Q1.

a)

$$\pi_{age}\big((\pi_{cid}Orders\ -\ \pi_{cid}((\sigma_{year\leq 2000}Books)\bowtie Orders))\bowtie\ Customers\big)$$

b)

$$\pi_{cname}\big((\pi_{cid}Orders\ \bowtie\ (\sigma_{author="EdgarCodd"}Books)-\ \pi_{cid}((\sigma_{price>100}Books)\bowtie Orders))\bowtie\ Customers\big)$$

c)

$$\pi_{zipcode}\left((\pi_{bid}\big(\sigma_{author="EdgarCodd"\wedge bname="Databases"}Books\big)\right)\bowtie\sigma_{quantity\geq 20}Orders\bowtie\ Customers\big)$$

d)

$$\rho(B1, Books\bowtie\pi_{bid}Orders\ )$$

$$\rho(B2, B1\ )$$

$$\pi_{cname.zipcode}((\pi_{bid}B1-\pi_{B1.bid}(B1\bowtie_{(B1.price<B2.price)}B2))\bowtie\ Orders\bowtie\ Customers\big)$$

e)

$$\rho(C1, Customers\ )$$

$$\rho(C2, Customers\ )$$

$$\rho(B1, \pi_{bid}(Orders\bowtie\left(\pi_{cid}C1-\pi_{C1.cid}\big(C1\bowtie_{(C1.age>C2.age)}C2\big)\right))\bowtie Books\ )$$

$$\rho(B2, B1\ )$$

$$\pi_{btitle}((\pi_{bid}B1-\pi_{B1.bid}(B1\bowtie_{(B1.price<B2.price)}B2))\bowtie\ Books\big)$$

Q2.

a)

```
SELECT  DISTINCT C.zipcode
FROM Customers C WHERE NOT EXISTS(
    SELECT B.year FROM Books B
    MINUS
    SELECT B1.year FROM Orders O, Books B1
    WHERE O.bid=B1.bid AND O.cid = C.cid AND O.quantity >= 1
    )
```

b)

```
SELECT C.cid, MAX(B.price)
FROM Customers C, Orders O, Books B
WHERE C.cid=O.cid AND O.bid=B.bid
GROUP BY C.cid
HAVING 10,000 <= SUM( O.quantity * B.price )
```

c)

```
SELECT DISTINCT C.age
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 NOT B.title LIKE “%Databases%”
    )
```

d)

```
SELECT C.age
FROM Customers C, Orders O, Books B
WHERE C.cid=O.cid AND O.bid=B.bid AND B.price =
    (SELECT MAX(B1.price)
    FROM Books B1, Orders O1
    WHERE B1.bid=O1.bid)
```

e)

```
SELECT  TMP.cname
FROM        (SELECT C.cname, 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.cid, C.cname
            ) TMP
WHERE TMP.DollarAmount = (SELECT MAX(DollarAmount) FROM TMP)
```