	int	Y	No
	st_name	Student name	string	-	No
	TA_for	Course Id for which the student is TA, if he is.	c_id	-	Yes
Under_Grad_Students	st_id	Student Id	int	Y	No
	st_name	Student Name	string	-	No
Enrolled_In	c_id	Course Id	int	Y (FK)	No
	st_id	Enrolled Student’s Id	int	Y (FK)	No

Professor	prof_id	Professor Id	int	Y	No
	prof_name	Professor Name	string	-	No
Courses	c_id	Course Id	int	Y	No
	c_name	Course name	string	CK	No
	c_start_date	Course start date	date	-	No
	c_end_date	Course end date	date	-	No
	prof_id	Id of the professor who teaches this course.	int	- (FK)	No
Topics	tp_name	Topic name	string	-	No
	tp_id	Topic Id	int	Y	No
	c_id	Id of the course which contains this topic.	int	- (FK)	No
Questions	tp_id	Id of the topic which contains this question.	int	- (FK)	No
	q_id	Question Id	int	Y	No
	q_text	Question root text	string	CK	No
	q_diff	Question difficulty	int	-	No
	q_hint	Question’s optional hint	string	-	Yes
	q_det_soln	Question’s optional detailed solution	string	-	Yes
Fixed_Questions	q_id	Question Id	int	- (FK)	No
	q_ans	Question’s answer	string	-	No
Fixed_Inc_Answers	q_id	Question Id	int	- (FK)	No
	q_inc_answers	Incorrect answers for this question	string	-	No
Param_Questions	q_id	Question Id	int	Y (FK)	No
	q_par_num	Position of parameter for this parameterized question	int	Y	No

	q_comb_num	This is a unique number for a combination of all parameter values for a question.	int	Y	No
	q_param_value	Value of the parameter	string	-	No
Param_Answers	q_id	Question Id	int	- (FK)	No
	q_comb_num	This uniquely identifies a parametrized question	int	- (FK)	No
	q_ans	Answer of this question	string	-	No
Questions_In_Ex	e_id	Exercise Id	int	Y (FK)	No
	q_id	Question Id	int	Y (FK)	No
Assign_Attempt	attempt_num	Attempt number of student	int	Y	No
	e_id	Id of the attempted exercise	int	Y (FK)	No
	q_id	Id of the attempted question	int	Y (FK)	No
	st_id	Id of the student	int	Y (FK)	No
	is_correct	True if this question was correctly answered by the student	bool	-	No
	q_comb_num	This uniquely identifies a parametrized question	int	-	Yes
Has_Solved	st_id	Id of the student that solved the exercise	int	Y (FK)	No
	e_id	If of the exercise that student solved	int	Y (FK)	No
	with_score	Score associated with this submission	int	-	Yes, only 1
	submit_time	Time of submission	date	-	Yes, Only 1

In the above table, if Key value is Y, then that attribute is included in the primary key. If it's CK, then it is a candidate key. Additionally, some are foreign keys which are specified in the column as FK.

Functional Dependencies:

Table	Functional Dependencies
Exercises	ex_id -> {ex_name, ex_mode, ex_start_date, ex_end_date, num_questions, num_retries, ex_mode}
Grad_Students	st_id -> {st_name, TA_for}
Under_Grad_Students	st_id -> st_name
Professor	prof_id -> prof_name
Courses	c_id -> {c_name, c_start_date, c_end_date, prof_id}
	c_name -> {c_id, c_start_date, c_end_date, prof_id}
Topics	tp_id -> {tp_name, c_id}
Questions	q_id -> {tp_id, q_text, q_diff, q_hint, q_det_soln}
	q_text -> {q_id, tp_id, q_diff, q_hint, q_det_soln}
Fixed_questions	q_id -> q_ans
Param_questions	{q_id, q_par_num, q_comb_num} -> q_param_value
Assign_Attempt	{e_id, q_id, st_id, attempt_num, } -> {is_correct, q_comb_num}
Has_Solved	{st_id, e_id}->{submit_time, with_score}

