

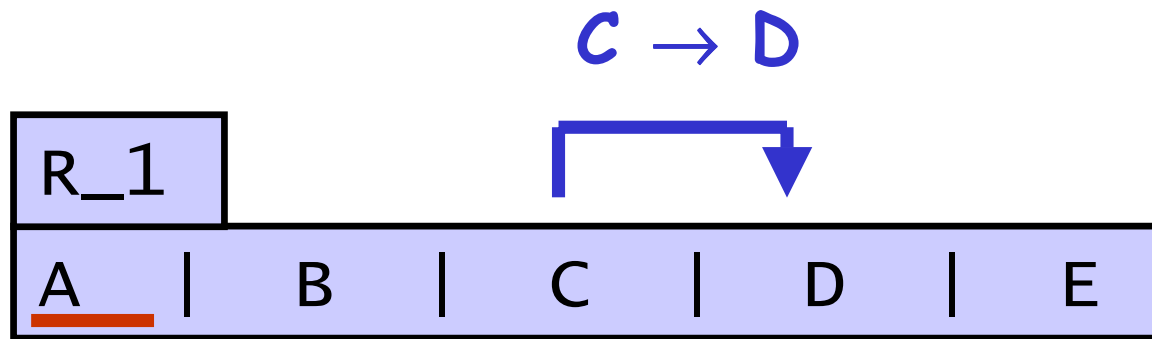
Third Normal Form

Primary Key Version

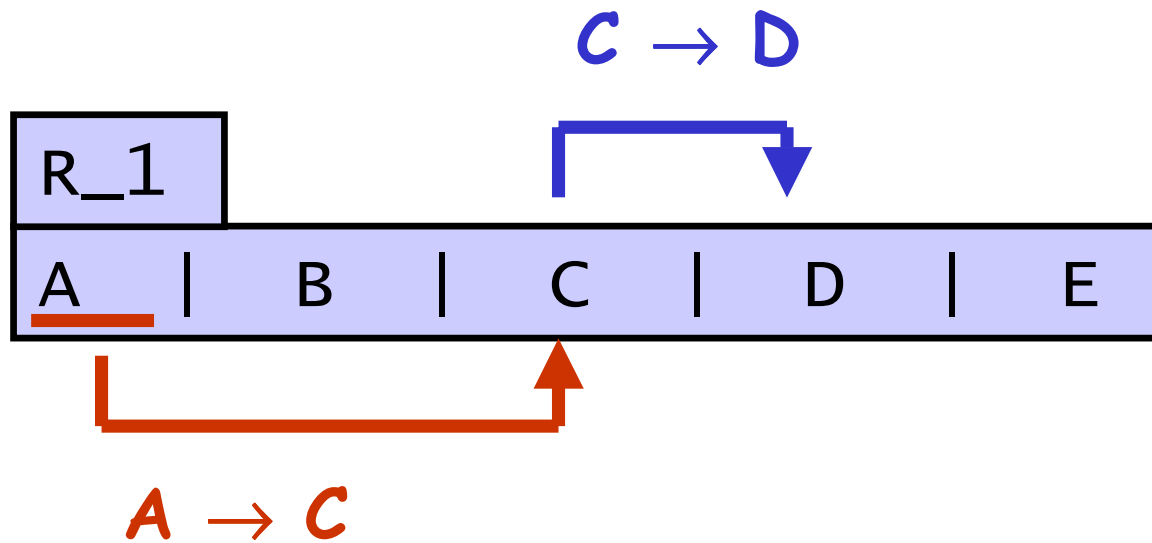
Definition

- Relation in 2NF
- No nonprime attribute transitively dependent on the key.
- Transitive Dependency
 - $KEY \rightarrow X$
 - $X \rightarrow Y$
 - Y not part of KEY

