Understanding BCNF: Boyce Codd Normal Form
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Recall the definition of 3NF:
R is in 3NF if $\forall X \rightarrow Y$, either $X$ is a superkey or $Y$ is a prime attribute.

BCNF is stricter:

R is in BCNF if $\forall X \rightarrow Y$, $X$ is a superkey.  
(BCNF is stronger, it eliminates second option)

Conditions for violating BCNF:

Consider $R(A,B,C)$
R is in 3NF but NOT in BCNF if all 5 of these conditions hold:

1) $AB \rightarrow C$ (required by the fact that $AB$ is a Candidate Key)
2) $A \vert \rightarrow C$ (A does NOT determine C: otherwise R is not in 3NF)
3) $B \vert \rightarrow C$ (similarly, otherwise R is not in 3NF)
4) $C \rightarrow B$ (violates BCNF)
5) $C \vert \rightarrow A$ (otherwise given 4, $C$ would be a superkey)

We can normalize $R$ into BCNF:
$R1(A,C)$
$R2(C,B)$

Example:

StudentMajor(SID, Major, Advisor)

Note: a student can have more than one Major, and one Advisor for each of their Major, and note that Advisors only advise in one Major

Advisor $\rightarrow$ Major

StudentMajor is in 3NF since Major is a Prime Attribute but it is NOT in BCNF because Advisor is not a superkey.

To Normalize into BCNF

StudentAdvisors(SID, Advisor)
AdvisorMajor(Advisor, Major)
(Aside: Note:
   StudentMajors(SID, Major)
   AdvisorMajor(Advisor, Major)

This is in BCNF but does not capture which Advisors a student has.)