Database and Information Systems

Homework 1

Due on September 26, 2007

The first two problems concern the Penn Ebay (PBAY) System, which is represented by the following schema:

- Sellers(sellerID:int, rating:char, email:string)
- Items(itemID:int, type:string)
- Buyers(buyerID:int, email:string, city:string, state:string)
- Stock(itemID:int, sellerID:int, startBid:float, quantity:int, endingTime:int)
- Purchase(itemID:int, buyerID:int, sellerID:int, price:float, purchaseQuantity:int, bidTime:int)

Problem 1 [60 points]: Express the following queries in (a) the relational algebra, (b) the tuple relational calculus, and (c) the domain relational calculus:

1. Find the ID s of items purchased for price < $50.
2. Find the email s of buyers from PA who buy items with purchaseQuantity > 3.
3. Find the ID s of buyers who purchased items from of purchaseQuantity less than 10% of the quantity provided by the same seller the buyer purchase from in the stock.
4. Find the ID s of buyers who purchased items with type “furniture” for over 10% of the startBid price of the items they bought.
5. Find the ID s of buyers who either always make purchases with purchaseQuantity < 5 or haven’t made any purchases.
6. Find the types of items stocked by ≥ 2 sellers or bought by ≥ 2 buyers.

Problem 2 [30 points]: State in English what the following queries compute:

1. \{Q \mid \exists P \in Purchase, \exists S \in Sellers (S.rating = “A” \land P.sellerID = S.sellerID \land P.purchaseQuantity = 2 \land Q.buyerID = P.buyerID)\}

2. \{e \mid \exists i, s(\exists r(< s, r, e \in Sellers) \land \exists d, q, n(< i, s, d, q, n \in Stock \land (d < 20) \land (q = 5)) \land \exists b, p, u, m(< i, b, s, p, u, m \in Purchase \land (p > 50))))\}

3. π_{email}(σ_{city="philadelphia"}(Buyers) \bowtie π_{buyid}(σ_{price<2*startBid}(σ_{type="book" \land purchaseQuantity=2}(Items \bowtie Purchase) \bowtie Stock)))

4. π_{rating}(π_{s1}(σ_{i1\neq i2}Sellers) \bowtie π_{itemID→i1, sellerID→i1}(Stock) \bowtie π_{itemID→i2, sellerID→i2}(Stock) \bowtie σ_{quantity\geq3}(Stock)) \bowtie_{s1=sellerID} Sellers)
**Problem 3 [10 points]:** Explain how Codd’s points of access path dependence and indexing dependence relate to today’s Java objects. (Assume the goal is to return all instances of a particular member variable of a particular object, which might be linked to by other objects.)