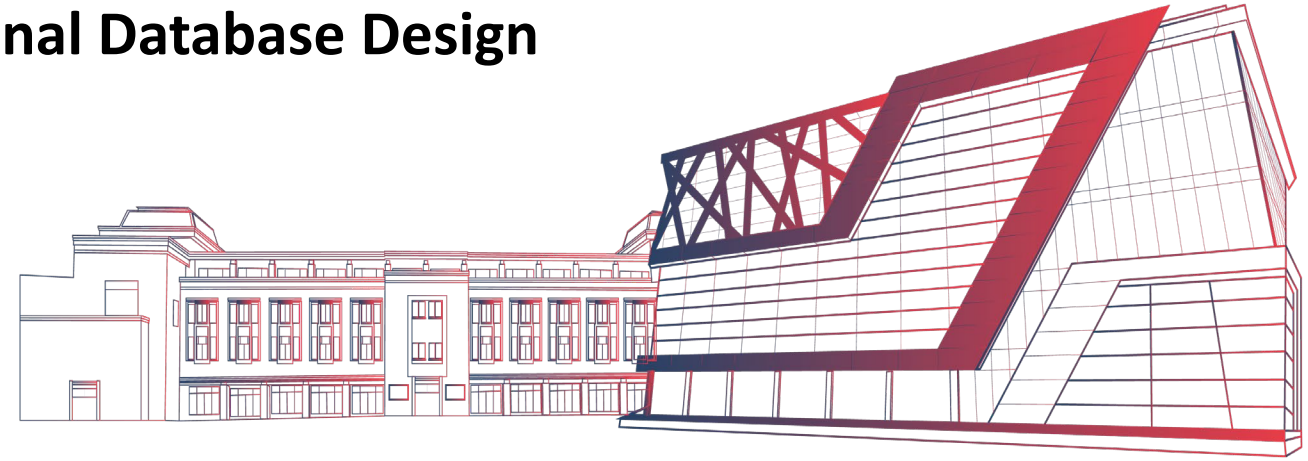
THE NORTHCAP UNIVERSITY

UNIT III

Relational Database Design



30 YEARS OF EXCELLENCE

NAAC Accredited

Lecture 14

THE NORTHCAP UNIVERSITY

Super Key

vs

Candidate Key

30 YEARS OF EXCELLENCE

NAAC Accredited

Attribute Closure [X^+]

- **[X^+] =** set of all attributes that are functionally determined by X

- **Relation F = {Ssn → Ename, Pnumber → {Pname, Plocation}, {Ssn, Pnumber} → Hours}**

- {Ssn} + = {Ssn, Ename}

  {Pnumber} + = {Pnumber, Pname, Plocation}

  {Ssn, Pnumber} + = {Ssn, Pnumber, Ename, Pname, Plocation,

  Hours}

Attribute Closure Drill 1

- Relation R(name, color, category, department, price)

name → color

category → department, color

category → price

Compute name+ , {name, category}+ , {color}+

Solution Drill 1

- **Closures:**

name+ = {name, color}

{name, category}+ = {name, category, color, department,

price}

color+ = {color}

Attribute Closure Drill 2

- R(A,B,C,D,E,F,G)

A → BC

BC → DE

D → F

CF → G

- **Compute A+, D+, BC+**

Solution Drill 2

$\mathbf{A^+}$ = { A }

= { A , B , C } (Using A → BC)

= { A , B , C , D , E } (Using BC → DE)

= { A , B , C , D , E , F } (Using D → F)

= { A , B , C , D , E , F , G } (Using CF → G)

Thus,

$\mathbf{A^+ = \{ A , B , C , D , E , F , G \}}$

$\mathbf{D^+}$ = { D }

= { D , F } (Using D → F)

Thus, $\mathbf{D^+ = \{ D , F \}}$

$\mathbf{\{ B , C \}^+}$ = { B , C }

= { B , C , D , E } (Using BC → DE)

