

The homework is due on Nov.7 (Thursday). Each student must submit one copy of the homework and one copy of the spool file.

The following shows the file name format:

- Zno_FirstName_LastName_HW02.pdf
- Zno_FirstName_LastName_HW02_spool.txt

Example)

Z00000001_KwangSoo_Yang_HW02.pdf

Z00000001_KwangSoo_Yang_HW02_spool.txt

- ✓ The pdf file should contain all answers for both Question and Lab Parts.
- ✓ **Please do not use the zip file to upload the files. Upload two separate files.**
- ✓ **After submitting the homework, please download it and see if the submission is correct.**
- ✓ Late submissions are not accepted after two days (i.e., Nov. 9 (Saturday)).
- ✓ Late penalty
 - 1st day: You lose -25 points.
 - 2nd day: You lose -50 points.

Question Part (50 points)

1. (24 points) Consider the following relations, where the primary keys are underlined.

- *Employee* (eid, ename, age, sup_eid)
- *WorkOn* (eid, pid, date)
- *Project* (pid, pname, budget, lid)
- *Location* (lid, street_name, city, state, zip_code)

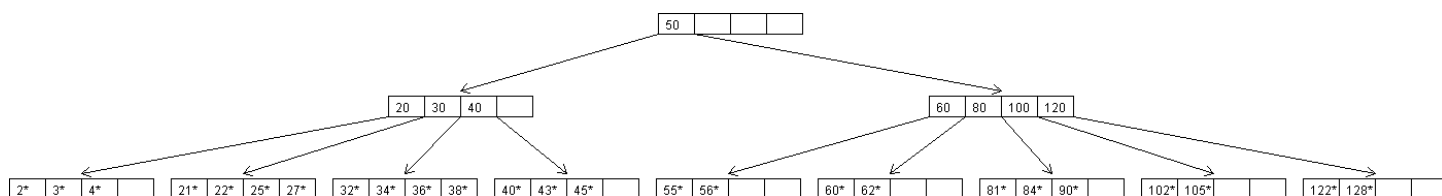
Employee.sup_eid refers to *Employee*.eid, *WorkOn*.eid refers to *Employee*.eid, *WorkOn*.pid refers to *Project*.pid, and *Project*.lid refers to *Location*.lid.

Let E be *Employee*, let W be *WorkOn*, let P be *Project*, and let L be *Location*.

Write the **relational algebra** for the following queries.

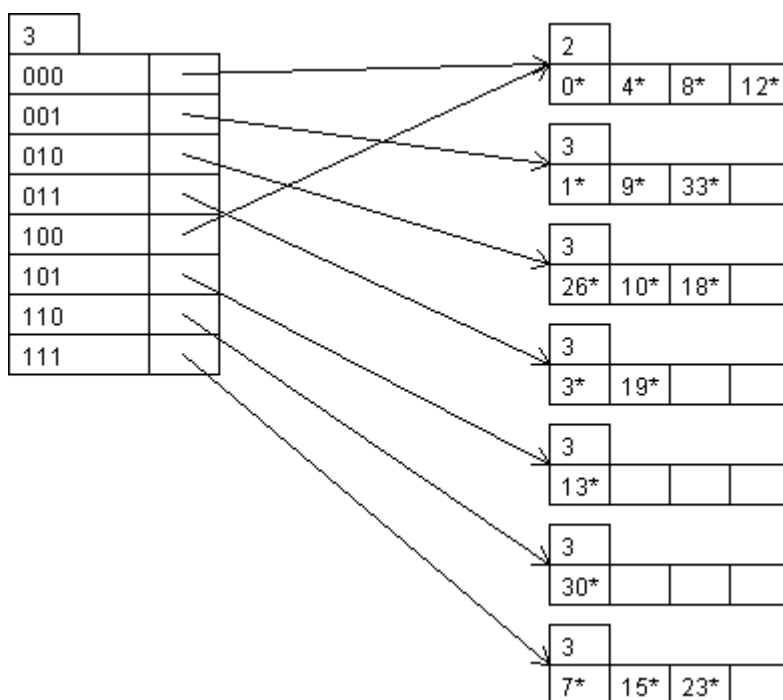
- 1) (3 points) List the names of employees who worked on the 'Database' project.
- 2) (3 points) List the names of employees who worked on the project located in the city of 'Boca'.
- 3) (3 points) List the names of employees who worked on the 'Database' project, but never worked on the 'Data Mining' project.
- 4) (3 points) List the names of employees who never worked on the project located in the city of 'Boca'.
- 5) (3 points) List the names of employees who worked on the same project as their supervisor.
- 6) (3 points) List the names of employees who worked on the same project on different dates
- 7) (3 points) List the names of employees who worked on all the project located in the city of 'Boca'.
- 8) (3 points) (Do not use the aggregation function) List the names of the oldest employees.