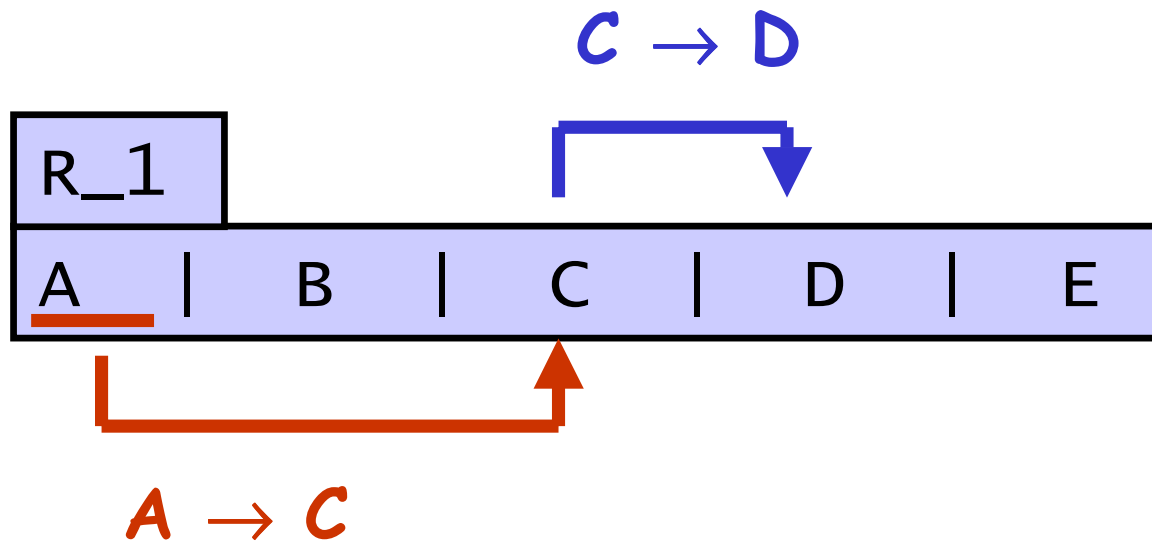
Example of Transitive Dependency



Example of Transitive Dependency

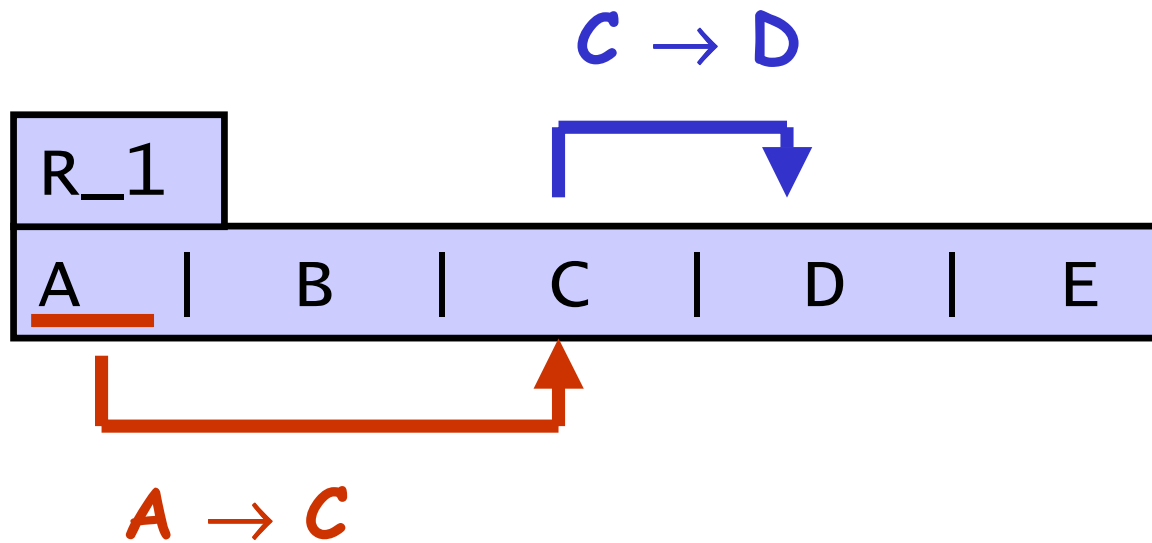


Example of Transitive Dependency



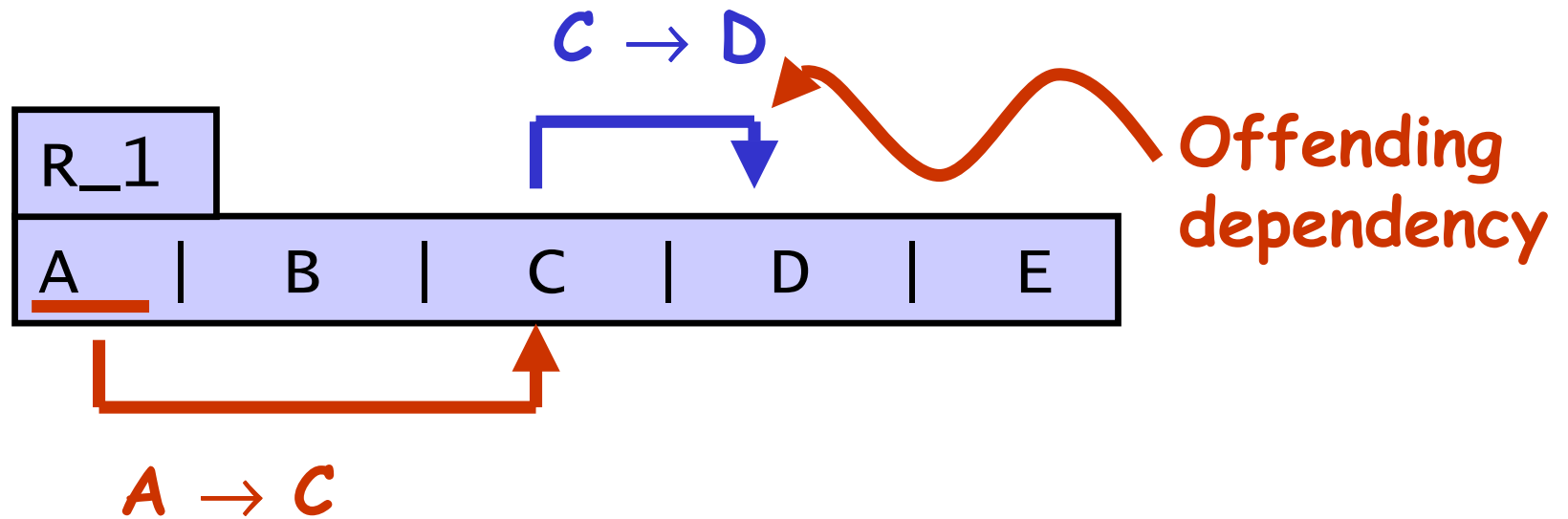
