

Coffee Vending Machine

in NuSRS & SMV

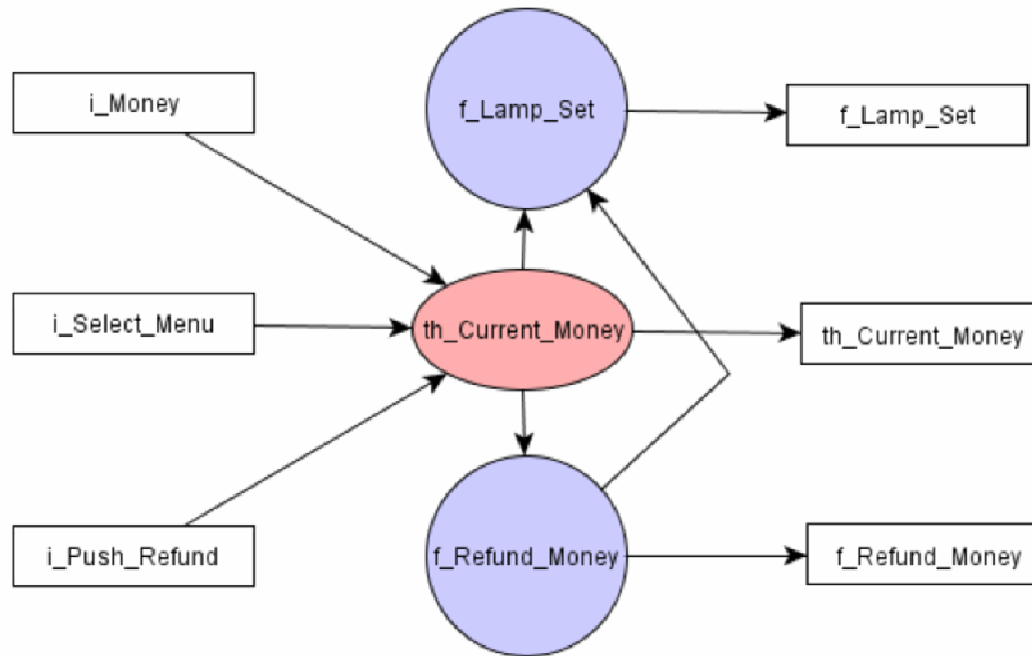


200310442 반현오

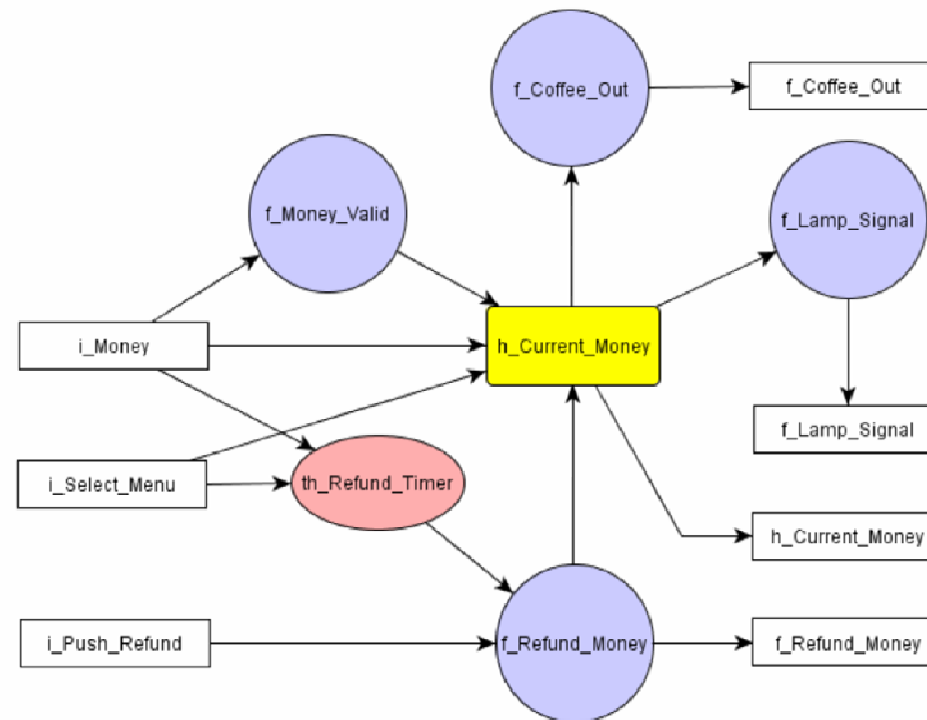
200310657 현창훈

