深 圳 大 学 实 验 报 告

课程名称：_____ **Database System**_____

实验项目名称：_____ **SQL 的多表连接查询以及视图**_____

学院：_____ **Computer Science and Software Engineering**_____

专业：_____

指导教师：_____ **Basker George**_____

报告人___学号：___班级：__

实验时间：___ **11th**___ **October, 2024**___ **to 8th November, 2024**___

实验报告提交时间：_____ **23th _ October, 2024**_____

教务部制

EXERCISES 2 JOINS

1. Find the name and salary of employees in Luton.
2. Join the DEPT table to the EMP table and show in department number order.
3. List the names of all salesmen who work in SALES
4. List all departments that do not have any employees.
5. For each employee whose salary exceeds his manager's salary, list the employee's name and salary and the manager's name and salary.
6. List the employees who have BLAKE as their manager.
7. List all the employee Name and his Manager's name, even if that employee doesn't have a manager

EXERCISES 3 FUNCTIONS

1. Find how many employees have a title of manager without listing them.
2. Compute the average annual salary plus commission for all salesmen
3. Find the highest and lowest salaries and the difference between them (single SELECT statement)
4. Find the number of characters in the longest department name
5. Count the number of people in department 30 who receive a salary and the number of people who receive a commission (single statement).
6. List the average commission of employees who receive a commission, and the average commission of all employees (assume employees who do not receive a commission attract zero commission)
7. List the average salary of employees that receive a salary, the average commission of employees that receive a commission, the average salary plus commission of only those employees that receive a commission and the average salary plus commission of all employees including those that do not receive a commission. (single statement)
8. Compute the daily and hourly salary for employees in department 30, round to the nearest penny. Assume there are 22 working days in a month and 8 working hours in a day.
9. Issue the same query as the previous one except that this time truncate (TRUNC) to the nearest penny rather than round.

EXERCISES 4 DATES

    1   Select the name, job, and date of hire of the employees in department 20. (Format the hiredate column using a picture MM/DD/YY)

    2   Use a picture to format hiredate as   DAY(day of the week), MONTH (name of the month,) DD (day of the month) and YYYY(year)

    3   Which employees were hired in March?

    4   Which employees were hired on a Tuesday?

    5   Are there any employees who have worked more than 16 years for the company?

    6   Show the weekday of the first day of the month in which each employee was hired. (plus their names)

    7   Show details of employee hiredates and the date of their first payday. (Paydays occur on the last Friday of each month) (plus their names)   (need to create User Defined Function)

    8   Refine your answer to 7 such that it works even if an employee is hired after the last Friday of the month (cf Martin)

EXERCISES 5 GROUP BY & HAVING

    1   List the department number and average salary of each department.

    2   Divide all employees into groups by department and by job within department. Count the employees in each group and compute each group's average annual salary.

    3   Issue the same query as above except list the department name rather than the department number.

    4   List the average annual salary for all job groups having more than 2 employees in the group.

    5   Find all departments with an average commission greater than 25% of average salary.

    6   Find each department's average annual salary for all its employees except the managers and the president.

    7A. List the Department ID and Name where there are at least one Manager and two clerk

    7. List the Department ID and Name where there are at least one Manager and two clerk and whose average salary is greater that the company's average salary.

   8. List the name of the Manager who manages most employee

   9. List the name of all the Manager who manages atleast 2 employees

EXERCISES 6 SUB QUERIES.

1   List the name and job of employees who have the same job as Jones.

2   Find all the employees in Department 10 that have a job that is the same as anyone in department 30.

3   List the name, job, and department of employees who have the same job as Jones or a salary greater than or equal to Ford.

4   Find all employees in department 10 that have a job that is the same as anyone in the Sales department

5   Find the employees located in Liverpool who have the same job as Allen. Return the results in alphabetical order by employee name.

6   Find all the employees that earn more than the average salary of employees in their department.

7   Find all the employees that earn more than JONES, using temporary labels to abbreviate table names.

8. List the Name of all employees who earn Highest salary and Second Highest salary.

EXERCISES 7 Data Manipulation

1   Create a new table called loans with columns named LNO NUMBER (3), EMPNO NUMBER (4), TYPE CHAR(1), AMNT NUMBER (8,2), Create all constraints, such as Primary Key, Foreign Key, Check

2   Insert the following data

LNO	EMPNO	TYPE	AMNT
23	7499	M	20000.00
42	7499	C	2000.00
65	7844	M	3564.00

3   Check that you have created 3 new records in Loans

4   The Loans table must be altered to include another column OUTST NUMBER(8,2)

5   Add 10% interest to all M type loans

6   Remove all loans less than   £3000.00

7   Change the name of loans table to accounts

8   Change the name of column LNO to LOANNO

9   Create a view for use by personnel in department 30 showing employee name, number, job and hiredate

10   Use the view to show employees in department 30 having jobs which are not salesman

11   Create a view which shows summary information for each department.

实验过程及内容：(**Methods and steps)**
.
Use MySQL Server

EXERCISES 2 JOINS

1.   Find the name and salary of employees in Luton.
select ENAME,SAL from EMP
JOIN DEPT ON EMP.DEPTNO=DEPT.DEPTNO
WHERE LOC="LUTON";
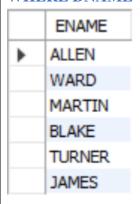
	ENAME	SAL
▶	GREEN	18500
	STEVENS	24750
	BARNES	11950

