

Q1.

a)

$$\pi_{age}((\pi_{eid}(\pi_{did}(\sigma_{dname='Catering'} Dept)) \bowtie Works) \bowtie Emp)$$

b)

$$\pi_{salary}((\pi_{eid}((\pi_{did}(\sigma_{budget \geq 50000} Dept)) \bowtie (\sigma_{pct_time \geq 30} Works)))) \bowtie Emp)$$

c)

$$\pi_{salary}(Dept \bowtie_{Dept.managerid=Emp.eid} Emp)$$

d)

$$\pi_{ename}(Emp \bowtie ((\pi_{eid}(\pi_{did}(\sigma_{dname='Marketing'} Dept)) \bowtie Works)$$

U

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e)

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$$\pi_{managerid} Dept - \pi_{managerid} (Dept \bowtie_{(Dept.managerid=TMP.managerid) \wedge (Dept.did <> TMP.did)} TMP)$$

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Q2.

a)

```
CREATE TABLE Works(  
    eid INTEGER,  
    did INTEGER,  
    pct_time INTEGER,  
    PRIMARY KEY(eid,did),  
    FOREIGN KEY eid REFERENCES Emp,  
    FOREIGN KEY did REFERENCES Dept
```

)

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b)

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```
SELECT E.ename
```

```
FROM Emp E, Works W, Dept D, Emp M
```

```
WHERE E.eid=W.eid AND W.did=D.did AND D.managerid=M.eid AND M.ename='Steve Smith';
```

c)

```
SELECT E1.age
```

```
FROM Emp E1
```

```
WHERE E1.eid NOT IN (
```

```
    SELECT E.eid
```

```
    FROM Emp E, Works W, Dept D
```

```
    WHERE E.eid=W.eid AND W.did=Dept.did AND D.budget < 20000
```

```
)
```

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d)

```
SELECT E.age  
FROM Emp E  
WHERE E.salary = (SELECT MAX(salary) FROM Emp)
```

e)

```
SELECT D.did, AVG(E.salary)  
FROM Emp E, Works W, Dept D  
WHERE E.eid=W.eid AND W.did=D.did AND E.age < 45  
GROUP BY D.did  
HAVING 10 <= (SELECT COUNT(*) FROM Works W1
```

```
WHERE W1.did=D.did
```

```
)
```

f)

```
SELECT E.ename  
FROM Emp E WHERE NOT EXISTS(  
    SELECT D.did FROM Dept D  
    MINUS  
    SELECT D1.did FROM Dept D1, Works W  
    WHERE D1.did=W.did and W.eid=E.eid  
)
```

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g)

```
SELECT TMP.dname
FROM      (SELECT D.did, D.dname, AVG(E.salary) AS avgsal
           FROM Dept D, Emp E, Works W
           WHERE D.did=W.did AND W.eid=E.eid
           GROUP BY D.did, D.dname
          ) AS TMP
WHERE TMP.avgsal = (SELECT MAX(avgsal) FROM TMP);
```

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