2. (8 points) Consider the following B+ index (Use 2-3 split rule).



- (4 points) Show the B+ tree that would result from inserting a data entry with key 26.
- (4 points) Given the result of (a), show the B+ tree that would result from deleting a data entry with key 56.

3. (6 points) Consider the following extendable hashing index.



- (3 points) Show the index that would result from inserting a data entry with key 16.
- (3 points) Given the result of (a), show the index that would result from inserting a data entry with key 21.

4. (6 points) Consider the following schedules.

S: R3(B);W2(B);R1(C);W1(C);R1(B);R1(C);W3(C);R3(C);R3(A);R3(A);C1;C3;C2

- Draw the **timetable** and **precedence graph** for the schedule. Is the schedule **conflict-serializable**?
- Is the schedule **recoverable**?

5. (6 points) Consider the following schedule.

S: W3(B);W3(C);R3(C);W3(C);W3(B);W1(C);W2(A);R1(C);R2(A);W1(C);C2;C1;C3

Assume that **Strict 2PL** is applied to the schedules. Draw both **deadlock detection table** (including shared and exclusive locks) and **wait-for-graph**. Does the schedule have a **deadlock**?

Lab Part 01 (35 points)

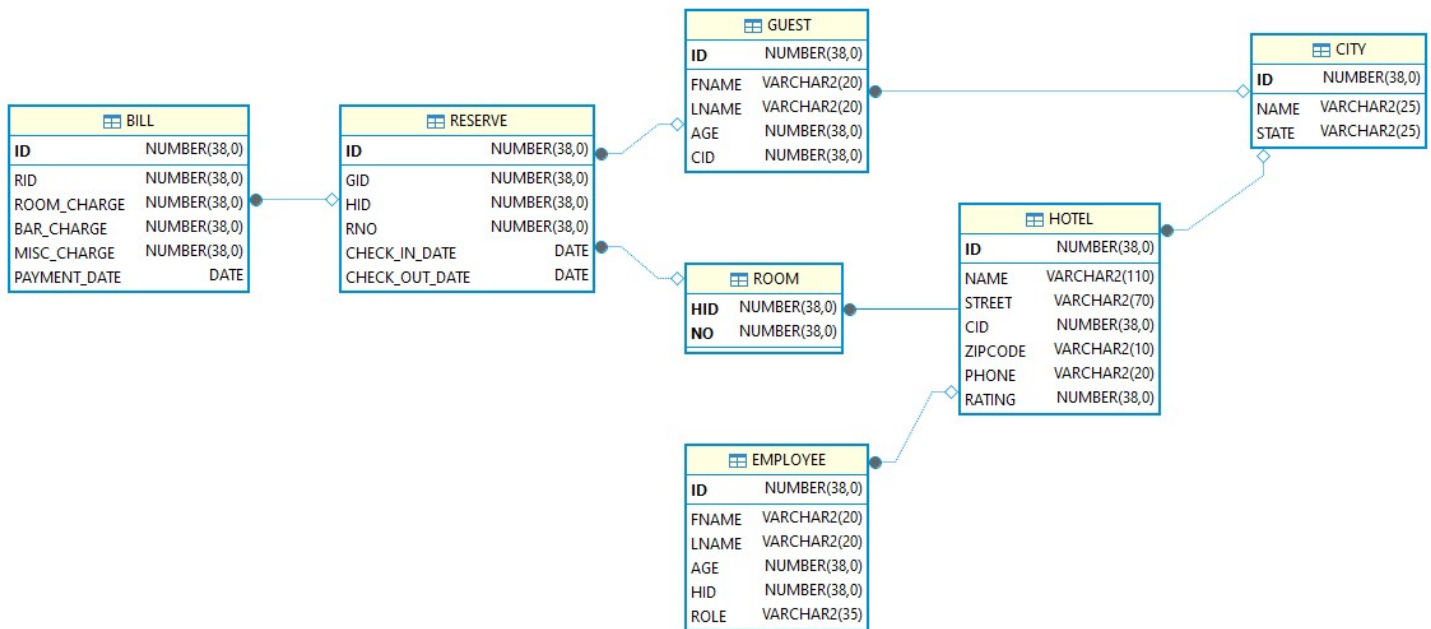
Preliminary

- Login into Linux machine (oraclelinux.eng.fau.edu)
- Connect to the database (e.g., sqlplus username/password)
- **ALTER SESSION SET CURRENT_SCHEMA = COP6731;**
- Please note that the schema name is defined as upper case characters.
- Execute the following SQL and identify all required tables.
 - **SELECT table_name from all_tables where owner = 'COP6731';**
- Please note that the owner's name is defined as upper case characters.
- Change line size and page size:
 - SET LINESIZE 400
 - SET PAGESIZE 0

Use the “spool” command to create a log file for the output of SQL (e.g., SPOOL filename and SPOOL OFF)

Note: Submit both answers and SPOOL files (i.e., an explanation and a SPOOL file).

Consider the following relational schema.



- Execute the following SQL and review the indexed keys.
SELECT table_name || ', ' || index_name || ', ' || column_name || ', ' || column_position
FROM all_ind_columns
WHERE table_owner = 'COP6731'
ORDER BY index_name, column_position;
- Execute the following SQL and review the index structure.
SELECT index_name || ', ' || index_type || ', ' || blevel || ', ' || leaf_blocks || ', ' || table_name || ', ' ||
