

## Homework 1 on Distributed Database Design

**Problem 5.2.** Consider relation ASG in Figure 5.3. Suppose there are two applications that access ASG. The first is issued at five sites and attempts to find the duration of assignment of employees given their numbers. Assume that managers, consultants, engineers, programmers, and analysts are located at five different sites. The second application is issued at two sites where the employees with an assignment duration of less than 20 months are managed at one site, whereas those with longer duration are managed at a second site. Derive the primary horizontal fragmentation of ASG using the foregoing information.

EMP			ASG			
ENO	ENAME	TITLE	ENO	PNO	RESP	DUR
E1	J. Doe	Elect. Eng	E1	P1	Manager	12
E2	M. Smith	Syst. Anal.	E2	P1	Analyst	24
E3	A. Lee	Mech. Eng.	E2	P2	Analyst	6
E4	J. Miller	Programmer	E3	P3	Consultant	10
E5	B. Casey	Syst. Anal.	E3	P4	Engineer	48
E6	L. Chu	Elect. Eng.	E4	P2	Programmer	18
E7	R. Davis	Mech. Eng.	E5	P2	Manager	24
E8	J. Jones	Syst. Anal.	E6	P4	Manager	48
			E7	P3	Engineer	36
			E8	P3	Manager	40

  

PROJ				PAY	
PNO	PNAME	BUDGET	LOC	TITLE	SAL
P1	Instrumentation	150000	Montreal	Elect. Eng.	40000
P2	Database Develop.	135000	New York	Syst. Anal.	34000
P3	CAD/CAM	250000	New York	Mech. Eng.	27000
P4	Maintenance	310000	Paris	Programmer	24000

Figure 5.3. Modified Example Database

**Problem 5.8.** Assume the following view definition

```

CREATE VIEW    EMPVIEW(ENO, ENAME, TITLE, PNO, RESP) =
AS      SELECT  E.ENO, E. ENAME, ASG.PNO, ASG.RESP
            FROM    EMP, ASG
            WHERE   EMP.ENO=ASG.ENO AND ASG.DUR=24 AND
                    EMP.TITLE="Programmer"

```

is accessed by application q1, located at sites 1 and 2, with frequencies 10 and 20, respectively.

Let us further assume that there is another query q2 defined as

```
SELECT  ENO, DUR
FROM    ASG
```

which is run at sites 2 and 3 with frequencies 20 and 10, respectively. Based on the above information, construct the  $use(q_i, A_j)$  matrix for the attributes of both relations EMP and ASG. Also construct the affinity matrix containing all attributes of EMP and ASG. Finally, transform the affinity matrix so that it could be used to split EMP and ASG into two vertical fragments, respectively, using heuristics.

**Problem 5.17.** Assume the environment of Exercise 5.8. Also assume that 60% of the accesses of query q1 are updates to PNO and RESP of view EMPVIEW and that ASG.DUR is not updated through EMPVIEW. In addition, assume that the data transfer rate between site 1 and site 2 is half of that between site 2 and site 3. Based on the above information, find a reasonable fragmentation of ASG and EMP and an optimal replication and placement for the fragments, assuming that storage costs do not matter here, but copies are kept consistent.

Hint: Consider horizontal fragmentation for ASG based on DUR=24 predicate and the horizontal fragmentation for EMP based on TITLE="Programmer". Also look at the affinity matrix obtained in Example 5.8 for EMP and ASG together, and consider whether it would make sense to perform a vertical fragmentation for ASG.