

## Problem Set 6

**Problem 1.** Consider the relation  $E(\text{Eno}, \text{Ename}, \text{Dname}, \text{Salary})$ . Let the domain of  $\text{Dname}$  be  $\{\text{CS}, \text{EE}, \dots, \text{History}\}$  and domain of  $\text{Salary}$  be the set of positive integers. The most frequent queries on  $E$  use the set of simple predicates  $\{\text{Dname} = \text{History}, \text{Dname} = \text{CS}, \text{Salary} \geq 60000, \text{Salary} \leq 30000\}$ . Compute the primary horizontal fragments of  $E$ .

**Problem 2.** Consider the relations  $P(\text{Pno}, \text{Pname}, \text{Budget}, \text{Loc})$  and  $A(\text{Eno}, \text{Pno}, \text{Duration})$ . Let  $P$  be horizontally fragmented into  $P_1 = \sigma_{\text{Pno} < 100}(P)$  and  $P_2 = \sigma_{\text{Pno} \geq 100}(P)$ ; let  $A$  be horizontally fragmented into  $A_1 = \sigma_{\text{Pno} < 50}(A)$ ;  $A_2 = \sigma_{50 \leq \text{Pno} < 100}(A)$ ;  $A_3 = \sigma_{\text{Pno} \geq 100}(A)$ . Transform the following SQL query into a reduced algebraic query tree:

```
SELECT Duration, Budget
FROM A, P
WHERE A.Pno = P.Pno AND P.Pname = "DB"
```

**Problem 3.** Consider the relations  $E$ ,  $P$  and  $A$  as defined in the previous two problems. Let  $P$  be horizontally fragmented into  $P_1 = \sigma_{\text{Pno} < 100}(P)$  and  $P_2 = \sigma_{\text{Pno} \geq 100}(P)$ ; let  $E$  be vertically fragmented into  $E_1 = \pi_{\text{Eno}, \text{Ename}, \text{Salary}}(E)$  and  $E_2 = \pi_{\text{Eno}, \text{Dname}}(E)$ . Let the horizontal fragmentation of  $A$  be derived from that of  $P$ , based on the  $\text{Pno}$  attribute (assume  $\text{Pno}$  is the key of  $P$ ). Reduce the following query:

```
SELECT Ename
FROM E, A, P
WHERE P.Pno = A.Pno AND E.Eno = A.Eno AND P.Loc = "Palo Alto"
```

**Problem 4.** Compute  $k_0$  for the example shown in slide 20 of lecture 14. (Note: There was a typo in the originally handed out slides. The correction was announced in class - for site 2, the min should be 7 and not 10).