avg_leaf_blocks_per_key || ', ' || avg_data_blocks_per_key || ', ' || clustering_factor || ', ' || distinct_keys
FROM all_indexes
WHERE table_owner = 'COP6731';

Query Evaluation

- Use the Spool command to log the output of SQL (e.g., SPOOL filename and SPOOL OFF)
- There are two files you should submit: 1) explanation for query execution plans and 2) recorded spool file.

1. **(5 points)** Execute the following two SQLs and explain which access method is used in each query. Explain why one outperforms another.

```
SELECT /*+ GATHER_PLAN_STATISTICS */ count(G.id)
FROM guest G
WHERE G.id BETWEEN 1 AND 10;

SELECT * FROM TABLE (DBMS_XPLAN.display_cursor (format=>'ALLSTATS LAST'));

SELECT /*+ GATHER_PLAN_STATISTICS */ count(G.id)
FROM guest G
WHERE G.age BETWEEN 1 AND 10;

SELECT * FROM TABLE (DBMS_XPLAN.display_cursor (format=>'ALLSTATS LAST'));
```

2. **(5 points)** Execute the following two SQLs and explain which access method is used in each query. Explain why one outperforms another.

```
SELECT /*+ GATHER_PLAN_STATISTICS */ count(H.id)
FROM hotel H
WHERE H.name LIKE '%pton Inn'

SELECT * FROM TABLE (DBMS_XPLAN.display_cursor (format=>'ALLSTATS LAST'));

SELECT /*+ GATHER_PLAN_STATISTICS */ count(H.id)
FROM hotel H
WHERE H.name LIKE 'Hamp%';

SELECT * FROM TABLE (DBMS_XPLAN.display_cursor (format=>'ALLSTATS LAST'));
```

3. **(5 points)** Execute the following SQL. How many tables were accessed to produce the outcome, and how many indexes were utilized in the process?

```
SELECT /*+ GATHER_PLAN_STATISTICS */ G.fname
FROM guest G, reserve R, hotel H
WHERE G.id = R.gid AND R.hid = H.id
AND G.id = 1047;

SELECT * FROM TABLE (DBMS_XPLAN.display_cursor (format=>'ALLSTATS LAST'));
```

4. **(10 points)** Execute the following SQL and **draw the query tree for the SQL**. Describe what kinds of access methods are used for each table. Explain which join method is used in each join operation.

```
SELECT /*+ GATHER_PLAN_STATISTICS */ H.name
FROM guest G, reserve R, hotel H, city C
WHERE G.id = R.gid AND R.hid = H.id AND H.cid = C.id
AND C.name = 'Blowing Rock' AND G.fname = 'Darryl' AND G.lname = 'Getty';

SELECT * FROM TABLE (DBMS_XPLAN.display_cursor (format=>'ALLSTATS LAST'));
```

5. **(10 points)** Execute the following SQL and **draw the query tree for the SQL**. Describe what kinds of access methods are used for each table. Explain which join method is used in each join operation.