2.   Join the DEPT table to the EMP table and show in department number order.
select EMP.*,DEPT.DNAME,DEPT.LOC from EMP
JOIN DEPT ON EMP.DEPTNO=DEPT.DEPTNO
ORDER BY DEPTNO;

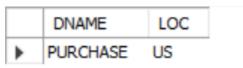| EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	DNAME	LOC
7782	CLARK	MANAGER	7839	09-JUN-88	27500	NULL	10	ACCOUNTING	LONDON
7839	KING	PRESIDENT	NULL	17-NOV-83	82500	NULL	10	ACCOUNTING	LONDON
7934	MILLER	CLERK	7782	23-JAN-95	13250	NULL	10	ACCOUNTING	LONDON
7369	SMITH	CLERK	7902	17-DEC-90	13750	NULL	20	RESEARCH	PRESTON
7566	JONES	MANAGER	7839	02-APR-89	26850	NULL	20	RESEARCH	PRESTON
7788	SCOTT	ANALYST	7566	19-APR-87	19500	NULL	20	RESEARCH	PRESTON
7876	ADAMS	CLERK	7788	23-MAY-96	11900	NULL	20	RESEARCH	PRESTON
7902	FORD	ANALYST	7566	03-DEC-91	21500	NULL	20	RESEARCH	PRESTON
7499	ALLEN	SALESMAN	7698	20-FEB-89	19000	6400	30	SALES	LIVERPOOL
7521	WARD	SALESMAN	7698	22-FEB-93	18500	4250	30	SALES	LIVERPOOL
7654	MARTIN	SALESMAN	7698	28-SEP-97	15675	3500	30	SALES	LIVERPOOL
7698	BLAKE	MANAGER	7839	01-MAY-90	24000	NULL	30	SALES	LIVERPOOL
7844	TURNER	SALESMAN	7698	08-SEP-92	18500	6250	30	SALES	LIVERPOOL
7900	JAMES	CLERK	7698	03-DEC-95	12500	NULL	30	SALES	LIVERPOOL
7500	CAMP...	ANALYST	7566	30-OCT-92	24500	0	40	OPERATIONS	STAFFORD
7999	KKA	CLERK	7934	13-MAR-92	25000	0	40	OPERATIONS	STAFFORD
3258	GREEN	SALESMAN	4422	24-JUL-95	18500	2750	50	MARKETING	LUTON
4422	STEVENS	MANAGER	7839	14-JAN-94	24750	NULL	50	MARKETING	LUTON
6548	BARNES	CLERK	4422	16-JAN-95	11950	NULL	50	MARKETING	LUTON

3.List the names of all salesmen who work in SALES

**select EMP.ENAME,DEPT.DNAME from EMP
JOIN DEPT ON EMP.DEPTNO=DEPT.DEPTNO
WHERE DNAME="SALES";**

ENAME
ALLEN
WARD
MARTIN
BLAKE
TURNER
JAMES

4.List all departments that do not have any employees.

**select DNAME,LOC from DEPT
LEFT JOIN EMP ON DEPT.DEPTNO=EMP.DEPTNO
WHERE EMP.EMPNO IS NULL;**

DNAME	LOC
PURCHASE	US

5.For each employee whose salary exceeds his manager's salary, list the employee's name and salary and the manager's name and salary.

**select * from EMP;
select**

E1.ENAME AS ENAME,
E1.SAL AS ESAL,
E2.ENAME AS MGR,
E2.SAL AS MGRSAL
from EMP E1
JOIN EMP E2 ON E1.MGR=E2.EMPNO
WHERE E1.SAL>E2.SAL;

ENAME	ESAL	MGR	MGRSAL
▶ KKAK	15000	MILLER	13250

6. List the employees who have BLAKE as their manager.

select
E1.ENAME AS ENAME,
E2.ENAME AS MGRNAME
from EMP E1
JOIN EMP E2 ON E1.MGR=E2.EMPNO
WHERE E2.ENAME="BLAKE";

ENAME	MGRNAME
▶ ALLEN	BLAKE
WARD	BLAKE
MARTIN	BLAKE
TURNER	BLAKE
JAMES	BLAKE

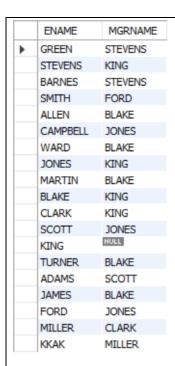7. List all the employee Name and his Manager's name, even if that employee doesn't have a manager
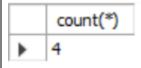
select
E1.ENAME AS ENAME,
E2.ENAME AS MGRNAME
from EMP E1
LEFT JOIN EMP E2 ON E1.MGR=E2.EMPNO;

