Question no 3.

a) Define the locking mechanism. Explain locking types and their protocol.

[2 Marks + 3 Marks + 6 Marks]

b) The following list represents the sequence of events in an interleaved execution of a set of transactions T1, T2, ... T24 in a concurrency system based on locking, where A, B, ...H are data items. Assume that FETCH A acquires an S lock on A, UPDATE A promotes that lock to an X lock, and all locks are held to the next synch point.

Time	*Transaction*	*operation*
t0	T1	*FETCH A*
t1	T2	*FETCH B*
t2	T2	*FETCH C*
t3	T3	*FETCH B*
t4	T5	*FETCH A*
t4	T5	*UPDATE A*
t5	T5	*FETCH D*
t6	T7	*FETCH E*
t7	T8	*FETCH G*
t8	T1	*COMMIT*
t9	T7	*FETCH A*
t10	T2	*UPDATE C*
t11	T3	*UPDATE B*
t12	T8	*FETCH E*
t13	T8	*UPDATE E*
t14	T8	*UPDATE G*
t15	T7	*ROLLBACK*
t16	T2	*FETCH G*
t17	T10	*FETCH C*
t18	T8	*FETCH A*
t19	T6	*FETCH F*
t20	T9	*FETCH F*
t21	T9	*UPDATE F*
t22	T3	*FETCH K*
t23	T3	*UPDATE K*
t24	T5	*FETCH K*
t25		

(i) Provide a Wait-for-Graph to illustrate whether there is any deadlock at time *t25*. You are advised to provide full and appropriate workings.

[10 Marks]

(ii) Discuss how the system could recover if it were deadlocked at time *t25*, and justify your choice of victim transaction(s).

[4 Marks]