CMSC 724, Spring 2016: Homework 1
Due Friday February 12, 2016, 6pm.

The homework is to be done by yourself. Be concise in your answers – answers to most questions should be at most one paragraph.

1. Give an example that illustrates that IMS violates the desirable property of physical data independence.

2. Briefly explain the notion of “currency indicators” in CODASYL.

3. Briefly explain what problems the normal forms (as a concept) were designed to address/solve, and how they solve those problems. What are the key tradeoffs different normal forms allow us explore?

4. What were the problems with Normalization theory that E/R model provides an effective solution for?

5. What was the key motivation behind Object-oriented databases? Why did they not succeed?

6. Briefly explain the notion of UDFs and their key advantages.

7. Briefly explain why I/O processes are typically needed if the database server is a single multi-threaded process. Is there something the OS could provide to address this problem?

8. Explain one scenario where it makes sense to assign multiple DBMS workers to a single SQL query, and discuss the pros and cons of doing so. There is a brief discussion towards the end of Section 2.3 (in the Architecture paper).

9. List three of the responsibilities of the query rewrite module in a database system.

10. Given three reasons why databases need fine-grained control over the buffer management.

11. Briefly explain why “Steal/No Force” is preferable, and what kind of problems it raises for guaranteeing ACID properties.

12. What trade-offs do Isolation Levels allow one to explore?

13. What are the three major concurrency control techniques?

14. Clearly explain the problem of “double-buffering” when running a database system on top of an OS. How does mmap help solve that problem?

15. Briefly explain the LRU-k buffer replacement policy, and how it helps circumvent some of the concerns with using the more standard LRU for database operations. There is a brief discussion in Section 5.3 of the Architecture paper.

16. What are some of the issues that come up if a database is being used on top of a RAID storage device?