ENAME	MGRNAME
▶ GREEN	STEVENS
STEVENS	KING
BARNES	STEVENS
SMITH	FORD
ALLEN	BLAKE
CAMPBELL	JONES
WARD	BLAKE
JONES	KING
MARTIN	BLAKE
BLAKE	KING
CLARK	KING
SCOTT	JONES
KING	NULL
TURNER	BLAKE
ADAMS	SCOTT
JAMES	BLAKE
FORD	JONES
MILLER	CLARK
KKAK	MILLER

EXERCISES 3 FUNCTIONS

1 Find how many employees have a title of manager without listing them.

select count(*) from EMP where JOB="MANAGER";

count(*)
▶ 4

2 Compute the average annual salary plus commission for all salesmen

select avg(SAL+COMM) from EMP where JOB="SALESMAN";

avg(SAL+COMM)
▶ 22665

3 Find the highest and lowest salaries and the difference between them (single SELECT statement)

select max(SAL) as maxSal,
min(SAL) as minSal,
max(SAL)-min(SAL) as salDiff
from EMP;

	maxSal	minSal	salDiff
▶	82500	11900	70600

4 Find the number of characters in the longest department name

select max(length(DNAME)) from DEPT;

	max(length(DNAME))
▶	10

5 Count the number of people in department 30 who receive a salary and the number of people who receive a commission (single statement).

select sum(case when DEPTNO=30 and SAL is not NULL then 1 else 0 end) as salary,
sum(case when DEPTNO=30 and COMM is not NULL then 1 else 0 end) as commission from EMP;

	salary	commission
▶	7	4

6 List the average commission of employees who receive a commission, and the average commission of all employees (assume employees who do not receive a commission attract zero commission)

select avg(COMM) as onlyE,avg(coalesce(COMM,0)) as allE from EMP;

	onlyE	allE
▶	3858.3333333333335	1218.421052631579

7 List the average salary of employees that receive a salary, the average commission of employees that receive a commission, the average salary   plus commission of only those employees that receive a commission and the average salary plus commission of all employees including   those that do not receive a commission. (single statement)

select avg(SAL) as case1,
avg(COMM) as case2,
avg(case when COMM is not NULL then (SAL+COMM) else 0 end) as case3,
avg(sal+coalesce(comm,0)) as case4
from EMP;

case1	case2	case3	case4
22085.526315789473	3858.3333333333335	7253.9473684210525	23303.947368421053

8   Compute the daily and hourly salary for employees in department 30, round to the nearest penny. Assume there are 22 working days in a month and 8 working hours in a day.

select EMPNO,ENAME,SAL,
round(SAL/22,2) as daily,
round(SAL/(22*8),2) as hourly
from EMP where DEPTNO=30;

EMPNO	ENAME	SAL	daily	hourly
7499	ALLEN	19000	863.64	107.95
7521	WARD	18500	840.91	105.11
7654	MARTIN	15675	712.5	89.06
7698	BLAKE	24000	1090.91	136.36
7844	TURNER	18500	840.91	105.11
7900	JAMES	12500	568.18	71.02
7999	KKAK	15000	681.82	85.23

9   Issue the same query as the previous one except that this time truncate (TRUNC) to the nearest penny rather than round.

select EMPNO,ENAME,SAL,
truncate(SAL/22,2) as daily,
truncate(SAL/(22*8),2) as hourly
from EMP where DEPTNO=30;

EMPNO	ENAME	SAL	daily	hourly
7499	ALLEN	19000	863.63	107.95
7521	WARD	18500	840.9	105.11
7654	MARTIN	15675	712.5	89.06
7698	BLAKE	24000	1090.9	136.36
7844	TURNER	18500	840.9	105.11
7900	JAMES	12500	568.18	71.02
7999	KKAK	15000	681.81	85.22

EXERCISES 4 DATES

1   Select the name, job, and date of hire of the employees in department 20. (Format the hiredate column using a picture MM/DD/YY)

select ENAME,JOB,
DATE_FORMAT(STR_TO_DATE(HIREDATE,'%d-%b-%y'),
'%m/%d/%y') AS HIREDATE_FORMATTED
from EMP where DEPTNO=20;

	ENAME	JOB	HIREDATE_FORMATTED
▶	SMITH	CLERK	12/17/90
	JONES	MANAGER	04/02/89
	SCOTT	ANALYST	04/19/87
	ADAMS	CLERK	05/23/96
	FORD	ANALYST	12/03/91

2   Use a picture to format hiredate as   DAY(day of the week), MONTH (name of the month,) DD (day of the month) and YYYY(year)

SELECT ENAME,JOB,
DATE_FORMAT(STR_TO_DATE(HIREDATE,'%d-%b-%y'),
'%W, %d %M %Y') AS HIREDATE_FORMATTED
FROM EMP;

