Fall, 2005 CIS 550

Database and Information Systems

Homework 1

Due on September 27, 2005

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`, *address*:`string`)
Stock(*itemID*:`int`, *sellerID*:`int`, *startBid*:`float`, *quantity*:`int`,*endingTime*:`int`)
Purchases(*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 with **startBid** price $< \$10$
2. Find the **email**s of sellers with rating 'A' who have items in stock with **startBid** price $< \$10$.
3. Find the **ID**s of buyers who purchased items for over 10% beyond the **startBid** price of the items they bought.
4. Find the **ID**s of buyers who purchase items with type "book" and with a **bidTime** within 5 minutes of the **endingTime**. (clarify: endingTime - bidTime will return minutes)
5. Find the **ID**s of buyers who either always make purchases with price $< \$10$ or haven't make any purchase.
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. $\pi_{buyerID}(\sigma_{purchaseQuantity=2}(Purchase) \bowtie \pi_{sellerID}(\sigma_{rating='A'}(Sellers)))$
2. $\pi_{email}((\pi_{sellerID}(\sigma_{quantity=4 \wedge startbid<10}(Stock)) \bowtie \pi_{sellerID}(\sigma_{price>20}(Purchase))) \bowtie Sellers)$
3. $\pi_{email}(\sigma_{address="philadelphia"}(Buyers) \bowtie \pi_{buyid}(\sigma_{price<startBid}(\sigma_{type="book" \wedge purchaseQuantity=2}(Items \bowtie Purchase) \bowtie Stock)))$
4. $\pi_{rating}(\pi_{sid}(\sigma_{i1 \neq i2 \bowtie s1=s2}(\rho_{itemID \rightarrow i1, sellerID \rightarrow s1}(Stock) \bowtie \rho_{itemID \rightarrow i2, sellerID \rightarrow s2}(\sigma_{quantity \geq 3}(Stock)))) \bowtie Sellers)$

Problem 3 [10 points]: Explain the principles of data independence, as argued for by Codd, and their significance.