5 Databases (TGG)

(a) Consider the following Entity-Relationship (ER) diagram.

Suppose we wish to implement this diagram in a relational database using three
tables, \( S(sid, A) \), \( T(tid, C) \), and \( R(\cdots) \). Describe the schema you would use for
\( R \) depending on the cardinality of the relationship.

(i) When \( R \) is a many-to-many relationship between \( S \) and \( T \). [2 marks]

(ii) When \( R \) is a one-to-many relationship between \( S \) and \( T \). [2 marks]

(iii) When \( R \) is a many-to-one relationship between \( S \) and \( T \). [2 marks]

(iv) When \( R \) is a one-to-one relationship between \( S \) and \( T \). [2 marks]

(b) Suppose \( R \) is a many-to-one relationship. Rather than implementing a new table
for \( R \), can we modify one of the tables representing \( S \) or \( T \) to implement this
relationship? Discuss the advantages and disadvantages of such a representation.
[4 marks]

(c) Suppose that we add the following diagram to our ER model.

Note that this implicitly defines a relationship between \( S \) and \( U \) resulting from
the composition of relationships \( R \) and \( Q \). Discuss the difficulties that you
might encounter in attempting to implement this derived relationship directly
in a table \( W \). For example, would the results of evaluating this SQL

```sql
select sid, tid, B, D
from R
join Q on R.tid = Q.tid
```

always be equivalent to the contents of such a \( W \)? [8 marks]