	ENAME	JOB	HIREDATE_FORMATTED
▶	GREEN	SALESMAN	Monday, 24 July 1995
	STEVENS	MANAGER	Friday, 14 January 1994
	BARNES	CLERK	Monday, 16 January 1995
	SMITH	CLERK	Monday, 17 December 1990
	ALLEN	SALESMAN	Monday, 20 February 1989
	CAMPBELL	ANALYST	Friday, 30 October 1992
	WARD	SALESMAN	Monday, 22 February 1993
	JONES	MANAGER	Sunday, 02 April 1989
	MARTIN	SALESMAN	Sunday, 28 September 1997
	BLAKE	MANAGER	Tuesday, 01 May 1990
	CLARK	MANAGER	Thursday, 09 June 1988
	SCOTT	ANALYST	Sunday, 19 April 1987
	KING	PRESIDENT	Thursday, 17 November 1983
	TURNER	SALESMAN	Tuesday, 08 September 1992
	ADAMS	CLERK	Thursday, 23 May 1996
	JAMES	CLERK	Sunday, 03 December 1995
	FORD	ANALYST	Tuesday, 03 December 1991
	MILLER	CLERK	Monday, 23 January 1995

3   Which employees were hired in March?

SELECT *
FROM EMP
WHERE MONTH(STR_TO_DATE(HIREDATE, '%d-%b-%y')) = 3;

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7999	KKKA	CLERK	7934	13-MAR-93	15000	NULL	10
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

4   Which employees were hired on a Tuesday?

SELECT *
FROM EMP
WHERE DAYOFWEEK(STR_TO_DATE(HIREDATE, '%d-%b-%y')) = 3;

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7698	BLAKE	MANAGER	7839	01-MAY-90	24000	NULL	30
7844	TURNER	SALESMAN	7698	08-SEP-92	18500	6250	30
7902	FORD	ANALYST	7566	03-DEC-91	21500	NULL	20
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

5   Are there any employees who have worked more than 16 years for the company?

SELECT *
FROM EMP
WHERE DATEDIFF(CURDATE(),
STR_TO_DATE(HIREDATE, '%d-%b-%y')) > 16 * 365;

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
3258	GREEN	SALESMAN	4422	24-JUL-95	18500	2750	50
4422	STEVENS	MANAGER	7839	14-JAN-94	24750	NULL	50
6548	BARNES	CLERK	4422	16-JAN-95	11950	NULL	50
7369	SMITH	CLERK	7902	17-DEC-90	13750	NULL	20
7499	ALLEN	SALESMAN	7698	20-FEB-89	19000	6400	30
7500	CAMPBELL	ANALYST	7566	30-OCT-92	24500	0	40
7521	WARD	SALESMAN	7698	22-FEB-93	18500	4250	30
7566	JONES	MANAGER	7839	02-APR-89	26850	NULL	20
7654	MARTIN	SALESMAN	7698	28-SEP-97	15675	3500	30
7698	BLAKE	MANAGER	7839	01-MAY-90	24000	NULL	30
7782	CLARK	MANAGER	7839	09-JUN-88	27500	NULL	10
7788	SCOTT	ANALYST	7566	19-APR-87	19500	NULL	20
7839	KING	PRESIDENT	NULL	17-NOV-83	82500	NULL	10
7844	TURNER	SALESMAN	7698	08-SEP-92	18500	6250	30
7876	ADAMS	CLERK	7788	23-MAY-96	11900	NULL	20
7900	JAMES	CLERK	7698	03-DEC-95	12500	NULL	30
7902	FORD	ANALYST	7566	03-DEC-91	21500	NULL	20
7934	MILLER	CLERK	7782	23-JAN-95	13250	NULL	10
7999	KKKA	CLERK	7934	13-MAR-93	15000	NULL	10
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

6   Show the weekday of the first day of the month in which each

employee was hired. (plus their names)

```sql
SELECT
    ENAME,
    DAYNAME(DATE_SUB(STR_TO_DATE(HIREDATE, '%d-%b-%y'),
    INTERVAL DAYOFMONTH
    (STR_TO_DATE(HIREDATE, '%d-%b-%y')) - 1 DAY))
    AS FIRST_DAY_OF_MONTH_WEEKDAY
FROM EMP;
```

ENAME	HIREDATE	FIRST_DAY_OF_MONTH_WEEKDAY
GREEN	24-JUL-95	Saturday
STEVENS	14-JAN-94	Saturday
BARNES	16-JAN-95	Sunday
SMITH	17-DEC-90	Saturday
ALLEN	20-FEB-89	Wednesday
CAMPBELL	30-OCT-92	Thursday
WARD	22-FEB-93	Monday
JONES	02-APR-89	Saturday
MARTIN	28-SEP-97	Monday
BLAKE	01-MAY-90	Tuesday
CLARK	09-JUN-88	Wednesday
SCOTT	19-APR-87	Wednesday
KING	17-NOV-83	Tuesday
TURNER	08-SEP-92	Tuesday
ADAMS	23-MAY-96	Wednesday
JAMES	03-DEC-95	Friday
FORD	03-DEC-91	Sunday
MILLER	23-JAN-95	Sunday
KKKA	13-MAR-93	Monday

