3 (a) 2

A database has four elements, A, B, C, and D. Assume that the following is a normal sequence of undo log records, using non-quiescent checkpointing:

(b) <start T1> 3
<T1,B,40>
<start T2>
<T2,A,56>
<T2,C,34>
<start T3>
<commit T1>
<T3,B,12>
<commit T2>

(c) <T3,D,89>
<start T4>
<T4,C,7>
<T3,A,22>
<commit T4>
<T3,A,99>
<commit T3>

(i) When is the latest time for transaction T1, T2 that ”dirty data” can be flushed onto disk (ie, the time Output(X) for data X can be performed)? 1

(ii) Suppose we start checkpointing right after Log 5, indicate where and what the start check-pointing record would look like. Then, indicate where and what the earliest end checkpoint record would look like. 1

(iii) Continue from (b). Suppose the system crashes right after Log 14 and the end checkpoint has been written out to disk. What is the contents of the earliest log line we must examine? And which transaction records do we need to undo in sequence? 3

ANS
**Between Log Line 5 and 6, <START Checkpoint(T1, T2)>**
**Between Log Line 9 and 10, <END Checkpoint>**

ANS
**Earliest Log File Contents: <START Checkpoint(T1, T2)> Log lines 5 and 6, Transaction**

**Sequence: <T3,A,22>, <T3,D,89>, <T3,B,12>**