CAT-II
DBMS

Q1)

$$gid = A$$
$$gname = B$$
$$specialization\_type = C$$
$$specialization\_name = D$$
$$\qquad " \quad \_department = E$$
$$vacancy = F$$
$$email = G$$
$$specialization\_head = H$$

Dependencies $= \left\{ \begin{array}{l} A \rightarrow BGC \\ C \rightarrow DE \\ C \rightarrow H \\ E \rightarrow F \end{array} \right\}$

a) Lets find the candidate keys for the above dependencies.

$$RHS = \{B, G, C, D, E, F\}$$

Remaining $= \{A\}$ = essential attribute.

$(A)^+ = ABGCHDERF$ ~~rat~~ candidate key

$(AB)^+ = ABGCHDE$

$(AC)^+ = ACBG$

$(AD)^+ =$

$(AE)^+ =$

$(AF)^+ =$

$(AG)^+ =$

$(AH)^+ =$

$\therefore$ A is candidate key.

prime attributes = { A }
non-prime " = { B C D E F G H }

↳ Check for BCNF:

& α must be candidate in every dependency (α → β).

in dependency:
C → DE

C is not candidate key.

∴ it is not BCNF.

↳ check for 3NF:

α can be a candidate key OR β can be prime attr. for each dependency.

A → BGC ✓
C → DE ✗

& C is not candidate key and DE are not prime attributes.

∴ it is not 3NF.

↳ check for 2NF:

There should not be any partial dependencies.

$$A \rightarrow BGC \quad \checkmark$$
$$C \rightarrow DE \quad \checkmark$$
$$C \rightarrow H \quad \checkmark$$
$$E \rightarrow F \quad \checkmark$$

Since all dependencies are not partial dependencies.

$$\therefore \text{ it is 2NF.}$$

b)

$$R(ABCDEFGH) \longrightarrow 2NF$$

* R breakdown:

(i) $R_1 (ABGC)$.

(ii) $R_2 (CDE)$

(iii) $R_3 (CH)$

(iv) $R_4(EF)$

These are in 3NF

* R_1 breakdown not required.

*

* R breakdown :

(i) R₁ (A B C D

* R breakdown :

R₁ (ABG CEH

b) R breakdown.

(i) R₁ (AB G C) :

(ii) R₂ (D E)

(iii) R₃ (C H)

(iv) R₄ (E F)

It is 3NF
as well as BCNF
as every table has
c.r.

Q2)

(a) $\boxed{\pi_{name} = (\sigma_{rating = 4} (actor))}$

(b) $\boxed{\pi_{type} (\sigma_{.theatre\_name = 'vison'} (theatre \bowtie ticket))}$

(c) $\boxed{\pi_{mid, name, date, actor-ID} (\sigma_{name = "John"} (movie \bowtie actor))}$

(d)

$\boxed{(\sigma_{theatername = "yourtheatre".}}$

$movie.actorid = actor.actorid = theatre.actorid$

$(movie \times actor \times theatre))$

π movie.name, actor.actorid, actor.name, actor.ratings

Q3)

name = A

date = B

company = C

altername = D

formula = E

dependencies = $\{$ A → CD

C → B

D → E

EC → A $\}$

(i) lets check for candidate keys :

RHS = $\{$ ABCDE $\}$

remains = $\{$ $\}$ none :

∴ try each combination :

$(A)^+$ = ACDBE ✓ candidate key.

$(B)^+$ = B ✗

$(C)^+$ = CB ✗

$(D)^+$ = DE ✗

$(E)^+$ = E ✗

try supersets of B, C, D, E

→ $(BC)^+$ = BC ✗

$(CD)^+$ = CDEAB ✓ candidate key

$(DE)^+$ = DE ✗

$(BD)^+$ = BDE ✗

$(BE)^+$ = BE ✗

$(CE)^+$ = CEADB ✓ candidate key.

try supersets of BC, DE, BD, BE

$$(\cancel{AB}DE)^+ = CBDEA \checkmark \quad C.K$$
$$(BCD)^+ = BCDEA \checkmark \quad C.K$$
$$(BCE)^+ = BCEAD \checkmark \quad C.K$$
$$(DEB)^+ = DEB \quad X$$
$$(BDE)^+ = BDEAC \checkmark \quad C.K.$$

∴ all candidate keys are :

① A
② CD
③ CE
④ ~~BCDE~~ : (cannot be c.k. since subset is also c.k.)
⑤ ~~BCD~~ (cannot be c.k since subset CD is also c.k.)
⑥ BDE

∴ final c.k. :

① A
② CD   ⎫
③ CE   ⎬ 4 c.K(s) in total.
④ ~~BCD~~   ⎭
④ BDE

B(ii)

① Using axiom if X → Y
   ∴ XZ → YZ

∴ if C → B
∴ $\boxed{AC \rightarrow AB}$

② using axiom if $X \rightarrow YZ$
$$\Rightarrow X \rightarrow Y$$
$$X \rightarrow Z$$

∴ $A \rightarrow CD$

$$\Rightarrow \boxed{\begin{array}{c} A \rightarrow C \\ A \rightarrow D \end{array}}$$ Ans.