25CS307-Assignment3 Exercise Questions

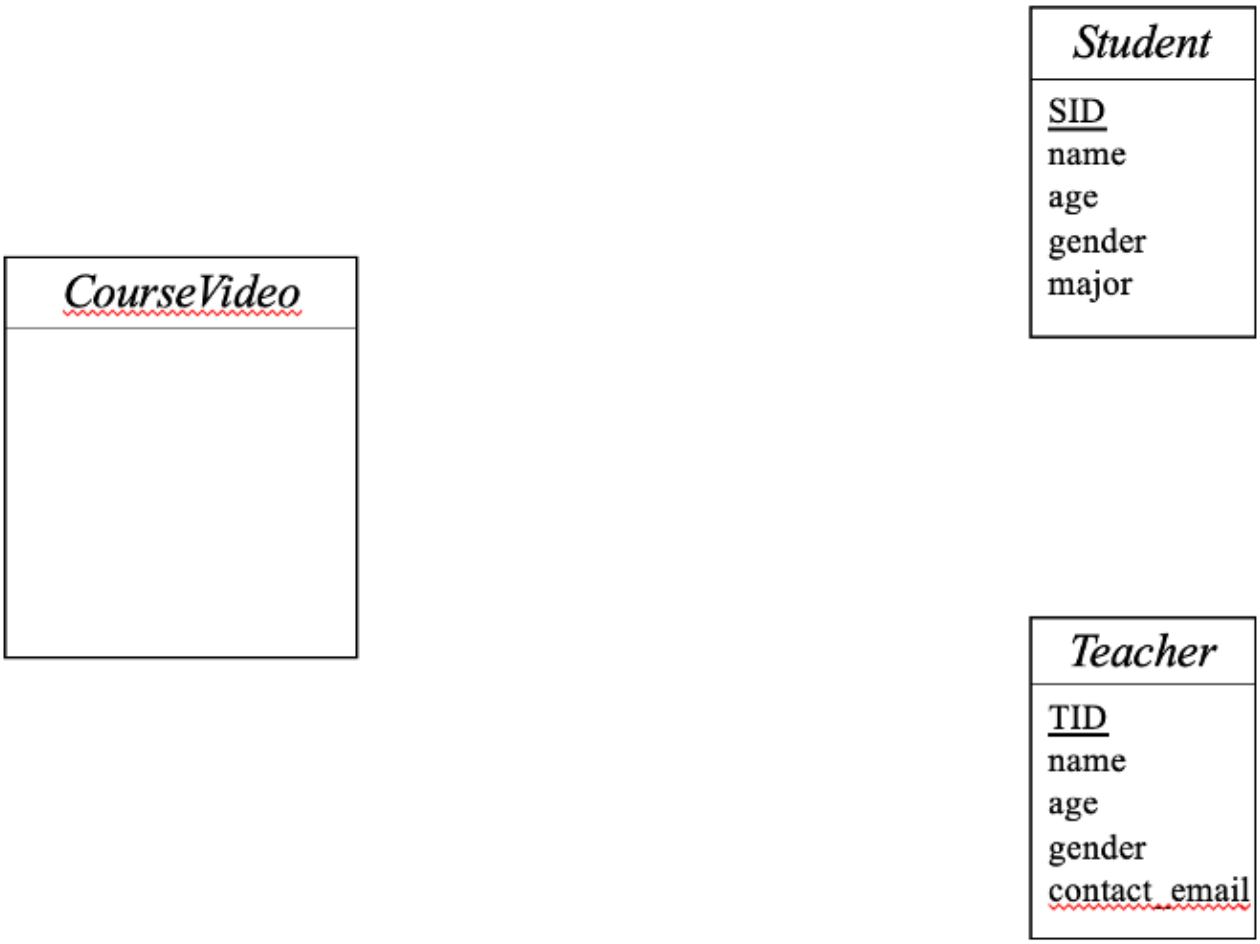
This assignment accounts for 5 points of the total score.

Question 1 (30 points):

Consider the following relation schemas when building a relational database for an online open-course website:

- **CourseVideo**(VID, title, description, release_timestamp, length)
- **Teacher**(TID, name, age, gender, contact_email)
- **Student**(SID, name, age, gender, major)

An unfinished E-R diagram is provided:



1. Complete the E-R diagram

Besides the three schemas, please also satisfy the following requirements by adding new elements:

- Teachers can upload any amount of course videos. A video can only have one uploader (i.e., teacher). All videos should have an uploader. There might be occasions where some teachers

have not uploaded any video yet.
- Students can watch any video uploaded by teachers, and some students may only register accounts with no further actions. The watching records should be modeled as a relationship between students and videos.Students can rate any amount of teachers. The rating is an integer between 0 to 100.

You also need to pay attention to the following points:

- The attributes with underlines in the schemas listed above can be considered unique identifiers of the entities.
- All attributes should be illustrated inside the corresponding entity sets in the diagram. For relationship sets, please also draw the necessary attributes.
- From the requirements, please identify the cardinality constraints and participations. Primary keys, cardinality constraints, and participations should be marked in the correct format when drawing the diagram.

2. Relational Algebra

2.1 Write relational algebra expression that returns a set containing the attribute `name` of Students whose age is larger than or equal to 20.

2.2 Write relational algebra expression that returns a set containing the `video title`, `video length` and `teacher name`, to represents the courses videos have been uploaded by the teacher named "Ma".

Question 2: Normalization (30 points)

We have a relation `R(A, B, C, D)` where *A* is a known superkey. A set of functional dependencies is also provided: `{(A, C)-> B, B -> C, B -> D}`. For the two questions below, please show the steps of proofs and decompositions. You will only receive 50% of the score if the reasoning process is missing.

1. Is `(A, C)` a superkey of *R*?
2. Please prove that *R* is not in BCNF.
3. Decompose *R* into relations that satisfy BCNF.

Question 3: Transaction (30 points)

	T1	T2	T3
1	R(A)		
2		R(B)	
3		W(A)	
4			W(A)
5			W(B)
6	R(B)		

1. Draw the precedence graphs for the schedule above?
2. Please explain whether the schedule is conflict serializable.

Submission (10 points)

Submission requirements:

1. **Handwritten** assignments are required, and the question number must be marked, and the answers must be written clearly and easily understood.
2. The paper for writing assignments must be **blank A4** paper.
3. **Scanning** and uploading are required. If you upload a photo, make sure **it is clear**.