Question 1: Case Studies . . . . . [200 points]

(i) **[10 points] MVCC Protocols:**
Define the snapshot isolation level. What anomaly is it susceptible to?

(ii) **[10 points] MVCC Protocols:**
Distinguish between: (1) repeatable reads and (2) snapshot isolation.

(iii) **[10 points] MVCC Protocols:**
Explain the purpose of these fields in MVTO protocol: (1) txn-id, (2) read-ts, (3) begin-ts, and (4) end-ts.

(iv) **[10 points] MVCC Protocols:**
Explain the purpose of these fields in MV2PL protocol: (1) txn-id, (2) read-cnt, (3) begin-ts, and (4) end-ts.

(v) **[10 points] MVCC Protocols:**
How does PostegreSQL tackle the txn id wrap-around problem?

(vi) **[10 points] Hekaton:**
Why does Hekaton use two timestamps?

(vii) **[10 points] Hekaton:**
Distinguish between these txn states: (1) COMMITTED, and (2) TERMINATED.

(viii) **[10 points] Hekaton:**
Explain the purpose of tracking: (1) read-set, (2) write-set, and (3) scan-set.

(ix) **[10 points] Hekaton:**
Explain how the protocol ensures: (1) read stability, and (2) phantom avoidance.

(x) **[10 points] Hekaton:**
How does Hekaton support both optimistic and pessimistic txns?

(xi) **[10 points] Hekaton:**
Define a lock-free data structure. Where does Hekaton use such structures?

(xii) **[10 points] Hekaton:**
Which CC protocol scales well on a write-intensive/medium-contention workload? Why?

(xiii) **[10 points] Hekaton:**
List the limitations of MVCC protocol in Hekaton.

(xiv) **[10 points] Hyper:**
Explain how Hyper uses precision locking?

(xv) **[10 points] Hyper:**
Explain why Hyper does not check whether write-sets overlap.

(xvi) **[10 points] Hyper:**
Explain why Hyper uses version synopses.

(xvii) **[10 points] HANA:**
Explain how HANA uses a hybrid storage layout.

Question 1 continues…

(xviii) **[10 points] Cicada:**
List the limitations of MVCC.

(xix) **[10 points] Cicada:**
List the limitations of OCC.

(xx) **[10 points] Cicada:**
How does Cicada do: (1) best-effort inlining, (2) contention-aware validation, and (3) early consistency check?