Q1)

(1) S1 (productCode, brandName, country. dispatch) $\subseteq$
Monitor (productCode, brandName, size, dispatch) $\wedge$
size $\geqslant 21 \wedge$ Brand (brandName, country, year)

(2) S2 (productCode, brandName) $\subseteq$
Monitor (productCode, brandName, size, dispatch) $\wedge$
dispatch = "FULLHD" $\wedge$ Brand (brandName, country, year) $\wedge$
country = Japan $\wedge$ size < 17

(3) S3 (productCode, brandName, size) $\subseteq$
Monitor (productCode, BrandName, size, dispatch) $\wedge$
Brand (BrandName, country, year) $\wedge$ country = "Korea"
$\wedge$ year $\geqslant 1990$

(4) S4 (sellerName, productCode, Price) $\subseteq$
Distributor (sellerName, productCode, Price) $\wedge$ monitor (productCode,
brandName, size, dispTech)

Q2

$q(SN, price) \leftarrow$ Monitor$(PC, BN, size,$ "FULLHD"$) \land size \geqslant 21$
Brand$(BN,$ "Korea", year$) \land$ Distributor$(SN, PC, price)$

Bucket Algorithm:

List of possible bucket for

Monitor	Brand	Distributor
		S4
S1	S1	
X S2	X S2 (removed due to conflict)	
S3	S3	
S4		

① S1 - S2 - S4

S1(PC, BN, C, D), S2(PC, BN), S4$(SN, PC, price)$, country = "Korea", dispatch = "FULLHD"
monitor$(PC, BN, size, dispatch) \land size \geqslant 21 \land$ Brand$(BN, country, year)$
Monitor$(PC, BN, size, dispatch) \land$ dispatch = "FULL HD" $\land$ brand $(BN, country, year)$
country = "Japan" $\land \underline{size < 17}$

Checking Containment.

① S1 - S1 - S4
S1$(PC, BN, country, dispatch)$, S4$(SN, PC, price) \longrightarrow$
Monitor$(PC, BN, size, dispatch) \land size \geqslant 21 \land$ Brand$(BN, country, year)$
Monitor $($ productcode, BN, size, dispatch$) \land$ Distributor$(SN, PC, price)$
$= Q (SName, price)$

② S3 - S1 - S4
S3$(PC, BN, size)$, S1$(PC, BN, country, dispatch)$, S4$(SN, PC, price)$,
display Tech: "FULL HD"
$\longrightarrow$ Monitor$(PC, BN, size, dispatch) \land$ Brand$(bN, country, year) \land$ country = "Korea"
$\land$ year $\geqslant 1990$
Monitor $(PC, bN, size, dispatch) \land size \geqslant 21 \land$ Brand$(bN, country, year)$

Distributor $(SN, PC, Price) \land$ monitor $(PC, bN, size, dispatch)$

$\subseteq Q (SN, price).$

③ S4 − S3 − S4

S4(SN, PC, Price), S3(PC, BN, size), dysplay Tech = "FullHD"

Distributor(SN, PC, Price) ∧ monitor(PC, BN, size, dispatch)
Monitor(PC, BN, size, dispatch) ∧ Brand(BN, country, year)
country = "Korea" ∧ year ⩾ 1990
    ⊆ α(SN, price)

Q3 Converting LAV to (ausual form

① $S1(PC, BN, country, dispatch) \subseteq Monitor(PC, BN, size, dispatch) \wedge$
$size \geqslant 21 \wedge Brand(BN, country, year)$

$\rightarrow \forall PC, BN, country, dispatch [S1(PC, BN, country, dispatch) \rightarrow$
$\exists size, year [Monitor(PC, BN, size, dispatch) \wedge greater(size, 21) \wedge$
$Brand(BN, country, year)]$

$\rightarrow \neg S1(PC, BN, country, \cancel{year}, dispatch) \vee [Monitor(PC, BN, f_1(PC, BN, country, dispkch), dispkch)$
$\wedge$
$Brand(BN, country, f_1''(PC, BN, country, dispatch)$
$\wedge$
$greater(f_1(PC, BN, country, dispkch), 21)$

$a \rightarrow b \equiv \neg a \vee b$
$a \vee (b \wedge c) \equiv a \vee b \wedge a \vee c.$
Using these rules.

