Task 1:

$R(A,B,C,D,E,F)$

a,

Transitivity:

$$\text{If } (C) \xrightarrow{\text{decomposition } (C\to A)} (A,D) \text{ and } (A) \xrightarrow{\text{decomposition } (A\to B)} (B,C), \text{ then } (C)\to(B)$$

C goes to A, then A goes to B with help of Transitivity then we can see $C \to B$

b,

$$\underbrace{(A) \xrightarrow{\text{decomposition}} (C) \text{ and } (C) \xrightarrow{\text{decomposition}} (D)}_{\text{Transitivity}}, \text{ then } (A)\to(F) \quad (1)$$

With help of pseudo-transitivity we can see that $(A,D,E)\to(F)$ and because of (1) we can see that $(A)\to(F)$ and therefore $(A,E)\to(F)$ because we can reduce D with help of transititivity rule

---

Task 2:

a, $X=(A)$: we know that A goes to B and C, C goes to A and D therefor we can

X^+ with A^+ we can compute $(ABCD)$

b, $X=(C,E)$ C goes to A and with help of question above we know A goes to everything except F, we also have E now and $(D,E)\to(F)$. so we compute

(C,E,A,B,D,F)

Task 3:

a) A alone is not a candidate key same goes for B

AB is candidate key because they toghether can identify all remaining non-essential attributes

E and D not candidate key but (A,D) is one same reasoning as above.

b)

FD1: (A B), candidate key

FD2: not super key because it can only reach E and F

FD3: not super key because it can only reach D and B

Therfore FD2: and FD3: violates the BCNF condition since all FD:s needs to be super keys

c)

R(E,F) with FD2, is okay. candidate key is E, BCNF

R(D,B) with FD3, is okay. candidate key is D, BCNF

with help of these we can use decomposition to create the new relation:

R(ACDE) with the new FD4: AD → CDE and FD5

AB → CDE, candidate key is AB, BCNF

Task 4:

a)

To find candidate keys for both B and C needs to be present since they are not any right side of a dependecy. FD3 violates the BCNF property since it only contains C.

b)

To find the candidate key and based on a) we first try $(BC)^+$ but that isn't a candidate key since we need either A or B for it to be a candidate key therefore we have the Cks = (ABC), (BCD). We know that FD3 violates the BCNF and therefore we have need to decompose: R(C,D) with FD3 where the candidate key is (C). R(ABCE) with a new fd $ABC \rightarrow E$ wich is decomposed from fd1. Here the candidate key is (ABC).