Homework Assignment #3 – Chapter 5

1. What is the difference between a procedural and a nonprocedural language? How would you classify the relational algebra and relational calculus?

2. Discuss the differences between the five Join operations: Theta join, Equijoin, Natural join, Outer join, and Semijoin.

3. Compare and contrast the tuple relational calculus with domain relational calculus. In particular, discuss the distinction between tuple and domain variables.

   For the following exercises, use the Hotel schema defined below:

   Hotel (hotelNo, hotelName, city)
   Room (roomNo, hotelNo, type, price)
   Booking (hotelNo, guestNo, dateFrom, dateTo, roomNo)
   Guest (guestNo, guestName, guestAddress)

   where

   Hotel contains hotel details and hotelNo is the primary key;
   Room contains room details for each hotel and (roomNo, hoteINo) forms the primary key;
   Booking contains details of bookings and (hoteINo, guestNo, dateFrom) forms the primary key;
   Guest contains guest details and guestNo is the primary key.

4. Describe the relations that would be produced by the following relational algebra operations:

   (a) $\Pi_{\text{hotelNo}}(\sigma_{\text{price} > 50}(\text{Room}))$
   (b) $\sigma_{\text{Hotel.hotelNo} = \text{Room.hotelNo}}(\text{Hotel} \times \text{Room})$
   (c) $\Pi_{\text{hotelName}}(\text{Hotel} \bowtie_{\text{Hotel.hotelNo} = \text{Room.hotelNo}}(\sigma_{\text{price} > 50}(\text{Room})))$
   (d) $\text{Guest} \rtimes (\sigma_{\text{dateTo} \geq \text{'1-Jan-2007'}}(\text{Booking}))$
   (e) $\text{Hotel} \triangleright_{\text{Hotel.hotelNo} = \text{Room.hotelNo}}(\sigma_{\text{price} > 50}(\text{Room}))$
   (f) $\Pi_{\text{guestName, hotelNo}}(\text{Booking} \bowtie_{\text{Booking.guestNo} = \text{Guest.guestNo}} \text{Guest}) \div \Pi_{\text{hotelNo}}(\sigma_{\text{city} = \text{'London'}}(\text{Hotel}))$

5. Provide the equivalent tuple relational calculus and domain relational calculus expressions for each of the relational algebra queries in question 4 above.