Q1.

a)

$$\pi_{age}\big((\pi_{cid}Orders - \pi_{cid}((\sigma_{year\leq2000}Books) \bowtie Orders)) \bowtie Customers\big)$$

b)

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

c)

$$\pi_{zipcode}\Big((\pi_{bid}(\sigma_{author="EdgarCodd"\wedge bname="Databases"}Books)) \bowtie \sigma_{quantity\geq20}Orders \bowtie Customers\Big)$$

d)

$$\rho(B1, Books \bowtie \pi_{bid}Orders)$$
$$\rho(B2, B1)$$

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

e)

$$\rho(C1, Customers)$$

$$\rho(C2, Customers)$$

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

$$\rho(B2, B1)$$

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

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)