NORMALIZATION PROOFS

SKILL CONNECT

(Team ID – T306)

“user_t” Relation:

user_t(user_id, user_name, github_handle, codeforces_handle, leetcode_handle, dob, city, state)

FDs:

{user_id} →user_name
{user_id} →github_handle

{user_id} → codeforces_handle
{user_id} → leetcode_handle
{user_id} → dob
{user_id}→ city
{user_id}→ state

Closure of {user_id}:

$\{user\_id\}^+$ ={user_id, user_name, github_handle, codeforces_handle, leetcode_handle, dob, city, state}

Closure of user_id covers all the attributes of the Relation “user_t”.
Thus user_id is a candidate key.

Candidate Key: user_id

Since Candidate key is the subset of Super Key.
The determinant of all the functional dependencies of the relation “user_t” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Mobile_number” Relation:

mobile_number (user_id,mobile_number)

FDs:

{user_id,mobile_number} → {user_id,mobile_number}

Closure of {user_id, mobile_number}:

$\{user\_id,mobile\_number\}^{+}$ ={user_id, mobile_number}

Closure of {user_id,mobile_number}covers all the attributes of the Relation “mobile_number”.
Thus {user_id,mobile_number} is a candidate key.

Candidate Key: {user_id,mobile_number}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “mobile_number” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Email” Relation:

Email(user_id,email_id)

FDs:

{user_id, email_id} → {user_id, email_id}

Closure of {user_id, email_id}:

$\{user\_id, email\_id\}^{+}$ ={user_id, email_id}

Closure of {user_id, email_id} covers all the attributes of the Relation “Email”.
Thus {user_id, email_id} is a candidate key.

Candidate Key: {user_id, email_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Email” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“user_login” Relation:

user_login(user_id, applicant_username, password)

FDs:

{applicant_username} → {user_id}
{applicant_username} → {password}

Closure of {applicant_username}:

$\{applicant\_username\}^{+}$ ={applicant_username, user_id, password}

Closure of {applicant_username} covers all the attributes of the Relation “user_login”. Thus {applicant_username} is a candidate key.

Candidate Key: {applicant_username}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “user_login” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Project” Relation:

Project(pno, user_id,pname,description)

FDs:

{pno} → user_id
{pno} → pname
{pno} → description

Closure of {pno}:

$\{pno\}^+$ = {pno, user_id, pname, description}

Closure of {pno}covers all the attributes of the Relation “Project”.
Thus {pno} is a candidate key.

Candidate Key: {pno}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Project” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Project_techstack” Relation:

project_techstack(pno,tech)

FDs:

{pno,tech}→{pno, tech}

Closure of {pno,tech}:

$\{pno,tech\}^{+}$ ={pno, tech}

Closure of {pno, tech} covers all the attributes of the Relation “Project_techstack”.
Thus {pno, tech} is a candidate key.

Candidate Key: {pno, tech}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Project_techstack” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Skills” Relation:

skill(skill_name, description, skill_category)

FDs:

{skill_name} → description
{skill_name} → skill_category

Closure of {skill_name}:

$\{skill\_name\}^{+}$ ={skill_name, description}

Closure of {skill_name} covers all the attributes of the Relation “Skills”.
Thus {skill_name} is a candidate key.

Candidate Key: {skill_name}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Skills” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Possess” Relation:

possess(skill_name,user_id)

FDs:

{skill_name,user_id}→{skill_name,user_id}

Closure of {skill_name,user_id}:

$\{skill\_name,user\_id\}^{+}$ ={skill_name,user_id}

Closure of {skill_name,user_id}covers all the attributes of the Relation “Possess”.
Thus {skill_name,user_id} is a candidate key.

Candidate Key: {skill_name,user_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Possess” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Experience” Relation:

experience(eid,user_id,company_name, address, mode, duration)

FDs:

{eid} → user_id
{eid} → company_name
{eid} → address
{eid} → mode
{eid} → duration

Closure of {eid}:

$\{eid\}^+$ ={eid,user_id,company_name,address,mode,duration}

Closure of {eid}covers all the attributes of the Relation “Experience”.
Thus {eid} is a candidate key.