1.1 $Monitor(PC, bN, f_1(PC, BN, country, dispkch), dispkch) \leftarrow S1(PC, BN, country, dispkch)$

1.2 $Brand(BN, country, f_1'(PC, BN, country, dispkch)) \leftarrow S1(PC, BN, country, dispkch)$

1.3 $Greater(f_1(PC, BN, country, dispkch), 21) \leftarrow S1(PC, BN, country, dispkch).$

Using similar approach for S2, S3 and S4

② 2.1 $Monitor(PC, bN, f_2(PC, BN), f_2(PC, BN)) \leftarrow S2(PC, BN)$

2.2 $Brand(BN, f_2(PC, BN), f_2(PC, BN)) \leftarrow S2(PC, BN)$

2.3 $lessthan(f_2(PC, BN), 17) \leftarrow S2(PC, BN$

③ 3.1 $Monitor(PC, BN, size, f_3(PC, BN, size)) \leftarrow S3(PC, BN, size)$

3.2 $Brand(BN, f_3(PC, BN, size), f_3(PC, BN, size)) \leftarrow S3(PC, BN, size)$

3.3 $Greater(f_3(PC, bN, size), 1990) \leftarrow S3(PC, BN, size)$

④ 4.1 $Distributor(SN, PC, prize) \leftarrow S4(SN, PC, prize)$

4.2 $Monitor(PC, f_4(SN, PC, prize), f_4(SN, PC, prize),$
$f_4(SN, PC, prize)) \leftarrow S4(SN, PC, prize)$

$\theta(SN, Price) \leftarrow$ Monitor $(PC, BN, S, \text{"FullHD"}) \wedge$
Brand $(BN, \text{"Korea"}, Year) \wedge$
Distributor $(SN, PC, Price) \wedge$
greater $(Size, 21)$.

Element ① : Monitor $(PC, BN, S, \text{"FULLHD"})$

ⓐ Unify with 1.1 = Monitor $(PC, BN, f_1(PC, BN, country, disptech), disptech)$

Substitution $\sigma = \{ PC \rightarrow PC', BN \rightarrow BN, S \rightarrow f_1(PC, BN, country, disptech \}$
$\text{"FullHD"} \rightarrow disptech)$

$Pr_1(SN, Price) \leftarrow S_1(PC', BN', country, \text{"FullHD"}.)$ Brand $(BN', \text{"Korea"}, Year) \wedge$
Greater $(f_i(PC', BN', country, disptech), 21)$, Distributor $(SN, PC, Price)$

Element ② : Brand $(BN', \text{"korea"}, Year)$

ⓑ Unify with 1.1 Brand $(BN, \text{"Korea"}, f_1(PC, BN, \text{"Korea"}, \text{"FullHD"})$

Substitute $\sigma = \{ PC \rightarrow PC', BN \rightarrow BN'', country \rightarrow Korea, DT \rightarrow \text{"Full HD"},$
$Year \rightarrow f_1(PC'', BN'', \text{"Korea"}, \text{"FullHD"}) \}$

$Pr_2(SN, P) \leftarrow S_1(PC'', BN'', \text{"Korea"}, \text{"FullHD"}), S_1(PC'', BN'', Korea, \text{"FullHD"}$
greater $(f_1(PC'', BN'', \text{"Korea"}, \text{"FullHD"}), 21)$,
Distributor $(SN, PC'', price)$.

$Pr_2(SN, Price) \leftarrow S_1(PC'', BN'', \text{"Korea"}, \text{"FullHD"})$
greater $(f_1(PC'', BN'', \text{"Korea"}, \text{"FullHD"}), 21)$,
Distributor $(SN, PC'', price)$

Element ③ : greater $(f_1(PC'', BN'', \text{"Korea"}, \text{"Full HD"}), 21)$

ⓒ Unify with 1.1 greater $(f_1(PC''', BN''', \text{"Korea"}, \text{"Full HD"}), 21)$

Substitute $\{ PC'' \rightarrow PC''', BN'' \rightarrow BN''' \}$

$Pr_3(SN, Price) \leftarrow S_1(PC''', BN''', \text{"Korea"}, \text{"FullHD"}),$
$S_1(PC''', BN''', \text{"Korea"}, \text{"FullHD"}),$
Distributor $(SN, PC''', price)$.

Element ① Distributor $(SN, PC''', Priu)$

Unify with 4.1 Distributor $(SN', PC'''', Priu')$

Substitute $\sigma = \{SN \rightarrow SN', PC''' \rightarrow PC''''; Priu \rightarrow Priu'\}$

$P_{r_4}(SN, P)(u)$

$P_{r_4}(SN, Priu) \leftarrow S_1(PC''', BN'''', "Korea", "fuwvo")$
$\qquad\qquad\qquad\qquad S_4(SN', PC''', Priu).$