國 立 臺 北 科 技 大 學

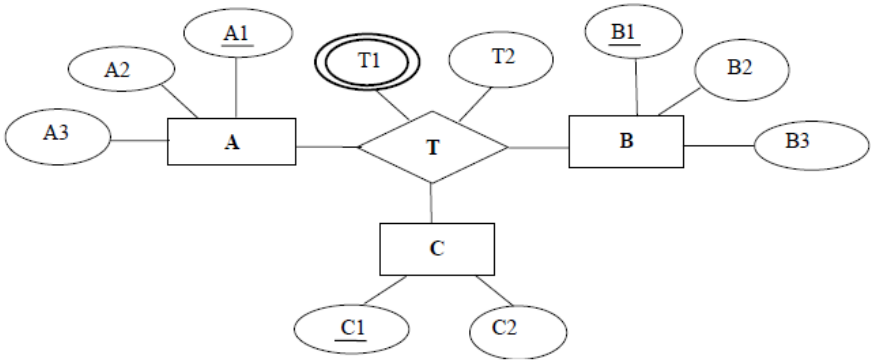
一百零二學年第一學期電機系博士班資格考試

資料庫 試題

注意事項：

1. 本試題共【9】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間:二小時。

1. [10 pts] Describe the two main constraints that apply to a specialization/generalization relationship in EER model.
2. [10 pts] Map the following ER diagram into a relational schema. Specify all primary keys and foreign keys.



3. [10 pts] Consider the relation R(A, B, C, D, E) with a multi-valued dependency $A \rightarrow\rightarrow BC$. Assume that the tuples (a, b_1, c_1, d_1, e_1), (a, b_2, c_2, d_1, e_2), and (a, b_1, c_1, d_2, e_2) are in the current instance of R. List the other tuples that must be in R.
4. Consider the relation R(A, B, C, D, E) and the set of functional dependencies

$$F=\{ A\rightarrow B,\ C\rightarrow A,\ CDE\rightarrow A\}.$$

(a) [5 pts] Compute C^+, the closure of C under F.

(b) [5 pts] Find all keys in R.

(c) [7 pts] Decompose the relation R into 3NF, indicating the primary key of each of the final relations.

5. [10 pts] Consider the relation R(A, B, C, D, E, F) and the set of functional dependencies F={ A→C, B→F, E→F, F→D }.Use the nonadditive join test for binary decompositions (Property NJB) to determine if the decomposition D={R_1(A, B, C, D), R_2(A, B, E, F)} is lossless. Show why.

6. Consider the following two transactions with the initial values X=3 and Y=4.

T_1:		T_2:	
	read_item(X);		read_item(Y);
	read_item(Y);		read_item(X);
	X=X+Y;		Y=X+Y;
	write_item(X);		write_item(Y);

(a)[5 pts] Show the final values of X and Y for each possible serial schedules of T_1 and T_2.

(b)[5 pts] Show a concurrent execution of T_1 and T_2 that produces a non-serializable schedule.

(c)[5 pts] Show a concurrent execution of T_1 and T_2 that produces a conflict-serializable schedule

(d)[8 pts] Add *read_lock*, *write_lock* and *unlock* operations to T_1 and T_2 so that they obey the two-phase locking protocol. Can the execution of these transactions results in a deadlock?

7. [10 pts] Consider the following relations A and B.

A

a_1	a_2
1	4
2	4
3	6
4	6

B

b_1	b_2	b_3
1	NULL	100
NULL	1	200
1	1	300
2	2	400
3	4	500

What is the output of the following query? Please draw the relation instance produced by this query in the form of a table.

```
SELECT    A.a1 as A1, count(*) as N, sum(B.b3) as S
FROM      A, B
WHERE     A.a1 = B.b1   OR   A.a1 = B.b2
GROUP BY  A.a1
```

8. [5 pts] Explain why a file can have at most one clustering index.

9. [5 pts] Explain why a secondary index on a non-ordering key field must be dense.