- D is Transitively Dependent on A

Example of Transitive Dependency



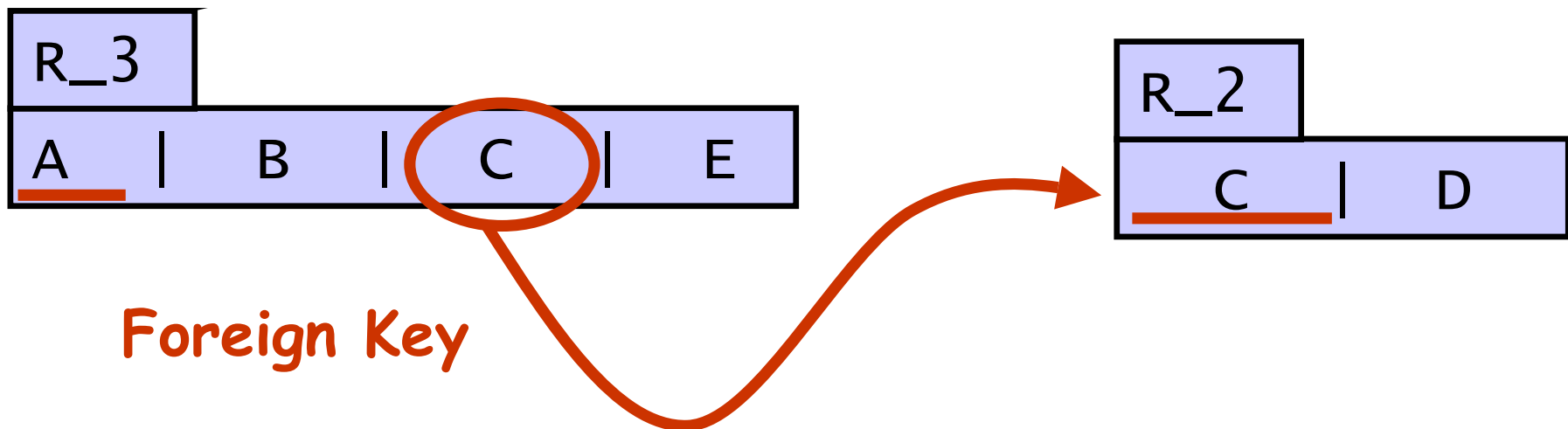
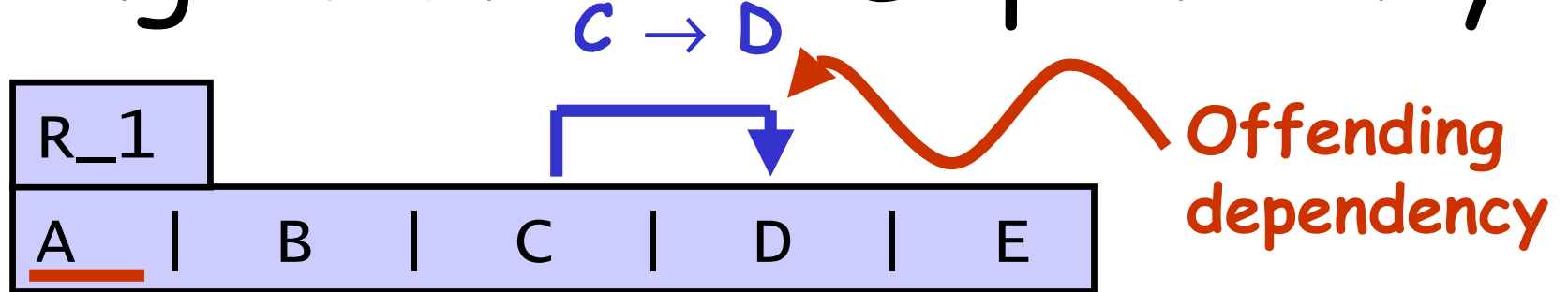
- **D** is Transitively Dependent on **A**
- Caused by $C \rightarrow D$

