COMP 231 --- Spring 1998

MID-TERM EXAMINATION

March 23, 1998

I hereby declare that no illegal aids were used in completing this examination. I understand that any act of cheating will result in severe penalty, including expulsion from the university.

Name:

Student ID:

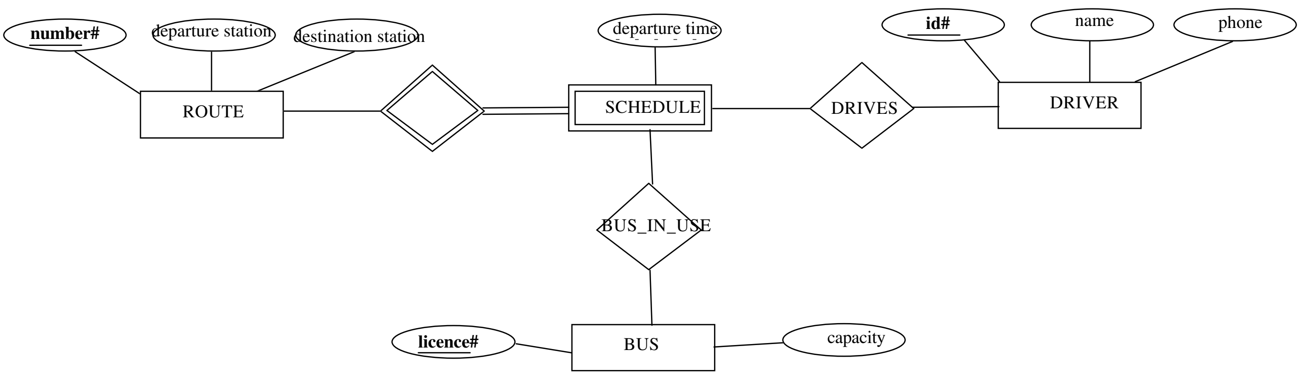
Lab Section (please circle)
Papadias: 1A, 1B, 1C
Shum: 2A, 2B, 2C

All questions should be answered within the space provided after each problem .

Problem 1 (25%)

A bus company wants to keep track of its bus routes and schedules. Design an ER diagram for the database according to the following description. Identify all constraints and keys. Write down all assumptions you made with justifications.:

1. Each bus route has a route number, a departure station and a destination station.
2. For each bus route, there is a schedule, which records the departure times of buses.
3. For each departure time of each route, a driver and a bus can be assigned (however this is not necessary - information about the driver or the bus may sometimes be missing)
4. A driver has an employee Id, a name and a phone number.
5. A bus is identified by its license number. The database also records the seating capacity of each bus.



Problem 2 (36%)

Let Employee(ID,Ename), Works(ID, DNO, Hours) two relation schemas where DNO corresponds to Department Number, ID to employee's HKID and Works denotes how many hours per week an employee works for a specific dept. (an employee may work for several departments). Write the corrsponding SQL, tuple calculus and domain calculus expressions for the following queries:

1. Retrieve the Ids of all Employees who work in dept. number 5.
2. Retrieve the Names of all Employees who work in dept. number 5.
3. Retrieve the Names of all Employees who work in dept. number 5 but not in dept. number 6.

	SQL	algebra	tuple calculus	domain calculus
1 **3%** each	SELECT ID FROM Works WHERE DNO=5	$\pi_{ID}(\sigma_{DNO=5}(Works))$	$\{t[ID] / t \in Works \wedge t[DNO]=5\}$ or $\{t / \exists s \in Works (s[ID]=t[ID] \wedge s[DNO]=5\}$	$\{\langle i\rangle / \exists d,h (\langle i,d,h\rangle \in Works \wedge d=5\}$
2 **3%** each	SELECT Ename FROM Works, Employee WHERE Works.ID = Employee.ID and DNO=5	$\pi_{Ename}(\sigma_{DNO=5}(Works\ JOIN\ Employee))$	$\{t[Ename] / t \in Employee \wedge \exists s \in Works (s[ID]=t[ID] \wedge s[DNO]=5)\}$ or $\{t / \exists s \in Employee (t[Ename]=s[Ename] \wedge \exists u \in Works (s[ID]=u[ID] \wedge u[DNO]=5))\}$	$\{\langle n\rangle / \exists i (\langle i,n\rangle \in Employee \wedge \exists d,h (\langle i,d,h\rangle \in Works \wedge d=5))\}$
3 **3%** each	SELECT Ename FROM Works, Employee WHERE Works.ID = Employee.ID and DNO=5 EXCEPT SELECT Ename FROM Works, Employee WHERE Works.ID = Employee.ID and DNO=6	$\pi_{Ename}(((\sigma_{DNO=5}(Works\ JOIN\ Employee))- (\sigma_{DNO=6}(Works\ JOIN\ Employee)))$	$\{t[Ename] / t \in Employee \wedge \exists s \in Works (s[ID]=t[ID] \wedge s[DNO]=5) \wedge \neg\exists u \in Works (u[ID]=t[ID] \wedge s[DNO]=6)\}$ or $\{t / \exists s \in Employee (t[Ename]=s[Ename] \wedge \exists u \in Works (s[ID]=u[ID] \wedge u[DNO]=5) \wedge \neg\exists v \in Works(s[ID]=v[ID] \wedge v[DNO]=5))\}$	$\{\langle n\rangle / \exists i (\langle i,n\rangle \in Employee \wedge \exists d,h (\langle i,d,h\rangle \in Works \wedge d=5) \neg\exists d,h (\langle i,d,h\rangle \in Works \wedge d=6) \}$

Problem 3 (20%)

Using the relation schemas of problem 2 write the following SQL queries (each 5%):

1. Display in descending order the number of employees who work in each department for all departments having more than 10 employees. SELECT DNO, COUNT(ID) FROM Works GROUP BY DNO HAVING COUNT(ID) > 10 ORDER BY COUNT(ID) DESC	2. Retrieve the names of all employees who <u>do not</u> work in some dept where employee with ID=54433 works SELECT Ename FROM Employee Works WHERE Employee.ID = Works.ID and DNO NOT IN (SELECT DNO FROM Works WHERE ID=54433)
3. Display the tuples of (Departments, Employee Ids, Hours) such that the Employee is the one who works for the largest number of hours in the corresponding department. CREATE VIEW DH AS SELECT DNO as D, Max(Hours) as H FROM Works GROUP BY DNO SELECT DNO, ID, Hours FROM WORKS, DH WHERE D=DNO AND Hours=H	4. The Company decides to remove DNO 5 and fire all employees who work more than 30 hours/week there. Write the appropriate delete statements. DELETE FROM Employee WHERE ID IN (SELECT ID FROM Works WHERE DNO=5 AND hours>30) DELETE FROM Work WHERE ID IN (SELECT ID FROM Works WHERE DNO=5 AND hours>30) DELETE FROM Works WHERE DNO=5

Problem 4 (19%)

Given the relation schema R(A,B,C,D,E) and the set of functional dependencies: F = $\{A \rightarrow B,\ AB \rightarrow C,\ D \rightarrow AC\}$:

1] Find the canonical cover (5%)

$\{A \rightarrow BC,\ D \rightarrow A\}$

2] Compute the following sets (10%):

A^+ = { A,B,C }

B^+ = { B }

C^+ = { C }

D^+ = { D,A,B,C }

E^+ = { E }

3] What is the key (candidate key)? (4%): DE