Candidate Key: {eid}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Experience” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Internship_experience” relation:

internship_experience(eid,supervision_level)

FDs:

{eid} → supervision_level

Closure of {eid}:

$\{eid\}^+$ ={eid,supervision_level}

Closure of {eid}covers all the attributes of the Relation “Internship_experience”.
Thus {eid} is a candidate key.

Candidate Key: {eid}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Internship_experience” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Job_experience” Relation:

job_experience(eid,seniority_level)

FDs:

{eid} → seniority_level

Closure of {eid}:

$\{eid\}^+$ ={eid,seniority_level}

Closure of {eid} covers all the attributes of the Relation “Job_experience”.
Thus {eid} is a candidate key.

Candidate Key: {eid}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Job_experience” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Expectation” relation

Expectation(exp_id,user_id,contract_time,salary,preference_mode)

FDs:

{exp_id,user_id} → contract_time
{exp_id,user_id} → salary
{exp_id,user_id} → preference_mode

Closure of {exp_id,user_id}:

$\{exp\_id,user\_id\}^{+}$ ={exp_id,user_id, preference_mode, salary, contract_time}

Closure of {exp_id,user_id} covers all the attributes of the Relation “Expectation”.
Thus {exp_id,user_id} is a candidate key.

Candidate Key: {exp_id,user_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Expectation” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Degree” Relation:

Degree(specialization,degree)

FDs:

{specialization,degree} → {specialization,degree}

Closure of {specialization,degree}:

$\{specialization,degree\}^{+}$ ={specialization,degree}

Closure of {specialization,degree} covers all the attributes of the Relation “Degree”.
Thus {specialization,degree} is a candidate key.

Candidate Key: {specialization,degree}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Degree” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“College” Relation:

college(college_name,address)

FDs:

{College_name} → address

Closure of {College_name}:

$\{College\_name\}^{+}$ ={College_name,address}

Closure of {College_name} covers all the attributes of the Relation “college”.
Thus {College_name} is a candidate key.

Candidate Key: {College_name}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “college” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Completed” Relation:

completed(user_id,specialization,degree,college_name,passout_year,CGPA)

FDs:

{user_id,specialization,degree,college_name} → passout_year
{user_id,specialization,degree,college_name} → CGPA

Closure of {user_id,specialization,degree,college_name}:

{user_id,specialization,degree,college_name}$^{+}$ = { user_id, specialization, degree, college_name, passout_year, CGPA}

Closure of {user_id, specialization, degree, college_name} covers all the attributes of the Relation “completed”.
Thus {user_id,specialization,degree,college_name} is a candidate key.

Candidate Key: {user_id, specialization, degree, college_name}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “completed” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Offer” Relation:

offer(college_name,specialization,degree)

FDs:

{college_name,specialization,degree} → {college_name,specialization,degree}

Closure of {college_name,specialization,degree}:

{college_name,specialization,degree}$^{+}$ ={college_name, specialization, degree}

Closure of {college_name,specialization,degree}covers all the attributes of the Relation “Offer”.
Thus {college_name,specialization,degree} is a candidate key.

Candidate Key: {college_name,specialization,degree}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “Offer” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Schooling” Relation:

schooling(seat_no_10th, seat_no_12th, passout_year_12th, school_name_12th, school_name_10th, percentage_10th, percentage_12th, school_address_12th, JEE_percentile)

FDs:

{seat_no_10th} → seat_no_12th
{seat_no_10th} → passout_year_12th
{seat_no_10th} → school_name_12th
{seat_no_10th} → school_name_10th
{seat_no_10th} → percentage_10th
{seat_no_10th} → percentage_12th
{seat_no_10th} → school_address_12th
{seat_no_10th} → JEE_percentile

Closure of {seat_no_10th}:

$\{seat\_no\_10th\}^{+}$ = {seat_no_10th, seat_no_12th, passout_year_12th, school_name_12th, school_name_10th, percentage_10th, percentage_12th, school_address_12th, JEE_percentile}

Closure of {seat_no_10th} covers all the attributes of the Relation “schooling”. Thus {seat_no_10th} is a candidate key.

Candidate Key: {seat_no_10th}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “schooling” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Company” Relation:

company(cid,company_name,website_link,headquarter_id)

FDs:

{cid} → company_name
{cid} → website_link
{cid} → headquarter_id

Closure of { cid }:

$\{cid\}^+$ = {cid, company_name, website_link, headquarter_id}

Closure of {cid}covers all the attributes of the Relation “company”.
Thus {cid} is a candidate key.

