Midterm exam 2 on Thursday, November 15th.

1. List the members of your group below. Underline your name.

2. Consider schema $R(A, B, C, D, E)$ with dependencies (n.b., both functional and multivalued):

$$\begin{aligned} AB &\rightarrow CD \\ E &\rightarrow D \\ C &\twoheadrightarrow E \end{aligned}$$

   Which, if any, of the following dependencies are logically implied by the above? Justify your answers briefly.

   (a) $BE \rightarrow C$

   (b) $C \twoheadrightarrow D$

   (c) $C \twoheadrightarrow ABD$

   (d) $C \twoheadrightarrow AB$

3. Decompose the schema of Question 2 to 4NF. Show all intermediate steps and details, as in previous exercises (keys, projected dependencies, decomposed relations, etc.).

$$\begin{aligned} AB &\rightarrow CD \\ E &\rightarrow D \\ C &\twoheadrightarrow E \end{aligned}$$

4. State *Armstrong's Axioms* for functional dependencies and prove their soundness from first principles.

5. Given a connected directed graph represented by its edges in relation `Edges(s,d)`, provide Datalog and SQL queries for:

   (a) Nodes (a, b) with **a** path of length three from a to b.

   (b) Nodes (a, b) such that the distance from a to b is 3.

   (c) Determining whether the graph has a cycle.

[additional space for answering the earlier question]