1.15 supplement

(the first attribute is the primary key)

- A table for *user*, like:

wechat_id	***gender***	***name***	***tickle***	***region***	**...**	***register-time***
zju_zpq	male	[ ]	null	Dongguan, Guangdong		2010.1.1
...						

- A table for *circle of friends*, like:

uid	***post_time***	***visible_range***	***content***	**...**	***favors_list***
127641	2020.1.1.00.00.00	all	test		null
...					

- A table for *relationship*, representing whether two users are friends, like:

friend_A_id	***friend_B_id***
zju_zpq	zju_lzy
...	

- A table for *authorization*, representing the applications the account has authorized, like:

app_id	***camera***	***phone_number***	***phone_id***	**...**	***post***
ddxyq	null	authorized	authorized		no
...					

(I didn't mean to do it casually, but the question doesn't demand for listing the attributes... But I do agree that listing the attributes agrees to the demand 'describe' better. My bad.)

2.9

a

Appropriate primary keys are:

branch: *branch_name*

customer: *customer_name*

loan: *loan_number*

borrower: *loan_number*

account: *account_number*, *customer_name*

depositor: *account_number*, *customer_name*

In reality, for *customer*, I think it's hard to identify a unique person even with all three attributes. However, based on the question, I assume that each person's name is unique. Based on the assumption, *customer_name* could also be the primary key of *account* and *depositor*.

b

branch: *null*

customer: *null*

loan: *branch_name* referencing *branch*

borrower: *loan_number* referencing *loan*, *customer_name* referencing *customer*

account: *branch_name* referencing *branch*

depositor: *account_number* referencing *account*, *customer_name* referencing *customer*

2.13

a

$\prod_{loan\_number}(\sigma_{amount>10,000}(loan))$

b

$\prod_{customer\_name}(\sigma_{balance>6,000}(depositor \bowtie account))$

c

$\prod_{customer\_name}(\sigma_{balance>6,000 \wedge branch\_name=\text{"Uptown"}}(depositor \bowtie account))$

6.11

a

$\prod_{person\_name}(\sigma_{company\_name=\text{"First Bank Corporation"}}(works))$

b

$\prod_{person\_name,city}(\sigma_{company\_name=\text{"First Bank Corporation"}}(employee \bowtie works))$

c

$\prod_{person\_name,street,city}(\sigma_{(company\_name=\text{"First Bank Corporation"}\wedge salary>10{,}000)}(employee \bowtie works))$

d

$\prod_{person\_name}(employee \bowtie works \bowtie company)$

e

$\prod_{company\_name}(company \div (\prod_{city}(\sigma_{company\_name=\text{"Small Bank Corporation"}}(company))))$
$- \prod_{company\_name}(\sigma_{company\_name=\text{"Small Bank Corporation"}}(company))$

6.13

a

$t \leftarrow {}_{company\_name}\mathcal{G}_{\textbf{count-distinct}(person\_name)\ \textbf{as}\ sum\_employee}(works)$

Then $\prod_{company\_name}(\mathcal{G}_{max(sum\_employee)}(t) \bowtie t)$

b

$t \leftarrow {}_{company\_name}\mathcal{G}_{\textbf{sum}(salary)\ \textbf{as}\ payroll}(works)$

Then $\prod_{company\_name}(\mathcal{G}_{min(payroll)}(t) \bowtie t)$

c

$t \leftarrow {}_{company\_name}\mathcal{G}_{\textbf{avg}(salary)\ \textbf{as}\ avg\_sal}(works)$

$fbc \leftarrow \sigma_{company\_name=\text{"First Bank Corporation"}}(t)$

Then $\prod_{company\_name}(t \bowtie_{t.avg\_sal>fbc.avg\_sal} fbc)$