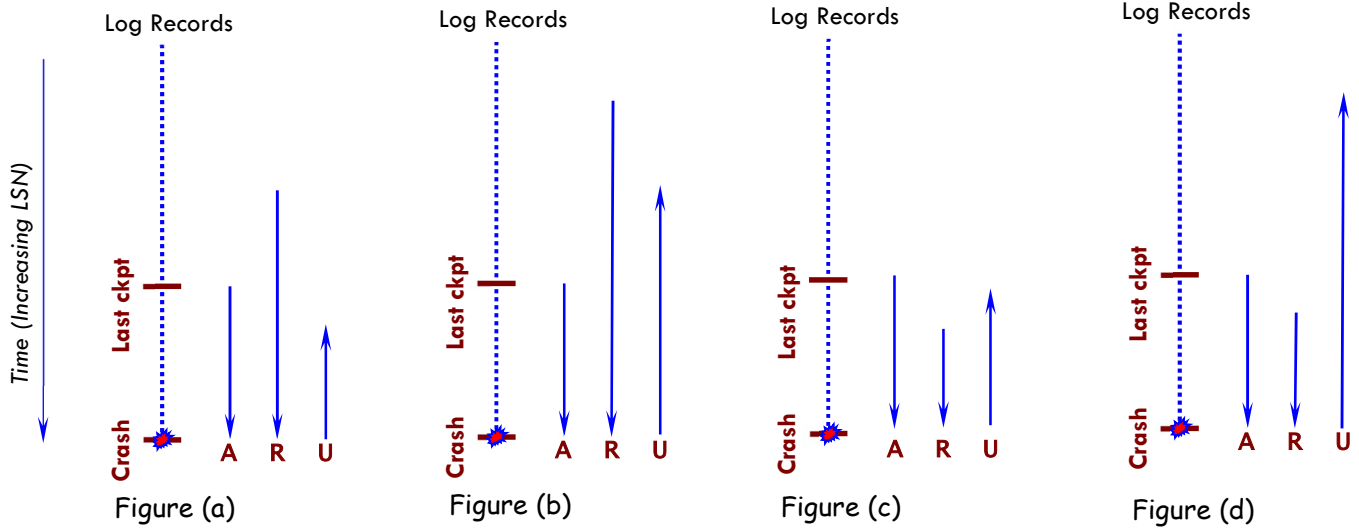


Question 3. [20 points] Recovery

a) [6 points] Consider the four figures below that indicate log records being processed by ARIES during recovery after a crash. Each dot on the timeline represents an update log record. In the log records assume that there is an update record right before and after the checkpoint record. The arrows denote the direction and the position from which the logs are scanned during the three phases of recovery. The arrow labeled A, R, and U denote the Analysis, Redo and Undo phases respectively. Which of these diagrams represent processing that can **never** occur in ARIES? Why?



Answer: (c) and (d).

Why?

If both the Redo start LSN and Undo min LSN occurred since the last checkpoint, the Undo LSN cannot be before the Redo LSN. Any undo needed must also generate a Redo-needing action, or already be present in the DPT. Either way, Redo will start at least as early as the min Undo LSN. If undo is before the checkpoint as in figure (d), the change could be flushed before the checkpoint and therefore not be in the DPT.