Example of Transitive Dependency

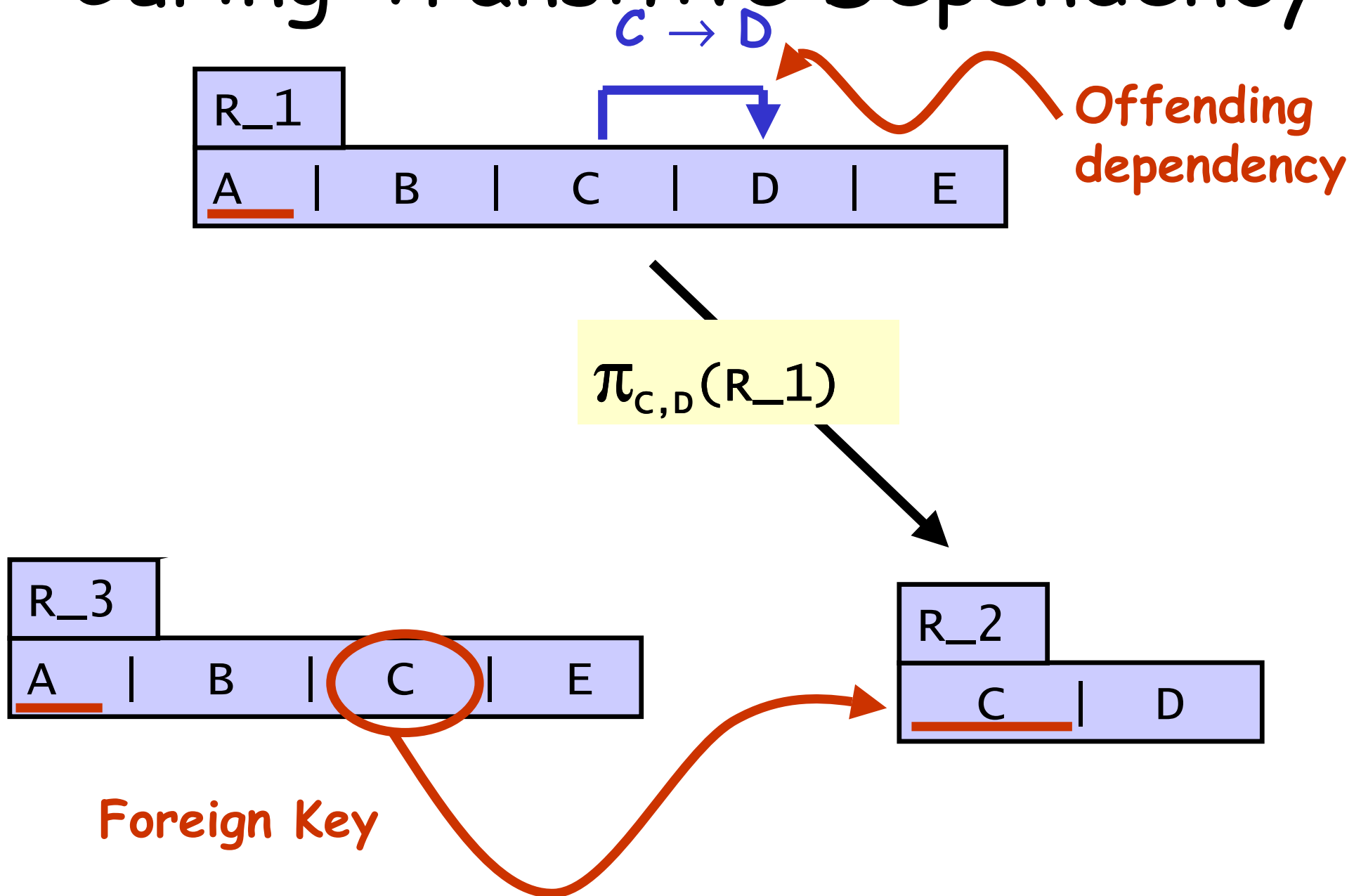


- D is Transitively Dependent on A
- Caused by $C \rightarrow D$

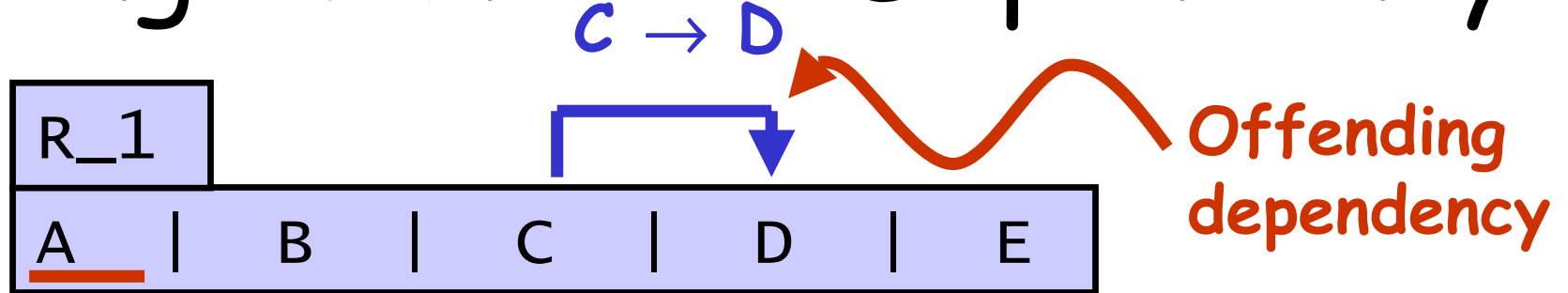
Curing Transitive Dependency



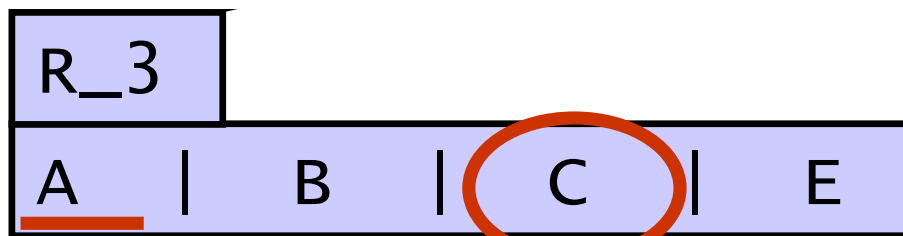
Curing Transitive Dependency