7   Show details of employee hiredates and the date of their first payday. (Paydays occur on the last Friday of each month) (plus their names)   (need to create User Defined Function)

```sql
DELIMITER //
CREATE FUNCTION LAST_FRIDAY_OF_MONTH(input_date DATE)
RETURNS DATE
BEGIN
    DECLARE last_day DATE;
    DECLARE last_friday DATE;

    SET last_day_of_month = LAST_DAY(input_date);
    SET last_friday = DATE_SUB(last_day,
    INTERVAL (WEEKDAY(last_day) - 4) % 7 DAY);

    RETURN last_friday;
END //
DELIMITER ;

SELECT
    ENAME,
```

```
    STR_TO_DATE(HIREDATE, '%d-%b-%y') AS HIREDATE,
    LAST_FRIDAY_OF_MONTH(STR_TO_DATE(HIREDATE,
'%d-%b-%y')) AS FIRST_PAYDAY
FROM EMP;
```

	ENAME	FIRST_DAY_OF_MONTH_WEEKDAY
▶	GREEN	Saturday
	STEVENS	Saturday
	BARNES	Sunday
	SMITH	Saturday
	ALLEN	Wednesday
	CAMPBELL	Thursday
	WARD	Monday
	JONES	Saturday
	MARTIN	Monday
	BLAKE	Tuesday
	CLARK	Wednesday
	SCOTT	Wednesday
	KING	Tuesday
	TURNER	Tuesday
	ADAMS	Wednesday
	JAMES	Friday
	FORD	Sunday
	MILLER	Sunday
	KKKA	Monday

8   Refine your answer to 7 such that it works even if an employee is hired after the last
     Friday of the month (cf Martin)

```
DELIMITER //
CREATE FUNCTION NEXT_LAST_FRIDAY(input_date DATE)
RETURNS DATE
DETERMINISTIC
BEGIN
    DECLARE last_day DATE;
    DECLARE last_friday DATE;
    DECLARE next_last_friday DATE;

    SET last_day = LAST_DAY(input_date);

    SET     last_friday     =     DATE_SUB(last_day,     INTERVAL
(WEEKDAY(last_day) - 4) % 7 DAY);

    IF input_date > last_friday THEN
        SET last_day = LAST_DAY(DATE_ADD(input_date, INTERVAL 1
MONTH));
        SET     next_last_friday     =     DATE_SUB(last_day,     INTERVAL
```

```sql
(WEEKDAY(last_day) - 4) % 7 DAY);
        RETURN next_last_friday;
    ELSE
        RETURN last_friday;
    END IF;
END //
DELIMITER ;

SHOW CREATE FUNCTION NEXT_LAST_FRIDAY;
SELECT
    ENAME,
    STR_TO_DATE(HIREDATE, '%d-%b-%y') AS HIREDATE,
    NEXT_LAST_FRIDAY(STR_TO_DATE(HIREDATE,    '%d-%b-%y'))
AS FIRST_PAYDAY
FROM EMP;
```

ENAME	HIREDATE	FIRST_PAYDAY
GREEN	1995-07-24	1995-08-04
STEVENS	1994-01-14	1994-02-04
BARNES	1995-01-16	1995-02-03
SMITH	1990-12-17	1991-01-04
ALLEN	1989-02-20	1989-03-03
CAMPBELL	1992-10-30	1992-10-30
WARD	1993-02-22	1993-02-26
JONES	1989-04-02	1989-04-28
MARTIN	1997-09-28	1997-10-03
BLAKE	1990-05-01	1990-06-01
CLARK	1988-06-09	1988-07-01
SCOTT	1987-04-19	1987-05-01
KING	1983-11-17	1983-12-02
TURNER	1992-09-08	1992-10-02
ADAMS	1996-05-23	1996-05-31
JAMES	1995-12-03	1995-12-29
FORD	1991-12-03	1992-01-03
MILLER	1995-01-23	1995-02-03
KKKA	1993-03-13	1993-04-02

EXERCISES 5 GROUP BY & HAVING

1   List the department number and average salary of each department.
SELECT DEPTNO,AVG(SAL) AS AVERAGE_SALARY
FROM EMP GROUP BY DEPTNO;

DEPTNO	AVERAGE_SALARY
▶ 50	18400
20	18700
30	18029.166666666668
40	24500
10	34562.5

2   Divide all employees into groups by department and by job within department. Count the employees in each group and compute each group's average annual salary.
SELECT DEPTNO,JOB,
   COUNT(*) AS EMPLOYEE_COUNT,
   AVG(SAL) * 12 AS AVG_SAL
FROM EMP GROUP BY DEPTNO, JOB;

DEPTNO	JOB	EMPLOYEE_COUNT	AVG_SAL
▶ 50	SALESMAN	1	222000
50	MANAGER	1	297000
50	CLERK	1	143400
20	CLERK	2	153900
30	SALESMAN	4	215025
40	ANALYST	1	294000
20	MANAGER	1	322200
30	MANAGER	1	288000
10	MANAGER	1	330000
20	ANALYST	2	246000
10	PRESIDENT	1	990000
30	CLERK	1	150000
10	CLERK	1	159000

3   Issue the same query as above except list the department name rather than the department number.
SELECT DEPT.DNAME,EMP.JOB,
   COUNT(*) AS EMPLOYEE_COUNT,

```sql
    AVG(EMP.SAL) * 12 AS AVG_SALARY
FROM EMP
JOIN DEPT ON EMP.DEPTNO = DEPT.DEPTNO
GROUP BY DEPT.DNAME, EMP.JOB;
```

