

due: Dec. 08, 2025

1.(15) What is the shadow paging principle? Assume that a database contains 7 pages and during the execution of a transaction page 5 and 1 are changed. Give the structures of the current directory and shadow directory before and after the transaction execution, respectively.

2.(20)

(a) Consider the five types of transactions given in Fig. 1. If "deferred update" strategy is used, which needs to be redone after the crash?

(b) Consider the five types of transactions given in Fig. 1. If "immediate update" strategy is used, which needs to be undone/redone after the crash?

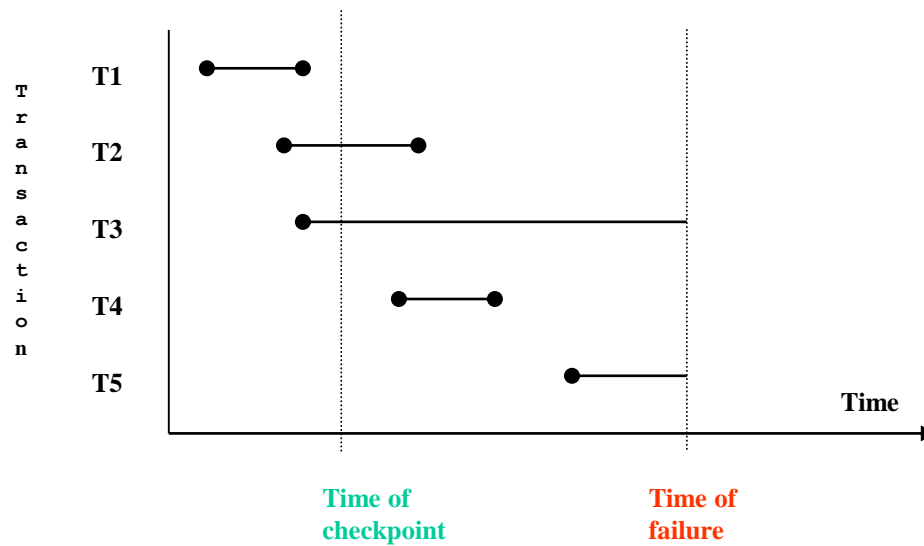


Fig. 1.

3.(20)

- (a) Discuss the two main types of constraints on specializations and generalization.
- (b) How does a category differ from a regular shared subclass?
- (c) Map the EER diagram shown in Fig. 4.1
(on page 77, 3rd edition; it can also be found on my home page)
into a relational schema.

4. (30) Construct an R-tree over a set of records for geographical objects with the following coordinates $[(x1, y1), (x2, y2)]$:

$[(0, 40), (60, 50)]$ ---- road1

$[(40, 0), (60, 40)]$ ---- road2

$[(15, 25), (35, 35)]$ ---- house1

$[(70, 40), (80, 50)]$ ---- house2

$[(70, 5), (80, 15)]$ ---- house3

$[(35, 25), (80, 35)]$ ---- pipeline

Assume that each node (either leaf or interior) can store 3 entries.

5.(15) Given the spatial database shown in the lecture notes on Spatial and Temporal Data Management. Design an SQL statement to find all the cities which are closer to Limerick than to Dublin.