= { B , C , D , E , F } (Using D → F)

= { B , C , D , E , F , G } (Using CF → G)

Thus, $\mathbf{\{ B , C \}^+ = \{ B , C , D , E , F , G \}}$

Superkey

- Let R be the relational schema and X be the some attribute set over

  R

- X is superkey of R iff X+ determines all attributes of R

i.e. X+ = {all attributes of R}

Superkey Example

- Relation R(A,B,C,D,E)

FD = { AB → C, C → D, B → E}

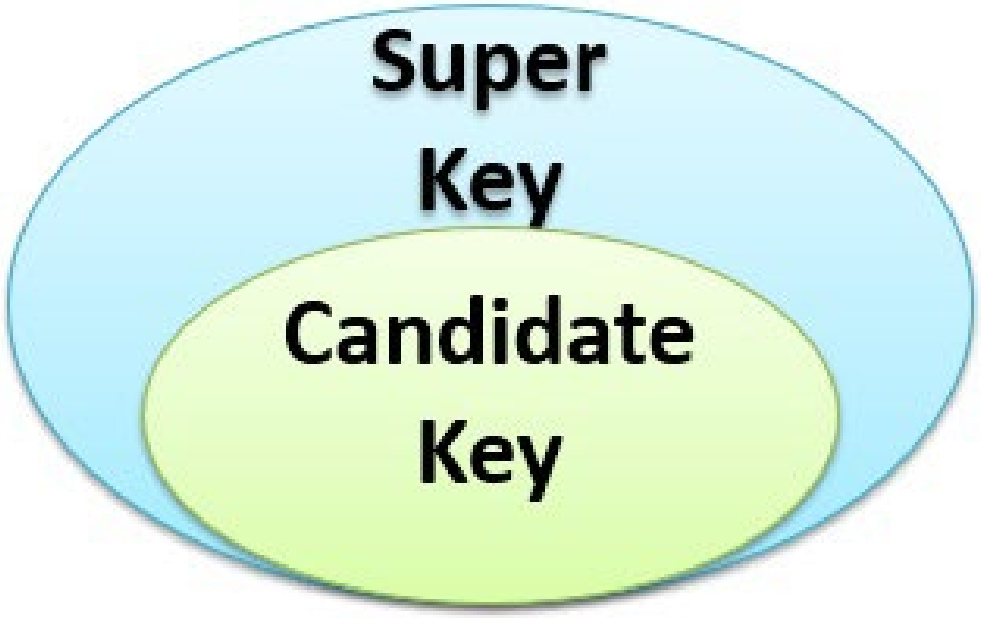
- (AB+) = { A, B, C, D, E } Thus, AB is superkey
- (ABC+) = { A, B, C, D, E } Thus, ABC is superkey
- (ABCDE+) = { A, B, C, D, E } Thus, ABCDE is superkey
- (BC+) = { B, C, D, E } Thus, BC is not superkey

Candidate Key: Minimal Superkey

- **X is candidate key of R if and only if**

  a) X is superkey of R and

  b) No proper subset of X is superkey



Candidate Key Example

- Relation R = (ABCDE),

F = {A → C, E → D, B → C}

- A+ = AC
- B+ = BC
- C+ = C
- D+ = D
- E+ = DE

Any attribute that only appears on the right side in a trivial dependency must be in the candidate key. For this, that includes ABE.

- ABE+ = ABCDE **Thus, candidate key is ABE**

Candidate Key (Cont.)

THE NORTHCAP UNIVERSITY

- If a relation schema has more than one key, each is called a ***candidate key***. One of the candidate keys is arbitrarily designated to be the ***primary key***, and the others are called ***secondary keys (alternate keys)***.