DNAME	JOB	EMPLOYEE_COUNT	AVG_SALARY
MARKETING	SALESMAN	1	222000
MARKETING	MANAGER	1	297000
MARKETING	CLERK	1	143400
RESEARCH	CLERK	2	153900
SALES	SALESMAN	4	215025
OPERATIONS	ANALYST	1	294000
RESEARCH	MANAGER	1	322200
SALES	MANAGER	1	288000
ACCOUNTING	MANAGER	1	330000
RESEARCH	ANALYST	2	246000
ACCOUNTING	PRESIDENT	1	990000
SALES	CLERK	1	150000
ACCOUNTING	CLERK	1	159000

4   List the average annual salary for all job groups having more than 2 employees in the group.

```sql
SELECT
    JOB,
    COUNT(*) AS EMPLOYEE_COUNT,
    AVG(SAL) * 12 AS AVG_SAL
FROM EMP GROUP BY JOB HAVING COUNT(*) > 2;
```

JOB	EMPLOYEE_COUNT	AVG_SAL
SALESMAN	5	216420
MANAGER	4	309300
CLERK	5	152040
ANALYST	3	262000

5   Find all departments with an average commission greater than 25% of average salary.

```sql
SELECT
    DEPTNO,
    AVG(SAL) AS AVG_SAL,
    AVG(COMM) AS AVG_COMM
FROM EMP GROUP BY DEPTNO
HAVING AVG(COMM) > 0.25 * AVG(SAL);
```

DEPTNO	AVG_SAL	AVG_COMM
30	18029.166666666668	5100

6   Find each department's average annual salary for all its employees except the managers and the president.

```sql
SELECT
    DEPTNO,
    AVG(SAL) * 12 AS AVG_SAL
FROM EMP WHERE JOB NOT IN ('MANAGER', 'PRESIDENT')
GROUP BY DEPTNO;
```

	DEPTNO	AVG_SAL
▶	50	182700
	20	199950
	30	202020
	40	294000
	10	159000

7A. List the Department ID and Name where there are at least one Manager and two clerk

```sql
SELECT DEPT.DEPTNO,DEPT.DNAME
FROM EMP JOIN DEPT ON EMP.DEPTNO = DEPT.DEPTNO
GROUP BY DEPT.DEPTNO, DEPT.DNAME
HAVING
    SUM(CASE WHEN EMP.JOB = 'MANAGER' THEN 1 ELSE 0 END) >= 1
    AND SUM(CASE WHEN EMP.JOB = 'CLERK' THEN 1 ELSE 0 END) >= 2;
```

	DEPTNO	DNAME
▶	20	RESEARCH

7B. List the Department ID and Name where there are at least one Manager and two clerk and whose average salary is greater that the company's average salary.

```sql
WITH CompanyAverage AS (
    SELECT AVG(SAL) AS AVG_SAL
    FROM EMP
)
SELECT DEPT.DEPTNO,DEPT.DNAME,
       AVG(EMP.SAL) AS DEPT_AVG,
       (SELECT AVG_SAL FROM CompanyAverage) AS COMPANY_AVG
FROM EMP JOIN DEPT ON EMP.DEPTNO = DEPT.DEPTNO
GROUP BY DEPT.DEPTNO, DEPT.DNAME
HAVING
    SUM(CASE WHEN EMP.JOB = 'MANAGER' THEN 1 ELSE 0
```

END) >= 1
   AND SUM(CASE WHEN EMP.JOB = 'CLERK' THEN 1 ELSE 0
END) >= 2
   AND AVG(EMP.SAL) > (SELECT AVG_SAL FROM CompanyAverage);

DEPTNO	DNAME	DEPT_AVG	COMPANY_AVG
▶ 20	RESEARCH	348916.6666666667	126559.21052631579

8. List the name of the Manager who manages most employee

WITH MECount AS (
    SELECT
        MGR,
        COUNT(*) AS ECOUNT
    FROM EMP
    WHERE MGR IS NOT NULL
    GROUP BY MGR
)
SELECT EMP.ENAME AS MANAGER_NAME,
       MECOUNT.ECOUNT AS EMPLOYEES_COUNT
FROM MECount
JOIN EMP ON MECount.MGR = EMP.EMPNO
WHERE MECount.ECOUNT = (SELECT MAX(ECOUNT) FROM
MECount);

MANAGER_NAME	EMPLOYEES_COUNT
▶ BLAKE	5

9. List the name of all the Manager who manages atleast 2 employees

WITH MECount AS (
    SELECT
        MGR,
        COUNT(*) AS ECOUNT
    FROM EMP
    WHERE MGR IS NOT NULL
    GROUP BY MGR

```
)
SELECT
    EMP.ENAME AS MANAGER_NAME,
    MECOUNT.ECOUNT AS EMPLOYEES_COUNT
FROM MECount
JOIN EMP ON MECOUNT.MGR = EMP.EMPNO
WHERE MECOUNT.ECOUNT >= 2;
```

	MANAGER_NAME	EMPLOYEES_COUNT
▶	STEVENS	2
	KING	4
	FORD	2
	BLAKE	5
	JONES	3

EXERCISES 6 SUB QUERIES.

