Q1.

a) 
\[ \pi_{\text{zipcode}} \left( \left( \pi_{\text{bid}}(\sigma_{\text{price}>100} \text{Books}) \right) \bowtie \left( \pi_{\text{bid,cid}}(\sigma_{\text{quantity}\geq 10} \text{Orders}) \right) \bowtie \text{Customers} \right) \]

b) 
\[ \pi_{\text{cname}} \left( \left( \pi_{\text{cid}} \text{Orders} - \pi_{\text{cid}}(\sigma_{\text{year}<1990} \text{Books}) \bowtie \text{Orders} \right) \bowtie \text{Customers} \right) \]

c) 
\[ \pi_{\text{cname}} \left( \left( \pi_{\text{bid}}(\sigma_{\text{author}="EdgarCodd"} \text{Books}) \right) \bowtie \text{Orders} \bowtie \text{Customers} \right) \]  
\[ \cup \]  
\[ \pi_{\text{cname}} \left( \left( \pi_{\text{bid}}(\sigma_{\text{btitle}="Databases"} \text{Books}) \right) \bowtie \left( \pi_{\text{bid,cid}}(\sigma_{\text{quantity}\geq 10} \text{Orders}) \right) \bowtie \text{Customers} \right) \]

d) 
\[ \rho(TMP, \text{Orders}) \]
\[ \pi_{\text{author}} \left( \left( \pi_{\text{bid}} \text{Books} - \pi_{\text{bid}}(\text{Orders} \bowtie (\text{Orders}.\text{bid}=\text{TMP}.\text{bid}) \bowtie (\text{Orders}.\text{cid}<\text{TMP}.\text{cid}) \bowtie \text{TMP}) \right) \bowtie \text{Books} \right) \]

e) 
\[ \rho(TMP, \text{Customers}) \]
\[ \rho(UniqueZip, \pi_{\text{cid}} \text{Customers} \]  
\[ - \pi_{\text{Customers,cid}} \left( \text{Customers} \bowtie \left( \text{Customers}.\text{zipcode}=\text{TMP}.\text{zipcode} \right) \bowtie \left( \text{Customers}.\text{cid}<\text{TMP}.\text{cid} \right) \bowtie \text{TMP} \right) \]
\[ \bowtie \text{UniqueZip} \bowtie \text{Orders} \bowtie \text{Books} \]
Q2.

a)
CREATE TABLE Orders(
    cid INTEGER,
    bid INTEGER,
    quantity INTEGER,
    PRIMARY KEY(cid,bid),
    FOREIGN KEY cid REFERENCES Customers,
    FOREIGN KEY bid REFERENCES Books
)

b)
SELECT B.btitle
FROM Books B
WHERE B.year = (SELECT MIN(year) from Books)

c)
SELECT C.zipcode
FROM Customers C, Orders O
WHERE C.cid = O.cid AND C.cid NOT IN (  
    SELECT O1.cid
    FROM Orders O1, Books B
    WHERE O1.bid=B.bid AND B.price <=200
  )
d)

```
SELECT C.cname
FROM Customers C, Orders O, Books B
WHERE C.cid=O.cid AND O.bid=B.bid AND O.quantity = 5 AND B.author='Edgar Codd'
```

e)

```
SELECT C.cid, MAX(B.price)
FROM Customers C, Orders O, Books B
WHERE C.cid=O.cid AND O.bid=B.bid AND B.year =1990
GROUP BY C.cid
HAVING 10 <= (SELECT COUNT(DISTINCT B1.title)
FROM Orders O1, Books B1
WHERE O1.cid=C.cid AND O1.bid = B1.bid
)
```

-- Note that, for e) you could have also grouped by cid, cname and output cname, that is also correct

f)

```
SELECT  C.cname
FROM Customers C WHERE NOT EXISTS(
    SELECT B.bid FROM Books B
    WHERE B.btitle LIKE '%%Databases%%'
    MINUS
    SELECT O.bid FROM Orders O
    WHERE O.cid=C.cid AND O.quantity >= 3
)
```
g)

```
SELECT TMP.zipcode
FROM (SELECT C.zipcode, SUM (O.quantity * B.price) as DollarAmount
       FROM Customers C, Orders O, Books B
       WHERE C.cid=O.cid and O.bid = B.bid
       GROUP BY C.zipcode
     ) TMP
WHERE TMP.DollarAmount = (SELECT MAX(DollarAmount) FROM TMP)

Or in Oracle

SELECT TMP.zipcode
FROM (SELECT C.zipcode, SUM (O.quantity * B.price) as DollarAmount
       FROM Customers C, Orders O, Books B
       WHERE C.cid=O.cid and O.bid = B.bid
       GROUP BY C.zipcode
     ) TMP
WHERE TMP.DollarAmount = (SELECT MAX(DollarAmount) FROM TMP)
```