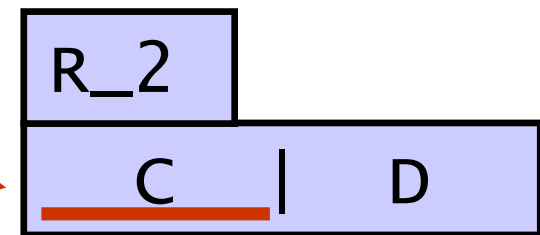
Curing Transitive Dependency



$\pi_{C,D}(R_1)$

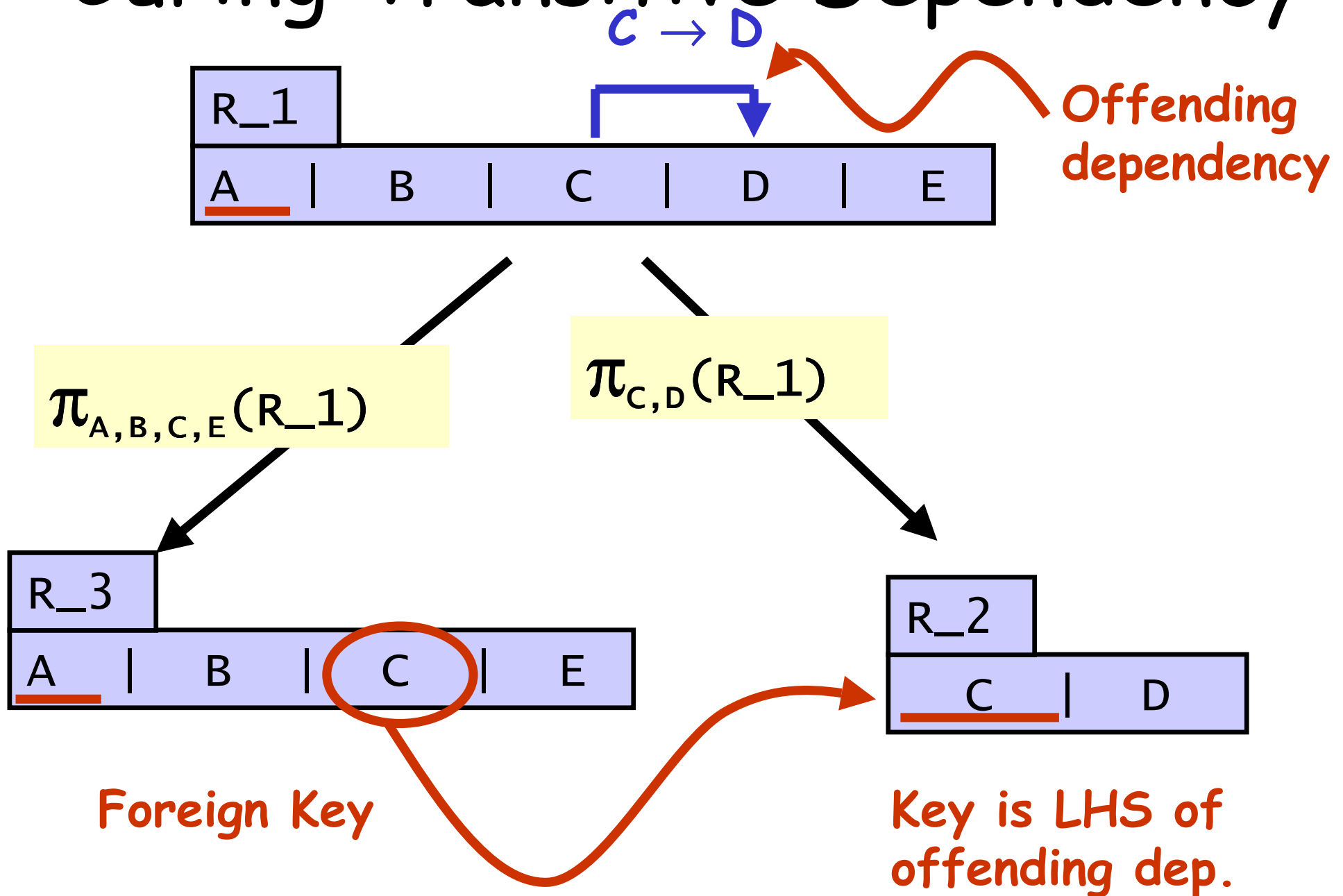


Foreign Key

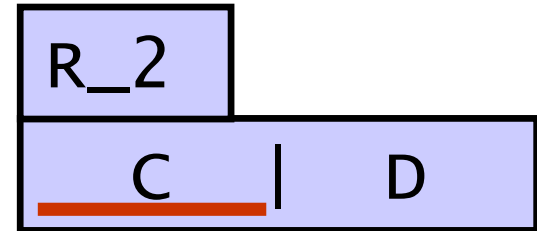
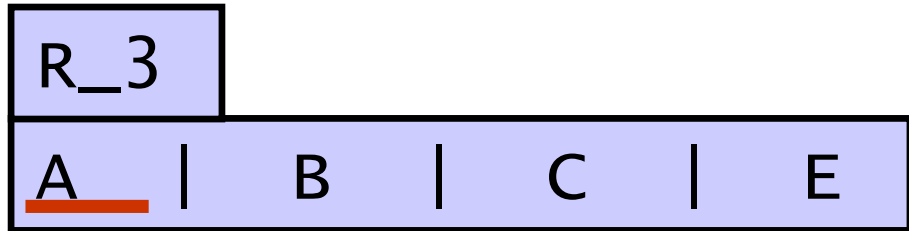


Key is LHS of offending dep.

