CSCI 332 Database Concepts
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Assignment 2 - Relational Algebra -Solutions

Complete the following exercises from Chapter 5 of your textbook, pages 140 and 141

1. Exercise 5.12 parts (b), (c), (e) and (g). This problem uses the Hotel database, which has the structure given on page 118 of the textbook and is the same one you used in Assignment 1. We reproduce the schema here:

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

   b. List all single rooms with a price below £20 per night..

$$\sigma_{\mathbf{type='Single' \wedge price<20}}(\mathbf{Room})$$

   c. Lists the names and cities of all guests.

   Note: Here by "city" we shall mean city where a guest is staying, rather than the city the guest is from since we have no way to extract just the city subtext from the address attribute of Guest.

$$\Pi_{\mathbf{guestName,city}}(\mathbf{Guest} * \Pi_{\mathbf{guestNo,hotelNo,city}}(\Pi_{\mathbf{guestNo,hotelNo}}(\mathbf{Booking}) * \Pi_{\mathbf{hotelNo,city}}(\mathbf{Hotel})))$$

   [Also acceptable, but grossly time- and resource-expensive is the following]

$$\Pi_{\mathbf{guestName,city}}(\mathbf{Guest} * \mathbf{Booking} * \mathbf{Hotel})$$

   e. List all guests currently staying at the Grosvenor Hotel.

$$\mathbf{Guest} * \Pi_{\mathbf{guestNo}}(\Pi_{\mathbf{hotelNo}}(\sigma_{\mathbf{hotelName="Grosvenor\ Hotel"}}(\mathbf{Hotel})) * (\sigma_{\mathbf{dateFrom<=}\mathit{currDate}\wedge\mathbf{dateTo>=}\mathit{currDate}}(\mathbf{Booking})))$$

   [where you see ***currDate*** above, a date of the form DD-MMM-YYYY should appear]

   [Again acceptable, but grossly time- and resource-expensive is the following]

$$\Pi_{\mathbf{guestNo,guestName,guestAddress}}(\sigma_{\mathbf{hotelName="Grosvenor\ Hotel"}\wedge\mathbf{dateFrom<=}\mathit{currDate}\wedge\mathbf{dateTo>=}\mathit{currDat}}(\mathbf{Guest} * \mathbf{Hotel} * \mathbf{Booking}))$$

   g. List the guest details and dates they stayed (guestNo,guestName,and guestAddress) of all guests who have ever stayed at the Grosvenor Hotel.

$$\Pi_{\mathbf{guestNo,\ guestName,\ guestAddress,dateFrom,dateTo}}(\mathbf{Guest} * (\Pi_{\mathbf{guestNo,hotelNo,dateFrom,dateTo}}(\mathbf{Booking}) * \Pi_{\mathbf{hotelNo}}(\sigma_{\mathbf{hotelName="Grosvenor\ Hotel"}}(\mathbf{Hotel}))))$$

   [Again acceptable, but grossly time- and resource-expensive is the following]

$$\Pi_{\mathbf{guestNo,\ guestName,\ guestAddress,dateFrom,dateTo}}(\sigma_{\mathbf{hotelName="Grosvenor\ Hotel"}}(\mathbf{Guest} * \mathbf{Booking} * \mathbf{Hotel}))$$

2. Still using the Hotel database from problem 1, express the following queries in relational algebra:

   a. Get a listing of the names of hotels that have a hotel in Cambridge.

   $$\pi_{\text{hotelName}}(\sigma_{\text{city='Cambridge'}}(\text{Hotel}))$$

   b. Get a listing of the names of hotels that do not have a hotel in Cambridge.

   $$\pi_{\text{hotelName}}(\text{Hotel}) - \pi_{\text{hotelName}}(\sigma_{\text{city='Cambridge'}}(\text{Hotel}))$$

   c. Get a listing of the guest numbers of guests who have had a booking with every hotel in Stratford.

   $$\pi_{\text{guestNo,hotelNo}}(\text{Booking}) \div \pi_{\text{hotelNo}}(\sigma_{\text{city='Stratford'}}(\text{Hotel}))$$

3. Exercise 5.8 parts (a), (b), (c) and (f). Use the Hotel database as described on page 118. Again, this is the same one you used in Assignment 1. Here by "describe the relation" you are to describe he query using language like that in problems 1. and 2.above. Terms like "projection," "selection," "join," etc. may not appear in your answer.

   a. $\pi_{\text{hotelNo}}(\sigma_{\text{price}>50}(\text{Room}))$

   Give the hotel numbers of all hotels that have rooms whose price is more than £50 (the £ symbol is not required)

   b. $\sigma_{\text{Hotel,hotelNo=Room.hotelNo}}(\text{Hotel} \times \text{Room})$

   Give full details of all the hotels and their rooms.

   c. $\pi_{\text{hotelName}}(\text{Hotel} \mid\times\mid_{\text{Hotel.hotelNo=Room.roomNo}}(\sigma_{\text{cprice}>50}(\text{Room}))$

   Give the names of all hotels that have rooms whose price is more than £50

   d. $\pi_{\text{guestName,hotelName}}(\text{Booking} \mid\times\mid_{\text{Booking.guestNo=Guest.guestNo}}\text{Guest}) \div \pi_{\text{hotelNo}}(\sigma_{\text{city}>\text{'London'}}(\text{Hotel})$

   Give the guest names and hotel numbers of any guests who have stayed in every hotel in London.