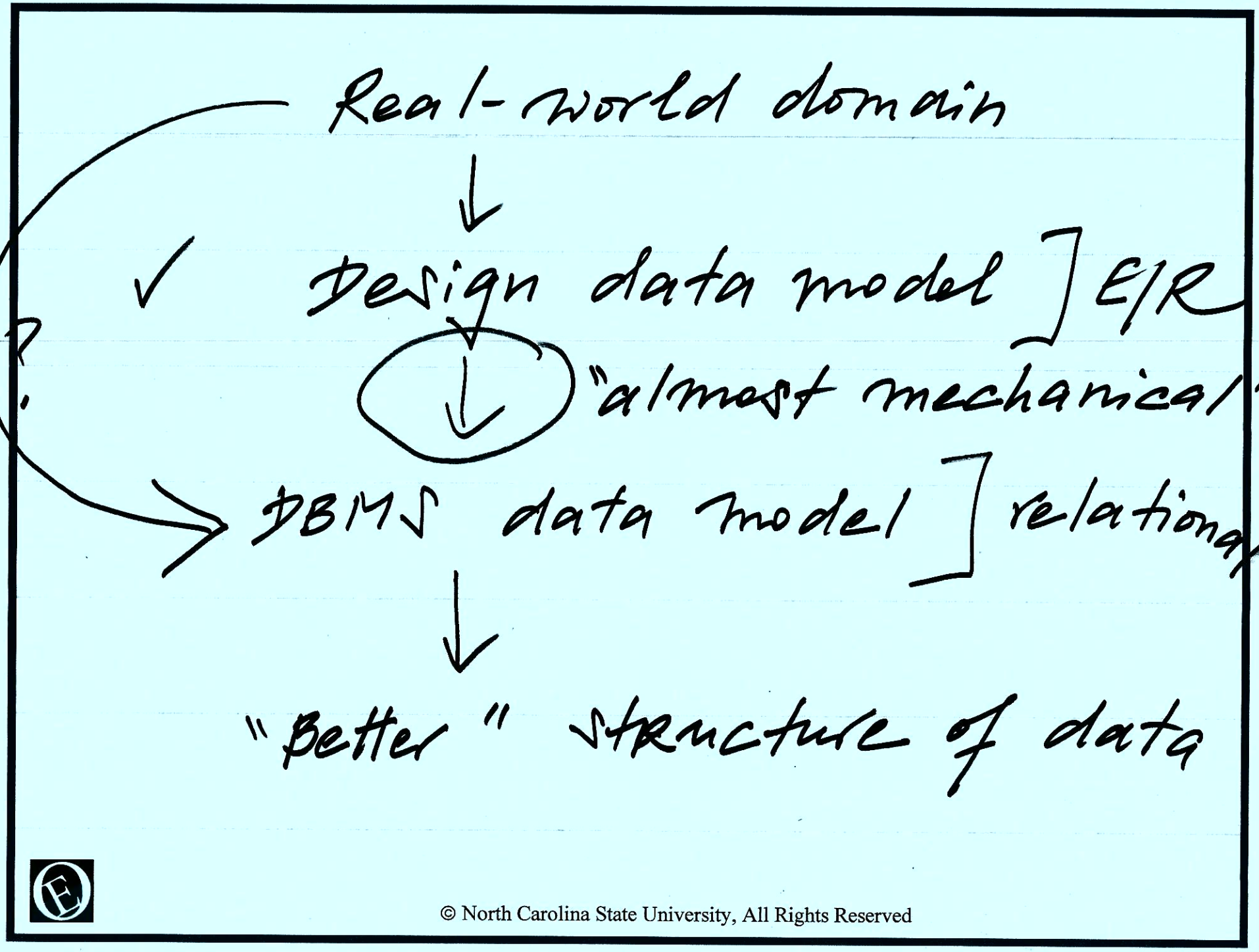


Relation schema:

Students(SID, name, address)

$f_{SID,name}(SID) \rightarrow name$

functional dependency

$f(\text{set A of attributes}) \rightarrow \text{set B of attributes}$

If you know the values of all the attributes in A, for a row in the relation → then there is at most one value for each attr in B for the same row

Apply: [applicant]

SSN	college	name	HSCode	HSCity	sport
1	'NCSU'	'Mary'	23	'Garner'	
1	'Duke'	'Mary'	23	'Garner'	
1	'NCSU'	'Mary'	74	'Raleigh'	
1	'Duke'	'Mary'	74	'Raleigh'	

⇓

12 tuples if 3 sports in each high school

1. Redundancy
2. Update anomaly
3. Deletion anomaly

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

$A \rightarrow B$ Meaning: functional dependency "A determines B" holds on R

$BC \rightarrow D$

Not OK:

R:

A	B	C	D
a	b	c	q ←
a	c	g	k
a	b	c	b ←
f	d	h	m

R:

A	B	C	D
a	b	c	d
f	b	c	d
a	b	g	h

OK

Apply(SSN, college, name, HSCode, HSCity, sports)

