Fall 2022

COMP2411 Tutorial No. 4 (Week 8)

1. A database is to be set up to maintain the pool of lecture theatres and to assist in their allocation to courses. Consider the following relation and the set of functional dependencies F defined on its attributes:

```
CourseRmAlloc(CourseId, CourseName, Year, Lecturer, Enrollment,
              RoomId, RoomCapacity, Day, Time)

F = {CourseId -> CourseName,
     CourseName -> CourseId,
     CourseId, Year -> Lecturer,
     CourseId, Year -> Enrollment,
     CourseId, Year, Day, Time -> RoomId,
     RoomId -> RoomCapacity,
     RoomId, Year, Day, Time -> CourseId}
```

After decomposition of the tables, we arrive at a set of tables:

```
Course(CourseId, CourseName)
CourseEnroll(CourseId, Year, Lecturer, Enrollment)
RoomAlloc(RoomId, Year, Day, Time, CourseId)
Room(RoomId, RoomCapacity)
```

Please verify that these are all in BCNF, and translate the following relational algebra expressions into plain language in English:

a) $\Pi_{RoomID}(Room) - \Pi_{RoomID}\left(\sigma_{Day\ =\text{'}15-Sep-2022\text{'}}\ (RoomAlloc)\right)$

b) $\Pi_{Lecturer,RoomID,Year,Day,Time}(CourseEnroll * RoomAlloc)$

2. Consider the relations ***r1(A,B,C)***, ***r2(C,D,E)***, and ***r3(E,F)***, with primary keys **A**, **C**, and **E**, respectively. Assume that ***r1*** has 1000 tuples, ***r2*** has 1500 tuples, and ***r3*** has 750 tuples. Estimate the size of ***r1 * r2 * r3*** (*where "*" denotes natural join*), and solve the following two problems:

   a) We have two ways to do the natural joins:
      i. ***r1*** with ***r2*** first and then with ***r3*** or
      ii. ***r2*** with ***r3*** first and then with ***r1***.

      Which one is more efficient in terms of comparisons?

   b) Assume that every primary key has a dense index built already. Give a most efficient strategy for computing the join.