Northeastern University
CS5200 – Database Management Systems
Fall 2017, Derbinsky

HW4

This assignment has nine (9) problems worth 100 points total. Notes:

- To receive credit, submit to Blackboard **a single ZIP file** that contains a **a single PDF** document, containing your responses to each of the problems.
- You must typeset all written responses and use software of your choice to produce professional relational schemas – hand-drawn diagrams will receive 0% credit.
- Relational schemas can be vertically oriented (like Chinook) or horizontally (like examples in the lecture slides).

Mapping ERDs

Problem 1 (10 points). Using the procedure discussed in Lecture 8, convert the AUTHORIZATION ERD to a relational database schema.

Problem 2 (20 points). Using the procedure discussed in Lecture 8, convert the FAMILY ERD to a relational database schema.

Problem 3 (20 points). Using the procedure discussed in Lecture 8, convert the RSS ERD to a relational database schema. Your single global schema should unify both views (Social Networking & Feed Subscription/Reading) – thus, for example, there should be a single user relation that captures all required attributes.

Normalization

Problem 4 (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

Problem 5 (5 points). List all non-trivial functional dependencies that do **NOT** hold in this relation:

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

With each FD you list, provide a pair of tuples that invalidate the FD. Refer to the first tuple as t_1, the second as t_2, and the third t_3.

Problem 6 (5 points). Consider the relational schema FOO(W, X, Y, Z) that has {W, X} as the primary key. Develop the minimal set of functional dependencies (FDs) under which FOO violates 2NF. Explain your answer and remember that your FD set must include the provided primary key.

Problem 7 (5 points). Consider the relational schema FOO(W, X, Y, Z) that has {W, X} as the primary key (same as the previous problem). Now, develop the minimal set of functional dependencies (FDs) under which FOO does not violate 2NF but does violate 3NF. Explain your answer and remember that your FD set must include the provided primary key.

Problem 8 (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 key(s) of BAR? What is the highest normal form BAR is in? If BAR violates 3NF, provide a decomposition that satisfies the FDs (remember to include all primary/foreign keys).

Problem 9 (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 key(s) of BAZ? What is the highest normal form BAZ is in? If BAZ violates 3NF, provide a decomposition that satisfies the FDs (remember to include all primary/foreign keys).