HW2

1.

a. From transitivity rule, because X—>Y, and Y—>Z, we can get that X—>Z. From union rule, because X—>Z and X—>Y， we can get that X—>YZ.
b. From Augmentation rule,because X—>Y,we can get that XW—>YW.From Augmentation rule,becauseZ—>W,we can get that XZ—>XW. From the transitivity rule, we can get that ,because XW—>YW and XZ—>XW,we can get that XZ—>YW.
c. From XY—>Z and Z—>X, we can’t get Z—>Y. For example,X is a kind of sport,such as football or basketball, Y is a player,such as Kobe or James, and Z is a sport team,such as Chicago bulls or Los angels Lakers. So when we have X(a kind of sport) and Y(player name),then we can get the Z(sport team). When we have the Z(sport team), we can get the X(a kind of sport). But when we have Z(sport team), we can not get the Y(player name),because a sport team may have many players.

2.

First, we need to find the candidate key for R is BH.Then we decompose it.
Looking at the first FD in F:ABH—>C. BH is candidate key.So the ABH is super key, this FD does not violate BCNF.
Looking at the second FD in F:A—>DE, A is not a super key,so this violate the BCNF.
Because (A)+ =(ADE)， We decompose this into two sub schemas:
R1=(ADE); F1={A—>DE}
key(R1)=A,so R1 does not violate BCNF.
R2=(ABCGFH); F2={BGH—>F;F—>AH;BH—>G} key(R2)=BH
Looking at the first FD in F2: BGH—>F. BGH is a super key. So this FD does not violate BCNF.
Looking at the second FD in F2:F—>AH,this violate the BCNF,
Because (F)+=AFH，We decompose this into two sub schemas:
R21=(AFH);F21={F—>AH}
Key(R21)=F,So R21 does not violate BCNF.
R22=(BCGF);F22={B—>G}

Final decomposition:
(a) R1=ADE with FD A—>DE,
(b) R21=AFH with FD F—>AH,
(c) R221=BCFG with FD B—>G,

3.

Yes, it is.There are four possibilities:

a.The first possibility is there are no non-trivial FDs in R, so it is already in BCNF.

b.The second possibility is that A—>B is the only non-trivial FD,so A is the key and R is in BCNF.

c. The third possibility is that B—>A is the only non-trivial FD,so B is the key and R is in BCNF.

d. The last possibility is that A—>B and B—>A are both non-trivial FD.either A or B is a key.So the R is in BCNF.

From above, we can conclude that a two attributes scheme is always in the BCNF.

4.

4.1:B in A->BC is extraneous, because from {A->C, B-AC, C->AB} we can also get A->BC; C in B->AC is extraneous, because from {A->C, B->A, C->AB} we get also get B->AC, and A in C->AB is extraneous because from {A->C, B->A, C->B} we can get C->AB. So canonical covers of F is {A->C, B->A, C->B}.

4.2:C in A->BC is extraneous, because from {A->B, B-AC, C->AB} we can also get A->BC; and A in B->AC is extraneous, because from {A->B, B->C, C->AB} we get also get B->AC, and B in C->AB is extraneous because from {A->B, B->C, C->A} we can get C->AB. So canonical covers of F is {A->B, B->C, C->A}.

5.

```
SELECT B
FROM r
GROUP BY B
HAVING COUNT(DISTINCT C)>1
```

If the result is empty, we can conclude that B—>C holds on r. If the result is not empty ,then B—>C doesn’t hold on r.

```
CREATE ASSERTION fd CHECK
   (NOT EXISTS
        (SELECT B
        FROM r
        GROUP BY B
        HAVING COUNT(DISTINCT C)>1
        )
   )
```

6.

a. $(A)^+ = (ABCDE)$ $(CD)^+ = (ABCDE)$ $(B)^+ = (BD)$ $(E)^+ = (ABCDE)$

$(BC)^+ = (ABCDE)$ $(C)^+ = (C)$ $(D)^+ = (D)$

From the question, we can get above things. Then it is easily to get :
The candidate key of R is :
(A) (BC) (CD) (E)

b.
because $R_1 \cap R_2 = A$

from the F we can get A—>ABC,so the decomposition is lossless-join decomposition.