Candidate Key:{cid}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “company” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Company_email” Relation:

company_email(cid,email_id)

FDs:

{cid, email_id} →{ cid, email_id }

Closure of { cid }:

$\{cid, email\_id\}^{+} = \{cid, email\_id\}$

Closure of {cid, email_id} covers all the attributes of the Relation “company_email”.
Thus {cid, email_id} is a candidate key.

Candidate Key: {cid, email_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “company_email” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Company_contact_number” Relation:

company_contact_number(cid,contact_number)

FDs:

{cid, contact_number} → {cid, contact_number}

Closure of {cid, contact_number}:

{cid, contact_number}$^{+}$ = {cid, contact_number}

Closure of {cid, contact_number} covers all the attributes of the Relation “company_contact_number”.
Thus {cid, email_id} is a candidate key.

Candidate Key: {cid, contact_number}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “company_contact_number” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Company_login” Relation:

company_login(company_username,password,cid)

FDs:

{company_username} → password
{company_username} → cid

Closure of { company_username } :

{ company_username } $^{+}$ ={ company_username , password, cid}

Closure of { company_username }covers all the attributes of the Relation “company_login”.
Thus { company_username } is a candidate key.

Candidate Key: {company_username}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “company_login” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Offices” Relation:

offices(cid,office_id,city,state)

FDs:

{cid,office_id} → state
{cid,office_id} → city

Closure of {cid,office_id} :

$\{cid,office\_id\}^{+}$ ={cid,office_id, state, city}

Closure of {cid,office_id} covers all the attributes of the Relation “offices”.
Thus {cid,office_id} is a candidate key.

Candidate Key: {cid,office_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “offices” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Contract” Relation:

contract(contract_number, contract_start_date, offer_id, contract_end_date, min_duration, location, mode, shift)

FDs:

{contract_number,offer_id} → min_duration
{contract_number,offer_id} → contract_end_date
{contract_number,offer_id} → location
{contract_number,offer_id} → mode
{contract_number,offer_id} → shift
{contract_number,offer_id} → contract_start_date

Closure of {contract_number,offer_id} :

$\{contract\_number,offer\_id\}^{+}$ ={contract_number,offer_id, min_duration, contract_end_date, location, mode, shift, contract_start_date}

Closure of {contract_number,offer_id} covers all the attributes of the Relation “contract”.

Thus {contract_number,offer_id} is a candidate key.

Candidate Key: {contract_number,offer_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “contract” is a Super Key.

Thus given relation is in BCNF (Boyce-Codd Normal Form)

“Offers” Relation:

offers(offer_id,cid, skill_required, role, number_of_vacancies, end_date, salary)

FDs:

{offer_id} → cid
{offer_id} →skill_required
{offer_id} → role
{offer_id} → number_of_vacancies
{offer_id} → end_date
{offer_id} → salary

Closure of {offer_id}:

$\{offer\_id\}^{+}$ ={ offer_id, cid, skill_required, role, number_of_vacancies, end_date, salary}

Closure of {offer_id} covers all the attributes of the Relation “offers”.
Thus {offer_id} is a candidate key.

Candidate Key: {offer_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “offers” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Apply” Relation:

apply(user_id,offer_id,apply_date,status)

FDs:

{user_id, offer_id} → apply_date
{user_id, offer_id} → status

Closure of {user_id, offer_id}:

{ user_id, offer_id }$^{+}$={ user_id, offer_id, apply_date, status}

Closure of {user_id, offer_id} covers all the attributes of the Relation “apply”.
Thus {user_id, offer_id} is a candidate key.

Candidate Key: {user_id, offer_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “apply” is a Super Key.
Thus given relation is in **BCNF (Boyce-Codd Normal Form)**

“Search” Relation:

Search (cid, user_id)

FDs:

{cid, user_id} → {cid, user_id}

Closure of {cid, user_id}:

{cid, user_id }$^{+}$ ={cid, user_id}

Closure of {cid, user_id} covers all the attributes of the Relation “search”.
Thus {cid, user_id} is a candidate key.

Candidate Key: {cid, user_id}

Since Candidate key is the subset of Super Key

The determinant of all the functional dependencies of the relation “search” is a Super Key.
Thus given relation is in BCNF (Boyce-Codd Normal Form)