SSN → name

HSCode → HSCity

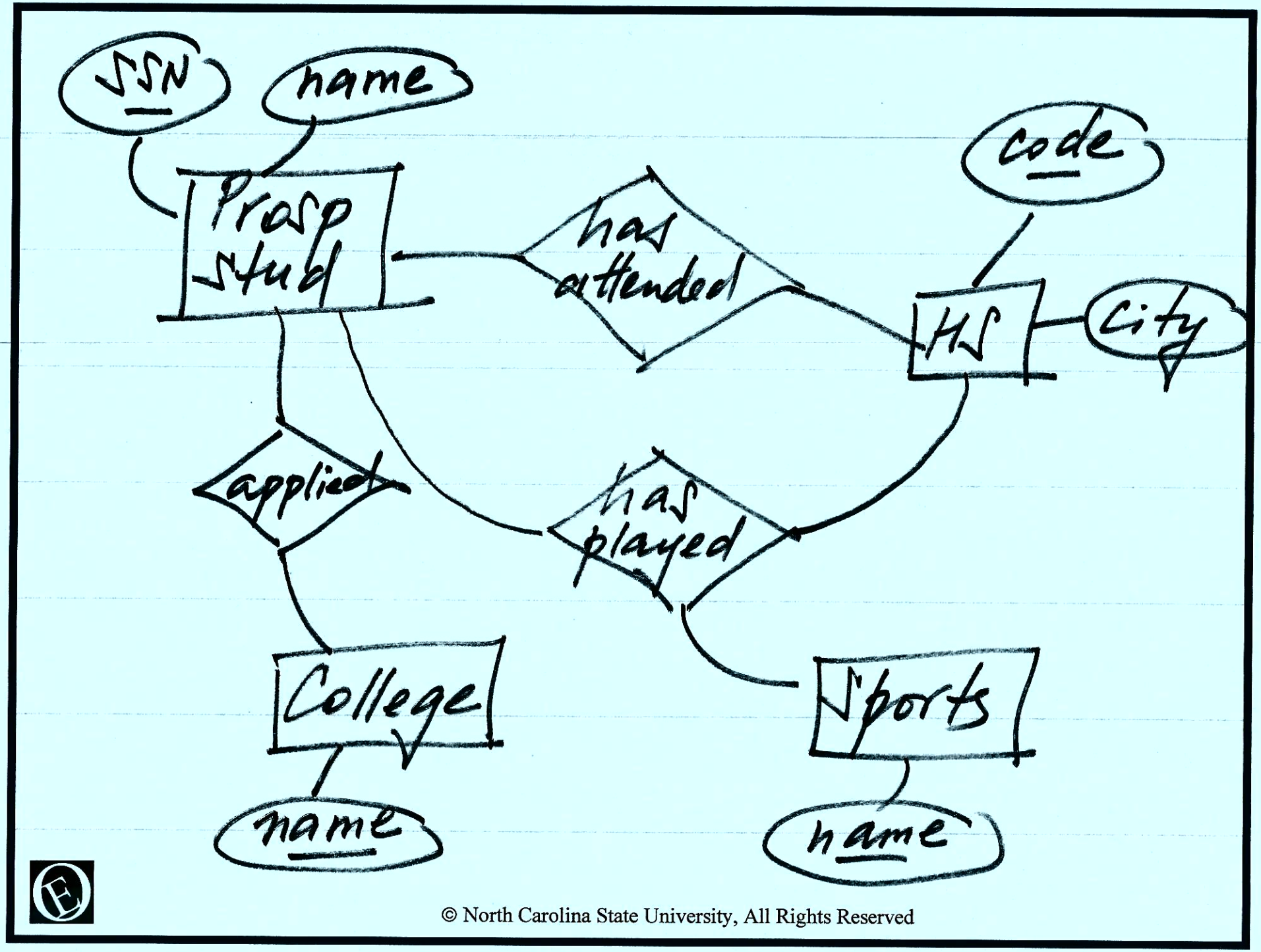
Applicant(SSN, name) ⇐ 1 row from the Apply relation

SSN → name

HS(HSCode, HSCity) ⇐ 2 rows from the Apply relation

HSCode → HSCity

ApplyNew(SSN, college, HSCode, sports) ⇐ 12 rows from the Apply relation



PS(SSN, name) ⇐ 1 tuple for Mary

HS(code, city) ⇐ 2 tuples

Sports(name) ⇐ 3 tuples

Campus(name) ⇐ 2 tuples

HasAttended(SSN, code) ⇐ 2 tuples

HasPlayed(SSN, code, name) ⇐ 6 tuples

Applies(SSN, name) ⇐ 2 tuples

$R(A, B, C)$

$A \to B$

$B \to C$

R:

A	B	C
a	d	g
b	k	h
c	d	g
a	d	g

Better schema:

$R1(A, B)$

$R2(B, C)$

⇓

R1:

A	B
a	d
b	k
c	d

R2:

B	C
d	g
k	h

$R(A, B, C)$

$A \to B$

$B \to C$

$A \to C$? ✓ yes

"transitive FD"

$C \to B$? no

Using FDs ~~to pro~~

1. ~~Fi~~ Showing that a candidate FD holds (or not)
2. Deriving FDs on same relation
3. Find keys of relation
4. Find FDs in projections of relation
5. Decompose relation schemas — normalize them (3NF, BCNF)

Key of relation schema is $\triangleq$ ~~if~~ a subset K of its attributes such that:

(1) it functionally determines all the other attributes
— "superkey"

(2) none of K's attributes can be removed with (1) preserved