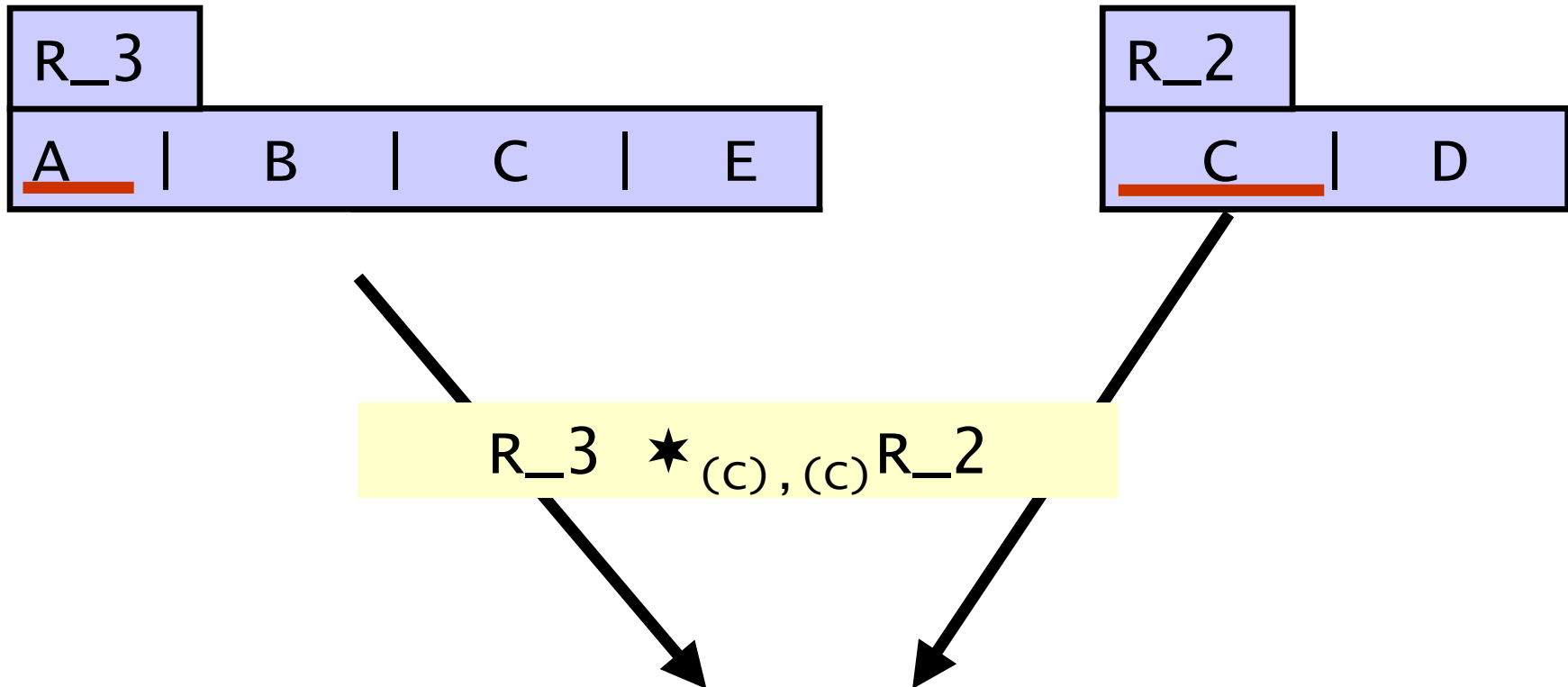
Curing Transitive Dependency



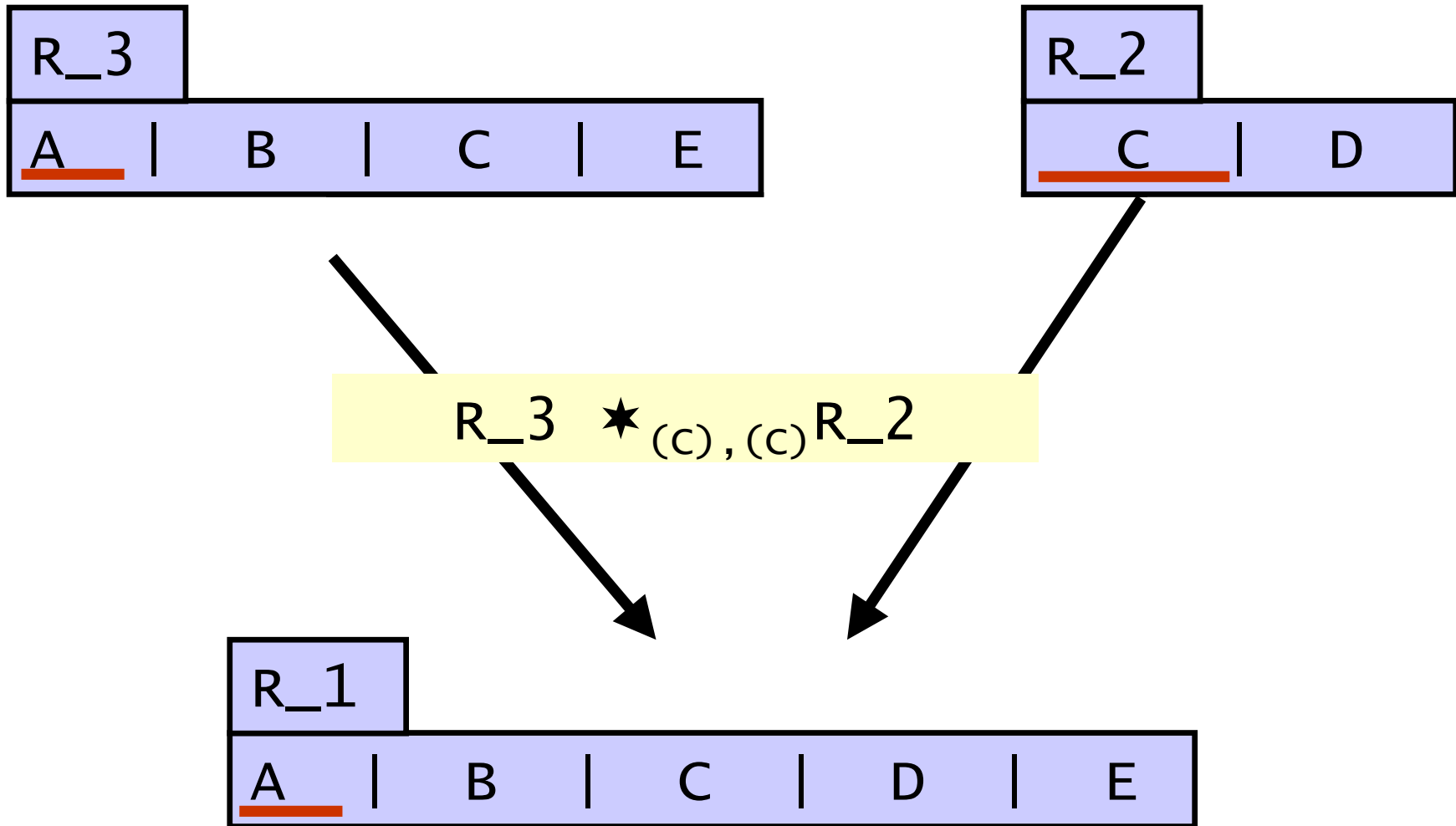
Retrieving R_1



Retrieving R_1



Retrieving R_1



2nd 3NF Example

EMP_DEPT						
ENAME	SSN	ADDR	DNUM	DNAME	MSSN	
Smith	123	Fond	5	Rsch	333	
Wong	333	Voss	5	Rsch	333	
Zelaya	999	Cast	4	Admin	987	
Wallace	987	Berr	4	Admin	987	
Narayan	666	Fire	5	Rsch	333	
English	453	Rice	5	Rsch	333	
Jabbar	987	Dall	4	Admin	987	
Borg	888	Ston	1	HeadQ	888	

Many opportunities
for anomalies

Redundancies due to
transitive dependency

2nd 3NF Example

EMP_DEPT					
ENAME	SSN	ADDR	DNUM	DNAME	MSSN
Smith	123	Fond	5	Rsch	333
Wong	333	Voss	5	Rsch	333
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Wallace	987	Berr	4	Admin	987
Narayan	666	Fire	5	Rsch	333
English	453	Rice	5	Rsch	333
Jabbar	987	Dall	4	Admin	987
Borg	888	Ston	1	HeadQ	888

