

Q1: Determine the correctness of the following statements, and explain your answer. (25 Marks)

1. The result of the PROJECT operation is a relation with degree and cardinality less than or equal the degree and cardinality of the input relation.
2. The result of the LEFT OUTER JOIN is a relation with cardinality less than the cardinality of the NATURAL JOIN's result
3. The expression $\sigma_{R.a > v} (R \bowtie_{a=b} S)$ is better than the expression $(\sigma_{R.a > v} (R)) \bowtie_{a=b} S$.
4. Properties of transactions (ACID) refer to Automated, Correct, Integrated, Defined.
5. A schedule S is serializable if it contains transactions executed one by one.
6. The concurrent update problem Occurs when two database users submit conflicting SELECT statements
7. A deadlock is a lock that has timed out and is therefore no longer needed
8. if every transaction in a schedule follows the two-phase locking protocol, the schedule is guaranteed to be serializable.
9. In wound-wait algorithms, the older transaction sacrifices for the young ones
10. If shadowing is used, it is not strictly necessary to maintain a log for recovering
11. If a transaction T is rolled back, any transaction S that has read the value of some data item X written by T must also be rolled back.
12. In RBAC: Roles May exist before users do.
13. Views may assist with security policy implementation by Restricting the databases to which a user has access
14. Encapsulation means that we separate the external aspects of an object from its internal details
15. A 1:* relationship between objects A and B is represented by adding an attribute containing a set of references to each object

Q2: Consider the following SQL query (10 Marks)

```
SELECT    EMPLOYEE.Fname, EMPLOYEE.LName, EMPLOYEE.Address
FROM      EMPLOYEE, DEPARTMENT
WHERE     DEPARTMENT.DName='Research' AND
          DEPARTMENT.Dnumber=EMPLOYEE.Dno;
```

- 1- State the query processing steps that done when the user submits the query until the result is delivered for him
- 2- Translate this SQL into relational algebra expression and draw its query tree.
- 3- Draw the initial query tree for this query, and then show how the query tree is optimized by the heuristic algorithm.

Q3: Consider the following schedules

(5 Marks)

- (a) $r1(x), r2(x), w1(x), w2(x), commit(T1), commit(T2)$
- (b) $r1(x), r2(y), w3(x), r2(x), r1(y), commit(T1), commit(T2), commit(T3)$
- (c) $r1(x), w2(x), w1(x), abort(T2), commit(T1)$
- (d) $w1(x), r2(x), w1(x), commit(T2), abort(T1)$
- (e) $r1(x), w2e(x), w1(x), r3(x), commit(T1), commit(T2), commit(T3)$

1- For each of these schedules, state whether the schedule is serializable, conflict serializable, recoverable, and whether it avoids cascading aborts:

2- Draw a precedence graph for each of these schedules (a) to (e).

Q4: Apply the two phase locking algorithm to the schedules in Figure below and determine whether deadlock exists. If there is a deadlock declare how the wait-die algorithm deal with it.

(5 Marks)

	Transaction T_1	Transaction T_2	Transaction T_3
Time ↓		read_item(Z); read_item(Y); write_item(Y);	
	read_item(X); write_item(X);		read_item(Y); read_item(Z);
		read_item(X);	write_item(Y); write_item(Z);
	read_item(Y); write_item(Y);	write_item(X);	

Q5: The given Figure shows the log corresponding to a particular schedule at the point of a system crash .

(10 Marks)

Describe the recovery process from the system crash. Specify which transactions are rolled back, which operations in the log are redone and which are undone, and whether any cascading rollback takes place.

For the following cases:

- 1- we use the immediate update protocol with checkpoint
- 2- We use Deferred Update

Q6: suppose that you create a relation R in the database. And you want another user B to be able to retrieve only some fields of R, and modify other fields. Write the statements that:

(5 Marks)

- a- Make user B can retrieve or modify the specific fields can grant any of these privileges to other users.
- b- Revoke the modify privileges from user B, what action The DBMS must tack according to this action.

```

[start_transaction,T3]
[read_item,T3,C]
[write_item,T3,B,15,12]
[Commit, T3]
[start_transaction,T2]
[read_item,T2,D]
[write_item,T2,D,20,21]
[chick point]
[start_transaction,T1]
[read_item,T1,A]
[read_item,T1,D]
[write_item,T1,D,21,26]
[Commit, T1]
read_item,T2,B]
[write_item,T2,B,12,18]
[read_item,T2,A]
System Crash
    
```

My Best Wishes;