1   List the name and job of employees who have the same job as Jones.

```
SELECT ENAME,JOB FROM EMP
WHERE JOB = (SELECT JOB FROM EMP WHERE ENAME = 'JONES')
  AND ENAME != 'JONES';
```

	ENAME	JOB
▶	STEVENS	MANAGER
	BLAKE	MANAGER
	CLARK	MANAGER

2   Find all the employees in Department 10 that have a job that is the same as anyone in department 30.

```
SELECT ENAME,JOB FROM EMP
WHERE
    DEPTNO = 10
    AND JOB IN (SELECT JOB FROM EMP WHERE DEPTNO = 30);
```

	ENAME	JOB
▶	CLARK	MANAGER
	MILLER	CLERK

3   List the name, job, and department of employees who have the same job as Jones or a salary greater than or equal to Ford.

```
SELECT ENAME,JOB,DEPTNO FROM EMP
WHERE
    JOB = (SELECT JOB FROM EMP WHERE ENAME = 'JONES') OR
    SAL >= (SELECT SAL FROM EMP WHERE ENAME = 'FORD');
```

	ENAME	JOB	DEPTNO
▶	STEVENS	MANAGER	50
	CAMPBELL	ANALYST	40
	JONES	MANAGER	20
	BLAKE	MANAGER	30
	CLARK	MANAGER	10
	KING	PRESIDENT	10
	FORD	ANALYST	20
	NEW	CLERK	20

4   Find all employees in department 10 that have a job that is the same as anyone in the Sales department

```
SELECT ENAME,JOB,DEPTNO FROM EMP
WHERE DEPTNO = 10 AND
    JOB IN (SELECT JOB FROM EMP WHERE DEPTNO = 30);
```

	ENAME	JOB	DEPTNO
▶	CLARK	MANAGER	10
	MILLER	CLERK	10

5   Find the employees located in Liverpool who have the same job as Allen. Return the results in alphabetical order by employee name.

```
SELECT EMP.ENAME,EMP.JOB,DEPT.LOC
FROM EMP
JOIN DEPT ON EMP.DEPTNO = DEPT.DEPTNO
WHERE
    DEPT.LOC = 'LIVERPOOL'
    AND EMP.JOB = (SELECT JOB FROM EMP WHERE ENAME = 'ALLEN')
ORDER BY EMP.ENAME ASC;
```

	ENAME	JOB	LOC
▶	ALLEN	SALESMAN	LIVERPOOL
	MARTIN	SALESMAN	LIVERPOOL
	TURNER	SALESMAN	LIVERPOOL
	WARD	SALESMAN	LIVERPOOL

6   Find all the employees that earn more than the average salary of employees in their department.

SELECT
   e1.ENAME AS EMPLOYEE_NAME,
   e1.SAL AS SALARY,
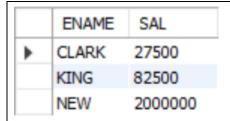   **e1.DEPTNO AS DEPARTMENT_NUMBER**
FROM EMP e1
WHERE e1.SAL > (SELECT AVG(e2.SAL) FROM EMP e2 WHERE e2.DEPTNO = e1.DEPTNO);

	EMPLOYEE_NAME	SALARY	DEPARTMENT_NUMBER
▶	GREEN	18500	50
	STEVENS	24750	50
	ALLEN	19000	30
	WARD	18500	30
	BLAKE	24000	30
	KING	82500	10
	TURNER	18500	30
	NEW	2000000	20

7   Find all the employees that earn more than JONES, using temporary labels to abbreviate table names.

SELECT ENAME,SAL FROM EMP
WHERE SAL > (SELECT SAL FROM EMP WHERE ENAME = 'JONES');

ENAME	SAL
▶ CLARK	27500
KING	82500
NEW	2000000

8. List the Name of all employees who earn Highest salary and Second Highest salary.

WITH RankedSal AS (
    SELECT ENAME,SAL,
       DENSE_RANK() OVER (ORDER BY SAL DESC) AS SalRank
    FROM EMP
)
SELECT ENAME,SAL FROM RankedSal
WHERE SalRank <= 2;

ENAME	SAL
▶ NEW	2000000
KING	82500

EXERCISES 7 Data Manipulation

1   Create a new table called loans with columns named LNO NUMBER (3), EMPNO NUMBER (4), TYPE CHAR(1), AMNT NUMBER (8,2), Create all constraints, such as Primary Key, Foreign Key, Check

DROP TABLE IF EXISTS LOANS;
CREATE TABLE IF NOT EXISTS LOANS(
    LNO INT(3) PRIMARY KEY,
    EMPNO INT(4) NOT NULL,
    TYPE CHAR(1) CHECK (TYPE IN ('M', 'C')),
    AMNT DOUBLE(8,2) CHECK (AMNT > 0),
    CONSTRAINT FK_LOANS_EMPNO FOREIGN KEY (EMPNO)
REFERENCES EMP (EMPNO)
);

