1. Given F = {a→b, b→c, c→ {d,e}}. What is the closure of b?
   $b^+ = \{b, c, d, e\}$

2. Given R(a,b,c,d,e,f). Given the following functional dependency:
   F = {ab→ cdef, c → abdef}.
   Identify the L M R, candidate keys, prime/non prime and normal form using the table below

L	M	R		Candidate Keys		prime	Non prime		Normal Form
	a	d		ab		a	d		BCNF
	b	e		c		b	e		
	c	f				c	f		

3. Given R(a,b,c,d,e,f). Given the following functional dependency:
   F = {ab→cdef , c →abdef, e→ a}.
   Identify the L M R, candidate keys, prime/non prime and normal form using the table below

L	M	R		Candidate Keys		prime	Non prime		Normal Form
	a	d		c		a	d		3rd NF
	b	f		ab		b	f		
	c			e		c			
	e					e			

e

4. Given R(a,b,c,d,e,f,g). Given the following functional dependency:
   F = {ab → cdeg, c → abdef, d→ b}
   Identify the L M R, candidate keys, prime/non prime and normal form using the table below

L	M	R		Candidate Keys		prime	Non prime		Normal Form
	a	e		c		a	e		3rd NF
	b	f		ab		b	f		
	c	g		ad		c	g		
	d					d			

1) $F = \{ a \to b, b \to c, c \to \{d, e\} \}$ $\quad b^+$?

$a \to b$
$b \to c$
$c \to de$

b^+ = $bcde$

b is given by reflexivity (identity) law
c is determined by b
d and e are determined by c

2) $R(a, b, c, d, e, f)$ $\quad F = \{ ab \to cdef, c \to abdef \}$

$F = \{$
$ab \to c$,
~~$ab \to d$~~,
~~$ab \to e$~~,
~~$ab \to f$~~,
$c \to a$,
$c \to b$,
$c \to d$,
$c \to e$,
$c \to f$
$\}$

$F_c = \{$
$ab \to c$,
$c \to a$,
$c \to b$,
$c \to d$,
$c \to e$,
$c \to f$
$\}$

1)

L	M	R
	a	d
	b	e
	c	f

2) ab^+ = $abcdef$ $\quad c^+$ = $abcdef$

Candidate Keys:
ab
c

3)

prime	nonprime
a	d
b	e
c	f

4) BCNF, LHS is a super key for all FDs.

3) $R(a,b,c,d,e,f)$ $F = \{ ab \to cdef,\ c \to abdef,\ e \to a \}$.

$F = \{ ab \to c,\ ab \to d,\ ab \to e,\ ab \to f,\ c \to a,\ c \to b,\ c \to d,\ c \to e,\ c \to f,\ e \to a \}$

$F_c = \{ ab \to c,\ c \to b,\ c \to d,\ c \to e,\ c \to f,\ e \to a \}$

1)

L	M	R
	a	d
	b	f
	c	
	e	

2)

ab^+	c^+	be^+
abcdef	abcdef	abcdef

Candidate Keys: ab, c, be

3)

Prime	Nonprime
a	d
b	f
c	
e	

4) Not in BCNF, since FD: $e \to a$ violates BCNF

3rd NF, since every FD either has LHS being a superkey or RHS being a prime attribute

4) $R(a,b,c,d,e,f,g)$ $F = \{ ab \to cdeg,\ c \to abdef,\ d \to b \}$

$F: \{ ab \to c,\ ab \to d,\ ab \to e,\ ab \to g,\ c \to a,\ c \to b,\ c \to d,\ c \to e,\ c \to f,\ d \to b \}$

$F_c = \{ ab \to c,\ ab \to g,\ c \to a,\ c \to d,\ c \to e,\ c \to f,\ d \to b \}$

1)

L	M	R
	a	e
	b	f
	c	g
	d	

2)

ab^+	c^+	ad^+
abcdefg	abcdefg	abcdef

3)

Prime	Nonprime
a	e
b	f
c	g
d	

4) Not in BCNF, since FD: $d \to b$ violates BCNF

3rd NF, since every FD either has LHS being a super key or RHS being a prime attribute