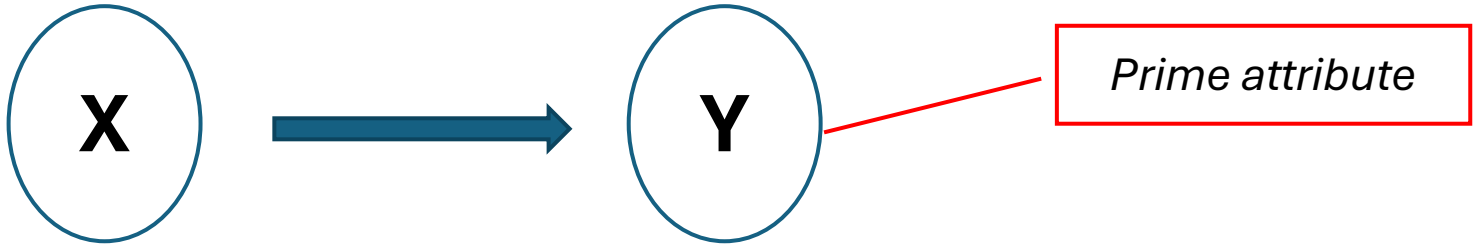
- **Prime Attribute:** member of some candidate key

- **Non-prime Attribute:** not a member of any candidate key.

30 YEARS OF EXCELLENCE | NAAC Accredited

How to Check for Multiple Candidate keys?

- If X → Y is a non-trivial FD in relation R with Y as a prime attribute, then R has atleast 2 candidate keys



- **Example: R (X, Y, P.....) & X → Y is one of the FD**

(YP)+ = {all attributes} Thus, YP is candidate key and Y is prime attribute

(XP)+ = {X, P, Y, remaining all attributes because of YP}

∴ XP is another candidate key

Candidate Key Drill

THE NORTHCAP UNIVERSITY

- Find candidate key

1) R = ABCDE, F = {A → BE, C → BE, B → D}

2) R = ABCDEF, F = {A → B, B → D, C → D, E → F}

3) R = ABCD, F={AB → C, BC → D, CD → A}

4) R = {A, B, C, D, E}, F = {A → BC, CD → E, B → D, E → A}

30 YEARS OF EXCELLENCE | NAAC Accredited

Solution Candidate Key Drill

THE NORTHCAP UNIVERSITY

1) **R = ABCDE, F = {A → BE, C → BE, B → D}**

A+ = ABDE

B+ = BD

C+ = CBDE

D+ = D

E+ = E

Thus, AC is candidate key

2) **R = ABCDEF, F = {A → B, B → D, C → D, E → F}**

A+ = ABD

B+ = BD

C+ = CD

D+ = D

E+ = EF

ACE+ = ABCDEF

Thus, ACE is a candidate key.

30 YEARS OF EXCELLENCE

NAAC Accredited

Solution Candidate Key Drill

3) R = ABCD, F={AB → C, BC → D, CD → A}

AB+ = ABCD

BC+=ABCD

CD+=ACD

BCD+ = ABCD

*Thus, **AB and BC** are candidate key. BCD is not candidate key as it is not minimal*

4) R = {A, B, C, D, E}, F = {A → BC, CD → E, B → D, E → A}

A+ = ABCDE B+ = BD C+ = C D+ = D

E+ = ABCDE AB+ = ABCDE AC+ = ABCDE AD+ = ABCDE

AE+ = ABCDE BC+ = ABCDE BD+ = BD BE → ABCDE

CD → ABCDE CE → ABCDE DE → ABCDE ABC → ABCDE

ABD → ABCDE ABE → ABCDE ACD → ABCDE ACE → ABCDE

ADE → ABCDE BCD → ABCDE BDE → ABCDE CDE → ABCDE ABCD → ABCDE

ABCE → ABCDE ABDE → ABCDE ACDE → ABCDE

BCDE → ABCDE

*Thus, **A, E, CD, BC** are candidate key.*

THE NORTHCAP UNIVERSITY

Thanks!!

30 YEARS OF EXCELLENCE

NAAC Accredited