2   Insert the following data

LNO	EMPNO	TYPE	AMNT
23	7499	M	20000.00
42	7499	C	2000.00
65	7844	M	3564.00

INSERT INTO LOANS (LNO, EMPNO, TYPE, AMNT) VALUES
(23, 7499, 'M', 20000.00),
(42, 7499, 'C', 2000.00),
(65, 7844, 'M', 3564.00);

3   Check that you have created 3 new records in Loans

SELECT * FROM LOANS;

	LNO	EMPNO	TYPE	AMNT
▶	23	7499	M	20000.00
	42	7499	C	2000.00
	65	7844	M	3564.00
*	NULL	NULL	NULL	NULL

4   The Loans table must be altered to include another column OUTST NUMBER(8,2)

ALTER TABLE LOANS ADD OUTST DOUBLE(8,2);

5   Add 10% interest to all M type loans

UPDATE LOANS
SET OUTST = AMNT * 1.10
WHERE TYPE = 'M';
SELECT * FROM LOANS WHERE TYPE = 'M';

	LNO	EMPNO	TYPE	AMNT	OUTST
▶	23	7499	M	20000.00	22000.00
	65	7844	M	3564.00	3920.40
*	NULL	NULL	NULL	NULL	NULL

6   Remove all loans less than   £3000.00

DELETE FROM LOANS
WHERE AMNT < 3000.00;

	LNO	EMPNO	TYPE	AMNT	OUTST
▶	23	7499	M	20000.00	22000.00
	65	7844	M	3564.00	3920.40
*	NULL	NULL	NULL	NULL	NULL

7   Change the name of loans table to accounts

RENAME TABLE LOANS TO ACCOUNTS;
SELECT * FROM ACCOUNTS;

	LNO	EMPNO	TYPE	AMNT	OUTST
▶	23	7499	M	20000.00	22000.00
	65	7844	M	3564.00	3920.40
＊	NULL	NULL	NULL	NULL	NULL

8   Change the name of column LNO to LOANNO

ALTER TABLE ACCOUNTS RENAME COLUMN LNO TO LOANNO;
SELECT * FROM ACCOUNTS;

	LOANNO	EMPNO	TYPE	AMNT	OUTST
▶	23	7499	M	20000.00	22000.00
	65	7844	M	3564.00	3920.40
＊	NULL	NULL	NULL	NULL	NULL

9   Create a view for use by personnel in department 30 showing employee name, number, job and hiredate

CREATE VIEW DEPT30 AS
SELECT ENAME, EMPNO, JOB, HIREDATE
FROM EMP
WHERE DEPTNO = 30;
SELECT * FROM DEPT30;

	ENAME	EMPNO	JOB	HIREDATE
▶	ALLEN	7499	SALESMAN	20-FEB-89
	WARD	7521	SALESMAN	22-FEB-93
	MARTIN	7654	SALESMAN	28-SEP-97
	BLAKE	7698	MANAGER	01-MAY-90
	TURNER	7844	SALESMAN	08-SEP-92
	JAMES	7900	CLERK	03-DEC-95

10   Use the view to show employees in department 30 having jobs which are not salesman

SELECT ENAME, EMPNO, JOB, HIREDATE
FROM DEPT30
WHERE JOB != 'SALESMAN';

	ENAME	EMPNO	JOB	HIREDATE
▶	BLAKE	7698	MANAGER	01-MAY-90
	JAMES	7900	CLERK	03-DEC-95

11　Create a view which shows summary information for each department.

```sql
CREATE VIEW DEPT_SUMMARY AS
SELECT
    DEPT.DEPTNO,
    DEPT.DNAME,
    COUNT(EMP.EMPNO) AS EMP_COUNT,
    AVG(EMP.SAL) AS AVG_SAL,
    MAX(EMP.SAL) AS MAX_SAL,
    MIN(EMP.SAL) AS MIN_SAL
FROM EMP
JOIN DEPT ON EMP.DEPTNO = DEPT.DEPTNO
GROUP BY DEPT.DEPTNO, DEPT.DNAME;
```

DEPTNO	DNAME	EMP_COUNT	AVG_SAL	MAX_SAL	MIN_SAL
50	MARKETING	3	18400	24750	11950
20	RESEARCH	6	348916.6666666667	2000000	11900
30	SALES	6	18029.166666666668	24000	12500
40	OPERATIONS	1	24500	24500	24500
10	ACCOUNTING	3	41083.333333333336	82500	13250

数据处理分析：(**Experiment process and content**)

1.学习了如何使用 SQL 的聚合函数

2. 学习了如何格式化日期、提取日期的特定部分（如星期、月份等），以及如何筛选特定日期的数据。

3. 使用`GROUP BY`和`HAVING`子句来对数据进行分组和筛选。

4. 子查询的用法，包括相关子查询和非相关子查询。

5. 学习了数据操作的 SQL 语句，包括创建表、插入数据、更新数据、删除数据等。

注：1、报告内的项目或内容设置，可根据实际情况加以调整和补充。
　　2、教师批改学生实验报告时间应在学生提交实验报告时间后 10 日内。