Note Redundancies

Many opportunities
for anomalies

Redundancies due to
transitive dependency

2nd 3NF Example

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Jabbar	987	Dall	4	Admin	987	
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Note Redundancies

Many opportunities
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Redundancies due to
transitive dependency

2nd 3NF Example

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English	453	Rice	5	Rsch	333	
Jabbar	987	Dall	4	Admin	987	
Borg	888	Ston	1	HeadQ	888	

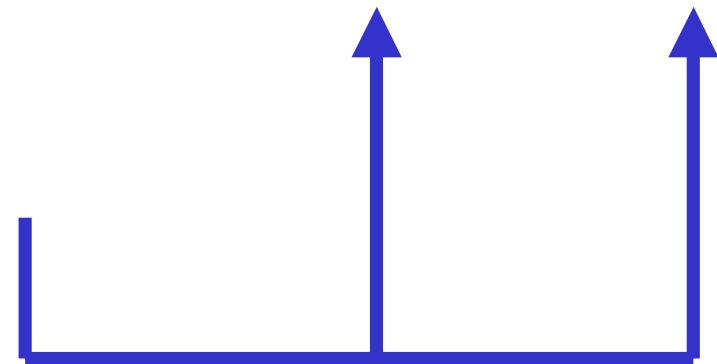
Note Redundancies

Many opportunities
for anomalies

Redundancies due to
transitive dependency

Functional Dependencies

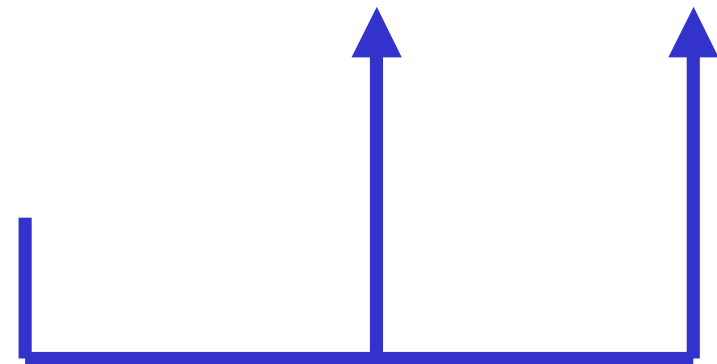
EMP_DEPT						
ENAME	SSN	ADDR	DNUM	DNAME	MSSN	
Smith	123	Fond	5	Rsch	333	
Wong	Key	Voss	5	Rsch	333	
Zelaya	999	Cast	4	Admin	987	
Wallace	987	Berr	4	Admin	987	
Narayan	666	Fire	5	Rsch	333	
English	453	Rice	5	Rsch	333	
Jabbar	987	Dall	4	Admin	987	
Borg	888	Ston	1	HeadQ	888	



$Dnum \rightarrow Dname, Mssn$

Functional Dependencies

EMP_DEPT						
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Jabbar	987	Dall	4	Admin	987	
Borg	888	Ston	1	HeadQ	888	

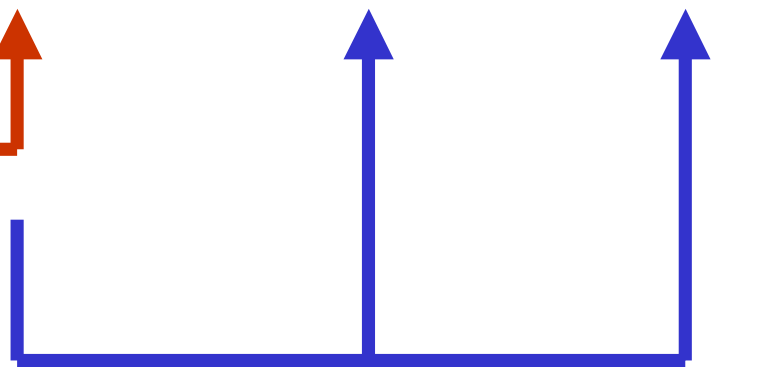


Dnum → Dname, Mssn

Functional Dependencies

EMP_DEPT						
ENAME	SSN	ADDR	DNUM	DNAME	MSSN	
Smith	123	Fond	5	Rsch	333	
Wong	Key	Voss	5	Rsch	333	
Zelaya	999	Cast	4	Admin	987	
Wallace	987	Berr	4	Admin	987	
Narayan	666	Fire	5	Rsch	333	
English	453	Rice	5	Rsch	333	
Jabbar	987	Dall	4	Admin	987	
Borg	888	Ston	1	HeadQ	888	


SSN → Ename, Addr, Dnum


Dnum → Dname, Mssn

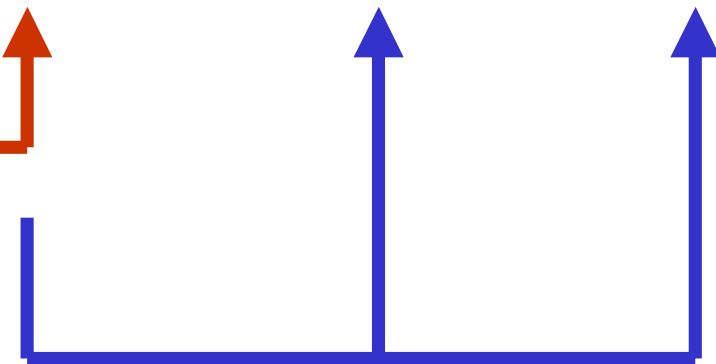
Functional Dependencies

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ENAME	SSN	ADDR	DNUM	DNAME	MSSN	
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English	453	Rice	5	Rsch	333	
Jabbar	987	Dall	4	Admin	987	
Borg	888	Ston	1	HeadQ	888	



