SYSC 5703 – Assignment #1 – Fall 2013

Distribution of marks and deadlines

Sections	Marks	Date Due
One	30 points	Oct. 1st, 2013
Two	30 points	
TOTAL	100% of 10 marks	

Section One – Entity Relationship Diagrams

Create an Entity-Relationship (ER) model for the systems below. Identify the entities and their attributes, as well as the relationships between entities. For every relationship, identify its cardinality, possible participation constraints (or structural constraints) and, if appropriate, role names, weak entity types and identifying relationships.

1. **Reservation system** – A trip reservation consists of a sequence of flight reservations, where each flight reservation refers to a specific flight. Sometimes another flight is substituted for a booked flight because of equipment problems, weather delays, or customer preference. The passenger may reserve a seat for each flight. A trip reservation is made on some date; the passenger must purchase a ticket within a certain number of days or the reservation becomes void. The airlines use record locators to find a particular trip reservation quickly and unambiguously. A trip is reserved by an agent, who either works for an airline or a travel agency. The frequent flyer account may be noted for a passenger. The owner of the frequent flyer account must be the passenger. Multiple payments may be made for a trip, such as two credit-card charges. Payment may also be made by cash or check.

2. **Flight Operation System** – An airport serves many cities, and a city may have multiple airports. Airlines operate flights between airports. A flight description refers to the published description of air travel between tow airports. In contrast, a flight refers to the actual travel made by an airplane on a particular date. The frequency indicates the days of the week for which the flight description applies. The start and stop effective dates bracket the time period for which the published flight description is in effect. The actual origin, destination, departure time, and duration of a flight can vary because of weather and equipment problems.

3. **Bus Company** - The database should cover the following information:
   - The company owns a fleet of buses. The following information is known for each bus: its license plate number, its type and the date the next maintenance is due. Each bus type has a name and a number of seats. (All busses of the same type have the same capacity).
   - The company operates a set of bus lines. Each line has a line_name, line_source, and line_destination.

- The company schedules its trips on a weekly basis (that is, the schedules of two weeks are identical). A set of trips is scheduled for each line every week. A trip goes from line_source to line_destination. Different scheduled trips of one line may differ in their days of the week, their times, their stops, and the types of buses they can use. Each scheduled trip will make several stops at known locations (or bus stops) at known times.
  Thus, the following information is relevant for each scheduled trip:
  - The day of the week and time of departure from line_source, as well as the day of the week and time of arrival to line_destination. No trip can last more than 24 hours, so the arrival day is redundant.
  - The bus types that can be used for the trip.
  - The locations and times of the stops. (Note that the list of locations for all the stops served by the bus company exists independently of particular trips and, thus, should be regarded as a separate abstract category).
- The company employs drivers and other personnel. For each employee, the name, social insurance number, address, and hourly wage and are relevant.
- The company keeps track of the actual trips performed. An actual trip is a realization of a scheduled trip. Since the trips are scheduled on a weekly basis, there are 52 actual trips per year for each scheduled trip. For every actual trip, the driver and bus used are known.

Section two - SQL and Relational Algebra

1. Student (*Id, Name, Country*)
   Course (*CrsCode, CrsName, Type, Instructor*)
   Results(*Id, CrsCode, Grade)*

All the key fields are underlined. The *Type* field specifies the course type, e.g. MATH, STAT, SYSC, TTMG, ELEC, etc. The Results relation lists the grade that students (in Student relation) obtain for courses (in Course relation). Write the following queries in (i) **relational algebra** and (ii) **SQL**.

a. Find the *Id* of students who take TTMG or SYSC course.
b. Find the *Id* of students who take every course.
c. Find the *Id* of students who take every SYSC course or take every TTMG course.
d. Find the *Names* of students who take some SYSC course given by *Instructor* named Samuel.

2. Consider the schema in question 1, state in English what the following query computes.

$$\pi_{Name}(\pi_{CrsCode}(\sigma_{Type = \text{'SYSC'}}Course) \triangleright\!\triangleleft (\sigma_{Grade=\text{'D'}}Result) \triangleright\!\triangleleft Student)$$