

# Exam 2

CS 417  
May 13, 2021

Name
------

- Your exam should contain six numbered pages.
- I'm spotting you four points — the exam is worth 100 points, but the questions only total 96 points.
- The exam is open book and open notes. You may consult Internet resources. You may *not* consult another carbon-based lifeform. (For the purposes of this exam, the instructor is a silicon-based lifeform, so it's fine to consult him.)
- Write your name on the title page only, please.
- In answering the questions, use database systems vocabulary appropriately and correctly. Clearly state and defend your assumptions and design decisions.
- Your writing and drawn figures must be legible and organized.

Good luck!!

May your transactions commit!

1. (48 pts.) Consider the relation  $R(A, B, C, D, E)$  with the functional dependencies

*The functional dependencies will be given on the actual exam.*

(a) Identify three candidate keys.

(b) Is  $R$ , with the primary key  $(A, B)$ , 2NF, 3NF, or neither? Explain.

(c) Find a decomposition of  $R$ , with the primary key  $(A, B)$  that is BCNF.

(d) Is your decomposition dependency preserving? Explain.

2. (12 pts.) Consider the following transaction schedule:

*The transaction schedule will be given on the actual exam.*

Assuming that reads acquire shared locks, writes acquire exclusive locks, transactions can upgrade a shared lock to an exclusive lock, and two-phase locking is in effect, a deadlock will occur.

(a) Explain how the deadlock occurs.

3. (36 pts.) Consider the following transaction schedule:

*The transaction schedule will be given on the actual exam.*

(a) Is this schedule serializable? Show work.

- (b) Show the resulting schedule if two-phase locking is used. Assume that the transactions only request exclusive locks and that they release locks as soon as possible.

(c) Show the resulting schedule if timestamps are used.