1. R(ABCDEF)

$A \rightarrow C$
$C \rightarrow D$
$D \rightarrow B$
$E \rightarrow F$

Look for attributes which cannot be determined from these f.D. (they are those att. which are not present on the right hand side of FD's i.e. A & E (they will be present in C.K. for sure).

Now to see whether A & E i.e. AE is a candidate key or not finds its closure

$(AE)^+ \rightarrow \{A, E, C, D, B, F\}$

As the closure contains all attributes of R (AE) is a candidate key.

R (ABCDE)

A → B

AB → C

BC → E

BD → E

Start with att. not Present on right hand side

i.e. AD

find closure of $(AD)^+$

$(AD)^+ = ADBCE$

∴ Candidate key will be (AD).

R(ABCDEFGH) Find out all Candidate keys.

CH → G

A → BC

B → CFH

E → A

F → EG

Search for attributes which are not there on R.H.S.

D DA

D

Find closure of D

$(D)^+ \rightarrow D$

Now we will take combination of Attribute with D

Lets start with A & find $[DA]^+ \rightarrow ADBCFHEG$

∴ its cand. key.

Take another attribute with D say for example B & find its closure

$(DB)^+ \rightarrow DB\ CFH\ GEA$ as all att exist

it is also C.K.

Take C with D   AD DB DE DF

$[DC]^+ \rightarrow DC$ ∴ it is not a C.K.

Take E with D

$[DE]^+ \rightarrow DEA$

Since DA is a candidate already discussed.
∴ DE is also a candidate key as.

from
lets Try with F & find Closure
$(DF) \rightarrow \underline{D}F\underline{E}G$ as it includes DE which has been proven to be candidate key

∴ DF is also a candidate key
as while Finding Closure of DF.
we arrived DE FG & we know DE
is a candidate key i.e. we arrived at
a candidate key ∴ we stop & say that
DF is also a candidate key.

If you further try other combinations
you will not be able to find anymore C.Ks
let's take another example. Randomely.
$[DCH]^+ \rightarrow DCHG$

Now we are stuck here ∴ this comb. fails.
Now let try another combination.

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Consider a Relation R (ABCDEFGH) with set of FDs as

F = { CH→G A→BC B→CFH E→A F→EG }. find out number of candidate keys?

Solⁿ :→ Search for attributes not present on RHS.

we have D ∴ we can surely say that D will be there in candidate key.

Let us find closure of D i.e. D^+

⇒ D^+ | D ∴ D alone is not a candidate key

Now we will take combinations of other attributes with D. To start with we can take A

∴ Find closure of D A

DA^+ | AD BCFHEG

as we can determine all att. ∴ $(DA)^+$ is a C.K.

Now let us try with B as a combination we find

DB^+ | BDCFHEGA again as all attributes have been determined ∴ (BD) is a C.K.

Now try another combination with C. i.e.

$(DC)^+$ | CD ∴ it is not a C.K.

Now take another combination with E & find DE^+

DE^+ | DEA Now as we know DA is already a C.K. ∴ DE is also a C.K.

Now try with F by finding out DF^+

DF^+ | DFE Now as DE is already C.K. ∴ DF is a C.K.

Now if you try another combination you will not find more ck. Say for eg if try for DCH (21)

$\{DCH\}^+$ / DCHG $\therefore$ DCH is not a candidate key

Ques1
Determine candidate key for R (ABCDE) with

$F = \{AB \to C, C \to D, D \to E, A \to B, C \to A\}$. (22)

Soln.

Let us first of all calculate AB^+

$AB^+ | ABCDE$ ∴ AB is a candidate key or not we need to find its minimal.

Now

$A^+ | AB$ as its closure includes AB which has proven to be a superkey. ∴ we can say that A^+ is a candidate key.

Also check B^+

B^+ / B ∴ B is not a candidate key.

$$\boxed{\begin{array}{l}\text{Candidate key} = \{A \\ \text{Prime Attribute} = \{A\end{array}}$$

Now we will check among all FDs which have Prime attributes on RHS and we have one such FD $C \to A$ that has Prime attribute A on RHS

we now replace A with C.

∴ we can say that C^+ also determines R.

and we can say that new candidate key will be C & new

∴ next candidate key will be C & new Prime attribute is also C. Therefore

$$\boxed{\begin{array}{l}\text{Candidate key} = \{A, C \\ \text{Prime Attribute} = \{A, C\end{array}}$$

Now again look for FDs which have C on RHS. we have one such FD i.e. AB→C i.e. we can replace C with AB. But we have already checked for AB.

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There fore we can say that we have only 2 Candidate keys (A, C) with Prime attributes (A, C) rest of the attributes are called Non Prime attributes (BDE).

Ques (2)

Determine candidate keys for R (ABCDE) with (24)

F = { A → D AB → C B → E D → C. E → A }.

Soln. Let us first of all calculate AB^+

AB^+ / ABCED which is equivalent to R ∴ AB is a superkey. Let us find out its minimal.

A^+ / ADC and B^+ / BEADC ∴ we can say B is a candidate key

Candidate key = {B
Prime attribute = {B

Now look for FD that has prime attribute on RHS.
We donot have any ~~and~~ such FD ∴ this Relation R has only one candidate key B.

Ques 3

Determine Candidate key for R (ABCDEF) with

F = { A → C B → D C → E, D → E E → A F → B } 25

Sol^n: Let us start with A^+ we can see that

A^+ / A C E we donot get R ∴ A is not a CK.

Let us Pick F & find out F^+

F^+ / F B D E A C we get R.

∴ F is candidate key.

Now look for FDs with F on RHS as we donot have any other candidate key.

Ques 4.
Determine candidate key for R (ABCDE) with
F = {AB→C C→D D→E E→A D→B}   26

Sol. Lets start with AB & find its closure
AB+ / ABCDE we get R ∴ AB is a superkey
Check for its minimal
A+ / A   B+ / B. ∴ AB is a candidate key.

Now look for FD with Prime Attribute A or B on RHS we have 2 such FDs E→A D→B
∴ first replace B with D & check for AD+
AD+ / AD BC as we already know that AB is a CK. ∴ AD is also a superkey Now check for

Candidate keys = {AB ~~A~~D Prime Attributes = {A, B, D

minimal A+ / A D+ / DEABC ∴ A is extraneous.
∴ D+ is a candidate key as shown above.

Now replace ~~E→A~~ A with E & check for EB
EB+ / EBACD ∴ EB is also a superkey. Now to find ~~AB~~ whether it is a candidate key or not find its minimal
E+ / EA   B+ / B ∴ EB is a candidate key

Candidate keys = {AB, D, EB

Prime Attributes = {A, B, D, E}

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Now check those FD which have Prime attribute D on RHS we have one such FD C → D ∴ D can be replaced with C. Therefore we can say that C^+ will also ∴ give us R and as it can be minimized it is another candidate key.

Candidate key = {AB, D, EB, C}

Prime Attribute = {A, B, D, E, C}

Now again look for FD that has C on RHS. we now have AB → C and since we have already included AB ∴ we stop here.

Finally we have 4 Candidate keys.

AB, D, EB, C.

Ques 5. Determine candidate key for R(ABCDEF) with FDs

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F = {AB → C C → DE E → F F → A}

Ans ⇒

C.K. = { AB, FB, EB, CB }

Prime att. = A, B, F, E, C

Ques 6. Determine Candidate keys for R(ABCDEFGH) with F = {AB → CD D → EG F → H C → EF H → A G → B A → B}

Ans ⇒

Candidate keys = { A, H, F, C }

Prime Attributes = { A, H, F, C }

Non Prime Attributes = { B, D, E, G }