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):

$$
AB \rightarrow CD \\
E \rightarrow D \\
C \rightarrow E
$$

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

(a) $BE \rightarrow C$
(b) $C \rightarrow D$
(c) $C \rightarrow ABD$
(d) $C \rightarrow AB$
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.).

\[
\begin{align*}
AB & \rightarrow CD \\
E & \rightarrow D \\
C & \rightarrow E
\end{align*}
\]
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 $\text{Edges}(s,d)$, 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]