

School of Computer Science, McGill University  
**COMP-421B Database Systems, Winter 2015**

Written Assignment 4: Functional Dependencies and Transactions

Due date: April 15 (5:00 PM no late submission!!)

**Assignment (Please turn in one solution per team)**

**Exercise 1: [50 points]**

- a) Using the schema you provided for your Database Project, Identify the functional dependencies in your programming project. (Include the latest requirements, E/R diagram and the schema you developed in your project) [20 points]
- b) Is your Database in 3NF (Explain). [5 points]
- c) Is your Database in BCNF (Explain). [5 points]
- d) Provide a postmortem for your project. Describe in one or two paragraphs the different phases of your project, what you have done, what you have learned and if you do it differently if you have to redo it again. [20 points]

**Exercise 2: [25 points]**

You are given a relation scheme  $\mathbf{R} = \{B, N, S, T, A, R, C\}$  where  $\mathbf{B}$  = Building,  $\mathbf{N}$  = Door Number,  $\mathbf{S}$  = Street,  $\mathbf{T}$  = Type,  $\mathbf{A}$  = Architect,  $\mathbf{R}$  = Subcontractor and  $\mathbf{C}$  = Class. Constraints between the attributes can be expressed in the form of the following functional dependencies:

$$\mathbf{F} = \{AB \rightarrow T, A \rightarrow B, R \rightarrow C, NS \rightarrow BT\}$$

- a. Find all candidate keys of  $\mathbf{F}$ . Prove that these are the only keys. [5 points]
- b. Derive a canonical cover for  $\mathbf{F}$  in a systematic manner. [10 points]
- c. Decompose  $\mathbf{R}$  into a set of 3NF schemes which preserve all dependencies in  $\mathbf{F}$  and form a lossless join. [5 points]
- d. Is your decomposition in (c) is in BCNF? (explain) [5 points]

**Exercise 3: [25 points]**

Consider the following classes of schedules: serializable, recoverable, avoid cascading aborts, and strict. For each of the following schedules, state which of the above classes it belongs to. If you cannot decide whether a schedule belongs in a certain class based on the listed actions, explain why not.

- a) T1: R(X), T2: R(X), T1: W(X), T2: W(X)

- b) T1: R(X), T2: W(X), T1: W(X), T2: Abort, T1: Commit
- c) T2: R(X), T3: W(X), T3: Commit, T1: W(Y), T1: Commit, T2: R(Y), T2: W(Z), T2: Commit
- d) T1: R(X), T2: W(X), T2: Commit, T1: W(X), T1: Commit, T3: R(X), T3: Commit
- e) T1: R(X), T2: W(X), T1: W(X), T3: R(X), T1: Commit, T2: Commit, T3: Commit