$SSN \rightarrow ENAME, ADDR, DNUM$

Transitive Dependency



$DNUM \rightarrow DNAME, MSSN$

Curing Emp_Dept

EMP_DEPT					
ENAME	SSN	ADDR	DNUM	DNAME	MSSN
Smith	123	Fond	5	Rsch	333
Wong	333	Voss	5	Rsch	333
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English	453	Rice	5	Rsch	333
Jabbar	987	Dall	4	Admin	987
Borg	888	Ston	1	HeadQ	888

DEPT		
DNUM	DNAME	MSSN
5	Rsch	333
4	Admin	987
1	HeadQ	888



EMP_DEPT1			
ENAME	SSN	ADDR	DNUM
Smith	123	Fond	5
Wong	333	Voss	5
Zelaya	999	Cast	4
Wallace	987	Berr	4
Narayan	666	Fire	5
English	453	Rice	5
Jabbar	987	Dall	4
Borg	888	Ston	1

Curing Emp_Dept

EMP_DEPT					
ENAME	SSN	ADDR	DNUM	DNAME	MSSN
Smith	123	Fond	5	Rsch	333
Wong	333	Voss	5	Rsch	333
Zelaya	999	Cast	4	Admin	987
Wallace	987	Berr	4	Admin	987
Narayan	666	Fire	5	Rsch	333
English	453	Rice	5	Rsch	333
Jabbar	987	Dall	4	Admin	987
Borg	888	Ston	1	HeadQ	888

Dnum → Dname, Mssn

EMP_DEPT1			
ENAME	SSN	ADDR	DNUM
Smith	123	Fond	5
Wong	333	Voss	5
Zelaya	999	Cast	4
Wallace	987	Berr	4
Narayan	666	Fire	5
English	453	Rice	5
Jabbar	987	Dall	4
Borg	888	Ston	1

DEPT		
DNUM	DNAME	MSSN
5	Rsch	333
4	Admin	987
1	HeadQ	888



Curing Emp_Dept

EMP_DEPT					
ENAME	SSN	ADDR	DNUM	DNAME	MSSN
Smith	123	Fond	5	Rsch	333
Wong	333	Voss	5	Rsch	333
Zelaya	999	Cast	4	Admin	987
Wallace	987	Berr	4	Admin	
Narayan	666	Fire	5	Rsch	
English	453	Rice	5	Rsch	555
Jabbar	987	Dall	4	Admin	987
Borg	888	Ston	1	HeadQ	888

Dnum → Dname, Mssn

$\pi_{\text{dnum, dname, mssn}}(\text{EMP_DEPT})$

EMP_DEPT1			
ENAME	SSN	ADDR	DNUM
Smith	123	Fond	5
Wong	333	Voss	5
Zelaya	999	Cast	4
Wallace	987	Berr	4
Narayan	666	Fire	5
English	453	Rice	5
Jabbar	987	Dall	4
Borg	888	Ston	1

DEPT		
DNUM	DNAME	MSSN
5	Rsch	333
4	Admin	987
1	HeadQ	888

Curing Emp_Dept

EMP_DEPT

ENAME	SSN	ADDR	DNUM	DNAME	MSSN
Smith	123	Fond	5	Rsch	333
Wong	333	Voss	5	Rsch	333
Zelaya	999	Cast	4	Admin	987
Wallace	987	Berr	4	Admin	
Narayan	666	Fire	5	Rsch	
English	453	Rice	5	Rsch	
Jabbar	987	Dall	4	Admin	987
Borg	888	Ston	1	HeadQ	888

Dnum $\rightarrow$ Dname, Mssn

$\pi_{\text{dnum, dname, mssn}}(\text{EMP_DEPT})$

DEPT

DNUM	DNAME	MSSN
5	Rsch	333
4	Admin	987
1	HeadQ	888

EMP_DEPT1

ENAME	SSN	ADDR	DNUM
Smith	123	Fond	5
Wong	333	Voss	5
Zelaya	999	Cast	4
Wallace	987	Berr	4
Narayan	666	Fire	5
English	453	Rice	5
Jabbar	987	Dall	4
Borg	888	Ston	1

$\pi_{\text{ename, ssn, addr, dnum}}(\text{EMP_DEPT})$

EMP_DEPT1

ENAME	SSN	ADDR	DNUM
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Smith	123	Fond	5
Wong	333	Voss	5
Zelaya	999	Cast	4
Wallace	987	Berr	4
Narayan	666	Fire	5
English	453	Rice	5
Jabbar	987	Dall	4
Borg	888	Ston	1

Retrieving Emp_Dept

DEPT

DNUM	DNAME	MSSN
5	Rsch	333
4	Admin	987
1	HeadQ	888

EMP_DEPT

ENAME	SSN	ADDR	DNUM	DNAME	MSSN
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Smith	123	Fond	5	Rsch	333
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Narayan	666	Fire	5	Rsch	333
English	453	Rice	5	Rsch	333
Jabbar	987	Dall	4	Admin	987
Borg	888	Ston	1	HeadQ	888

EMP_DEPT1

ENAME	SSN	ADDR	DNUM
Smith	123	Fond	5
Wong	333	Voss	5
Zelaya	999	Cast	4
Wallace	987	Berr	4
Narayan	666	Fire	5
English	453	Rice	5
Jabbar	987	Dall	4
Borg	888	Ston	1

Retrieving Emp_Dept

DEPT

DNUM	DNAME	MSSN
5	Rsch	333
4	Admin	987
1	HeadQ	888

EMP_DEPT1 *_{(DNUM), (DNUM)} DEPT

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Wong	333	Voss	5	Rsch	333	
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Narayan	666	Fire	5	Rsch	333	
English	453	Rice	5	Rsch	333	
Jabbar	987	Dall	4	Admin	987	
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