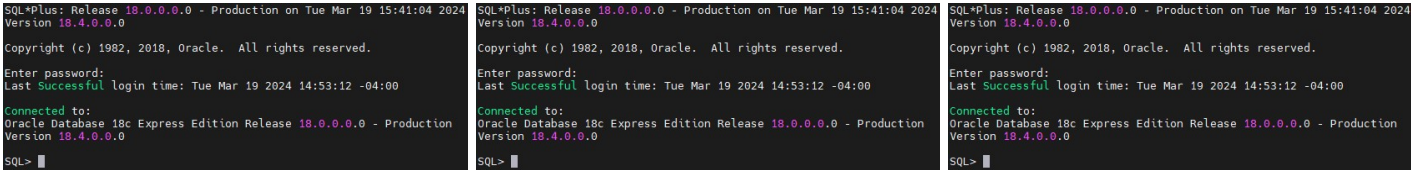
```
SELECT /*+ GATHER_PLAN_STATISTICS */ G.fname
FROM guest G, reserve R, room RM, hotel H, bill B
WHERE G.id = R.gid AND R.hid = RM.hid AND R.rno = RM.no AND RM.hid = H.id AND R.id = B.rid
AND H.name = 'Michiana Motel' AND B.payment_date='09-JUN-23' AND RM.no = 3;

SELECT * FROM TABLE (DBMS_XPLAN.display_cursor (format=>'ALLSTATS LAST'));
```

Lab Part 02 (15 points)

Preliminary

- Open three terminals (e.g., putty or XShell) and login Oracle database



- Assume that each terminal represents each user (i.e., User1 and User2).
 - Create the student table using the following query.

CREATE TABLE customer (id integer,
age integer,
primary key (id));

- Execute **SET AUTOCOMMIT OFF**. This command suppresses automatic committing so that you must commit changes manually (Note that # represents the order of the SQL execution).

#	User 1	User 2	User3
1	SET AUTOCOMMIT OFF		
2		SET AUTOCOMMIT OFF	
3			SET AUTOCOMMIT OFF

- TURN ON the spool.

#	User 1	User 2	User 3
1	SPOOL user1.log		
2		SPOOL user2.log	
3			SPOOL user3.log

- Execute the SQLs in each question and answer the question.
- Save the spool files and submit both answers and spool files.

#	User 1	User 2	User 3
1	SPOOL OFF		
2		SPOOL OFF	
3			SPOOL OFF

Transaction Processing and Recovery

1. (5 points) What is the result after STEP 8 and STEP10? Explain why this result makes sense or why it does not make sense?

#	User 1	User 2	User 3
1	DELETE FROM customer;		
2	COMMIT;		
3	INSERT INTO customer (id, age) VALUES (1, 20);		
4		UPDATE customer SET age = age +10;	
5	COMMIT;		
6			UPDATE customer SET age = age +10;
7		COMMIT;	
8			SELECT id, age FROM customer;
9			COMMIT;
10			SELECT id, age FROM customer;

2. (5 points) What is the result of STEP 7? Explain why this result makes sense or why it does not make sense?

#	User 1	User 2	User 3
	DELETE FROM customer;		
	COMMIT;		
1	INSERT INTO customer (id, age) VALUES (1, 20);		
2		INSERT INTO customer (id, age) VALUES (2, 20);	
3	COMMIT;		
4			DELETE FROM customer WHERE id = 1 OR id =2;
5		COMMIT;	
6			COMMIT;
7			SELECT id, age FROM customer;

3. (5 points) What happens after STEP 7 and STEP 8? What is the result of Step 9? Explain why this result makes sense or why it does not make sense?

#	User 1	User 2	User 3
1	DELETE FROM customer;		
2	COMMIT;		
3	INSERT INTO customer (id, age) VALUES (1, 20);		
4		UPDATE customer SET age =30 WHERE id = 1;	
5			INSERT INTO customer (id,age) VALUES (2, 20);
6			INSERT INTO customer (id,age) VALUES (1, 30);
7	INSERT INTO customer (id, age) VALUES (2, 30);		
8		INSERT INTO customer (id, age) VALUES (2, 40);	
9			COMMIT;
10		COMMIT;	
11	COMMIT;		