Application Constraints and Discussions

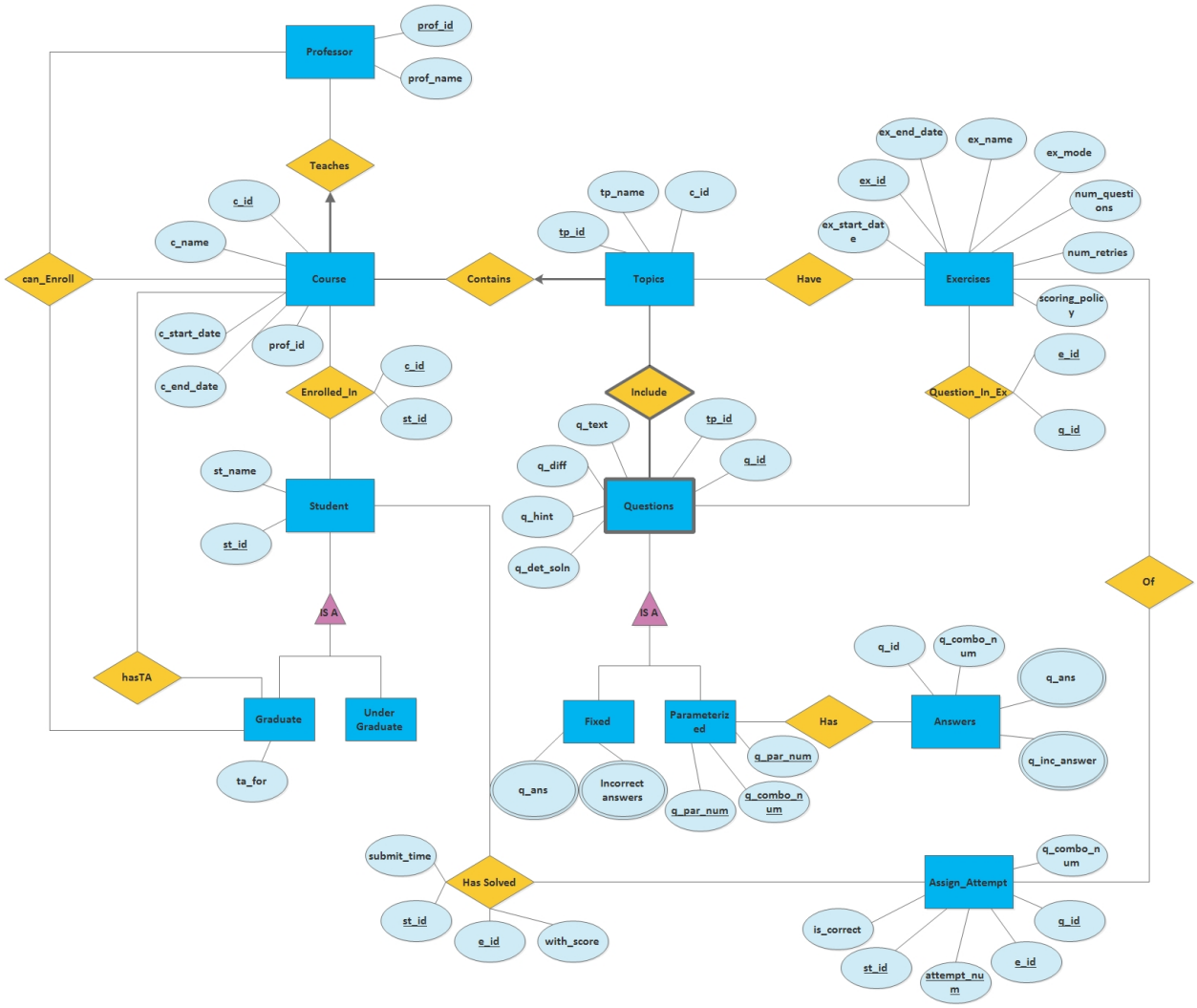
Discussion of normal form choices faced and justification for the decision made:

1. 1 NF choice made for Course having topics. We had discussion if we can create topics in course table but found the redundancy in the table as all the course information would be repeated in course table. So, splitting course and topics to achieve 1 NF.
2. The same argument we had for topics and questions for each topic. For the same reason, separated topic and questions table to avoid redundancy.

Constraints:

1. For entity Course, start date < end date.
2. Student should be enrolled by TA or Professor.
3. Only graduate students can be TA
4. Course can be created by Professor and assigned to teach same course automatically.
5. TA cannot be a student enrolled in the same class
6. A person enrolled as student for the course cannot be assigned as the TA for the same course, and vice versa
7. Only students who are enrolled in the course by TA or instructor can view homeworks for that course.
8. Exercise not available to student before start date or after end date.
9. Only enrolled students can view exercise
10. Solution is only available after deadline
11. Question's parameters must be unique.
12. When creating a parameterized question, different concrete parameter value options must be provided for each variable
13. The TA does not have access to the entire question bank. TAs can see the exercise as soon as it is created (even before the start date of the exercise)
14. Only instructors can create exercises and can do so only for their own course.
15. Concrete question in attempt one will have different parameters in attempt two
16. If the assessment allows for multiple retries and the student has not exhausted number of tries, and the due date/time for exercise has not passed, the student may re-attempt the assessment exercise.
17. All the attempts of all students for the course can be viewed by both the instructor and the TAs at all points of time.
18. Every student must be either Graduate or Undergraduate.
19. No student can be both Graduate and Undergraduate.
20. Parameterized and Fixed questions are disjoint.
21. Each question must be either parameterized and fixed.

E-R Diagram:



NOTE: This is also submitted separately in higher resolution for readability.

Acknowledgement

We acknowledge that we have asked all the questions we need clarify the ambiguities in the project description.