Northeastern University
CS5200 – DBMS
Spring 2025, Derbinsky

Homework 3

This assignment has four (4) problems worth 45 points total. Notes:

- Submit **a single PDF file**, containing your responses to each of the problems.
- You must typeset all responses – hand-written/drawn work will receive 0% credit.

Problem 1 (5 points). List all non-trivial functional dependencies that hold in the *current* state of this relation:

$\mathbf{A_1}$	$\mathbf{A_2}$	$\mathbf{A_3}$
1	x	i
1	x	ii
2	x	i
2	x	iii

Each FD should be minimal: that is to say, removing any attribute(s) from the left no longer functionally determines the right.

Problem 2 (10 points). List all non-trivial functional dependencies that do **NOT** hold given the current state of this relation:

	$\mathbf{A_4}$	$\mathbf{A_5}$	$\mathbf{A_6}$
t_1	1	y	iii
t_2	4	y	iii
t_3	5	z	iii

With each FD you list, provide a pair of tuples that invalidate the FD. As shown in the table above, refer to the first tuple as t_1, the second as t_2, and the third as t_3.

Problem 3 (15 points). Consider a relational schema BAR(M, N, O, P) that has the following functional dependencies (FDs): $O \rightarrow P$, $O \rightarrow M$, $N \rightarrow O$. What are the candidate key(s) of BAR? What is the highest normal form BAR is in? (You must justify your response.) If BAR violates 3NF, provide a decomposition that satisfies the FDs (remember to include all primary/foreign keys).

Problem 4 (15 points). Consider a relational schema BAZ(Q, R, S, T) that has the following functional dependencies (FDs): $R \rightarrow S$, $T \rightarrow Q$. What are the candidate key(s) of BAZ? What is the highest normal form BAZ is in? (You must justify your response.) If BAZ violates 3NF, provide a decomposition that satisfies the FDs (remember to include all primary/foreign keys).