

## Question 1: Concurrency Control Theory ..... [110 points]

- (i) [10 points] **Motivation:**  
Define a transaction. List the ACID properties.
- (ii) [10 points] **Motivation:**  
How do the concurrency control and recovery protocols help guarantee the ACID properties?
- (iii) [10 points] **Isolation:**  
Why is concurrency control automatically done by DBMS (instead of manually being done at the application level by the developer)?
- (iv) [10 points] **Motivation:**  
Explain why we need a correctness criteria to determine whether an interleaving is valid.
- (v) [10 points] **Isolation:**  
Distinguish between pessimistic and optimistic protocols.
- (vi) [10 points] **Isolation:**  
Define a: (1) serial schedule and (2) serializable schedule.
- (vii) [10 points] **Isolation:**  
List the conflicts associated with interleaved execution.
- (viii) [10 points] **Isolation:**  
Define a: (1) conflict equivalent schedule and (2) view equivalent schedule.
- (ix) [10 points] **Isolation:**  
Explain the intuition behind conflict serializability.
- (x) [10 points] **Isolation:**  
Explain how to efficiently check for conflict serializability.
- (xi) [10 points] **Isolation:**  
Why is view serializability a (weaker) notion of serializability?