1. a.

to figure out the candidate keys, we must know which one can be figure out using a key.

R => ABCD is the relation

FDs: AB 🡪 C , BC 🡪 D since A and B are the keys that can not be determined they are a candidate keys! In simple term, they are not found on the right side of the functional dependency.

So AB are not found in the right side so they are possible keys.

To find candidate keys, let’s take the closure of (AB)+

(AB)+ 🡪 (ABC) 🡪 (we have AB and BC key by decomposing) (and BC gives us D) 🡪 (ABCD) so (AB and ABC) is the candidate key but the primary key is (AB).

b.

B 🡪 D

It is on 3NF since there is no partial dependency or transitive dependency.

In order to change this into BCNF!

ABC 🡪 C

BC 🡪 D

The original functional dependence was AB 🡪 C and BC 🡪 D by applying the union we get!

ABC🡪 CD. ABC🡪 CD, AB🡪 C, BC🡪 D and when we minimize it

ABC🡪 C, BC🡪 D which is the BCNF and ABC is the super key.

1. a.

BC🡪 A, (BC)+ 🡪 BCA 🡪 ABCD

AB🡪 C, (AB)+ 🡪 AB(C)+ 🡪 ABCD

C🡪 DA, (C)+ 🡪 CDA

Since we don’t have B on the right side, B must be included in all candidate keys.

(AB, BC) are candidate keys or the keys since we can find all relation from just one of these keys.

b. C 🡪 DA is not in 3NF since (C)+ 🡪 ACD

(C)+ 🡪 ACD and AB+ 🡪 ABC preserved in BCNF and 3NF when we deconstruct the relations in sub relations but the FDs or the whole relation are not in BCNF, but they are in 3NF.

The new FD’s is

Union of (AB🡪 C, C🡪 DA) gives ABC🡪 CD

So ABC🡪 CD

BC🡪 A

1. on the second page

