Part 1

Let

A=Timestamp
B=State
C=locality
D=precinct
E=geo
F=totalvotes
G=Biden
H=Trump

Let R=ABCDEFGH be a relation. Since the precinct determines the location, which contains the state, locality, and geo, we have D (precinct) determine B (state), C (locality), and E (geo). In addition to location, the precinct determines the voting as well, so we have D (precinct) determine A (timestamp), F (totalvotes), G (Biden), and H (Trump).

a) In total, we have two functional dependencies, D->BCE and AD->FGH and have F={D->BCE, AD->FGH}.

b)

i) Penna, as R(ABCDEFGH), is decomposed to form R1(DBCE) and R2(ADFGH) since it is candidate key and does not satisfy BCNF due to conflicts with all functional dependencies. (By R - R1)

ii) R1(DBCE) satisfies BCNF because it determines all attributes of D->BCE, and is trivial with AD->FGH via projection (D->0).

iii) R2(ADFGH) satisfies BCNF because it determines all attributes of AD->FGH, and is trivial with D->BCE via projection (D->0).

Final two relations in BCNF: R1(DBCE), R2(ADFGH)