200412313 김은경

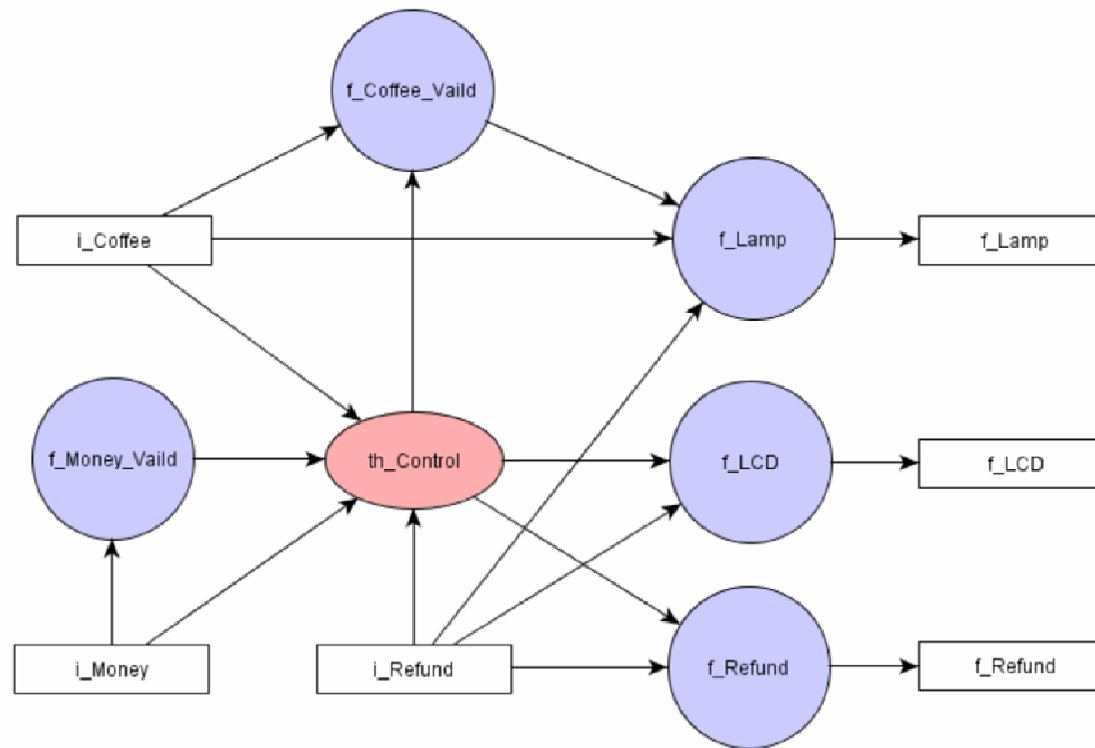
1st version by 3.27 (1)



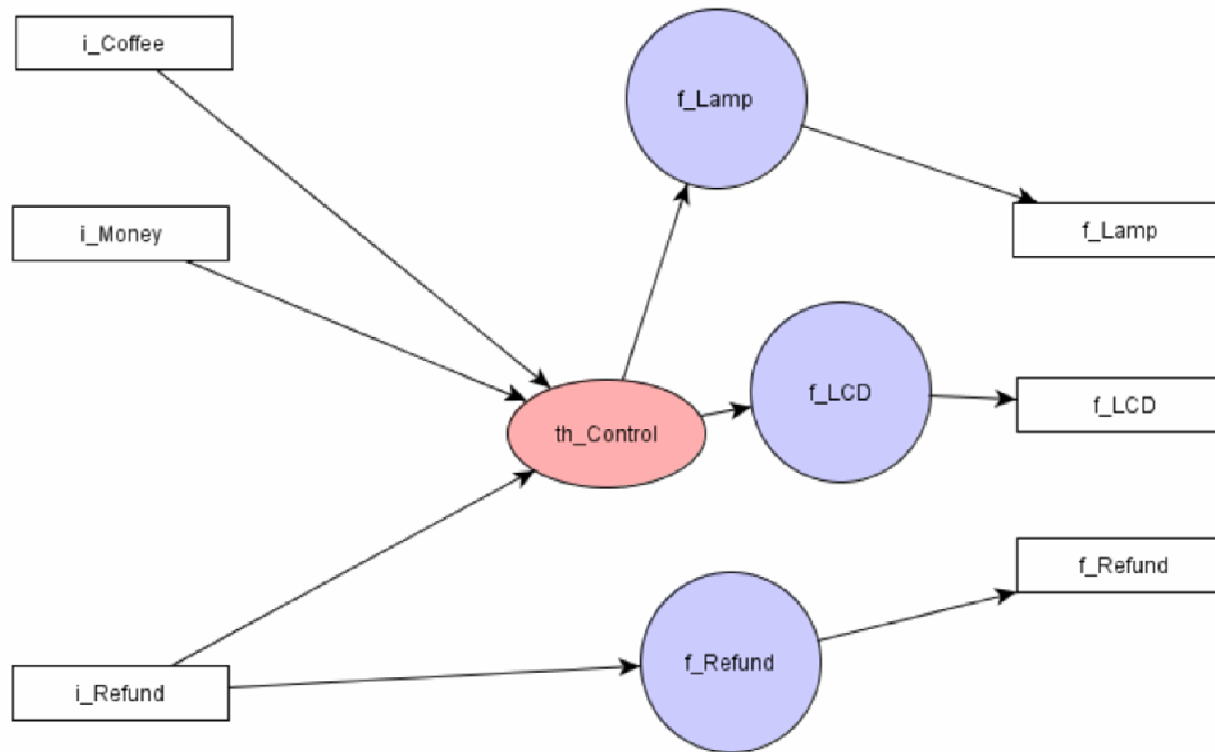
1st version by 3.27 (2)



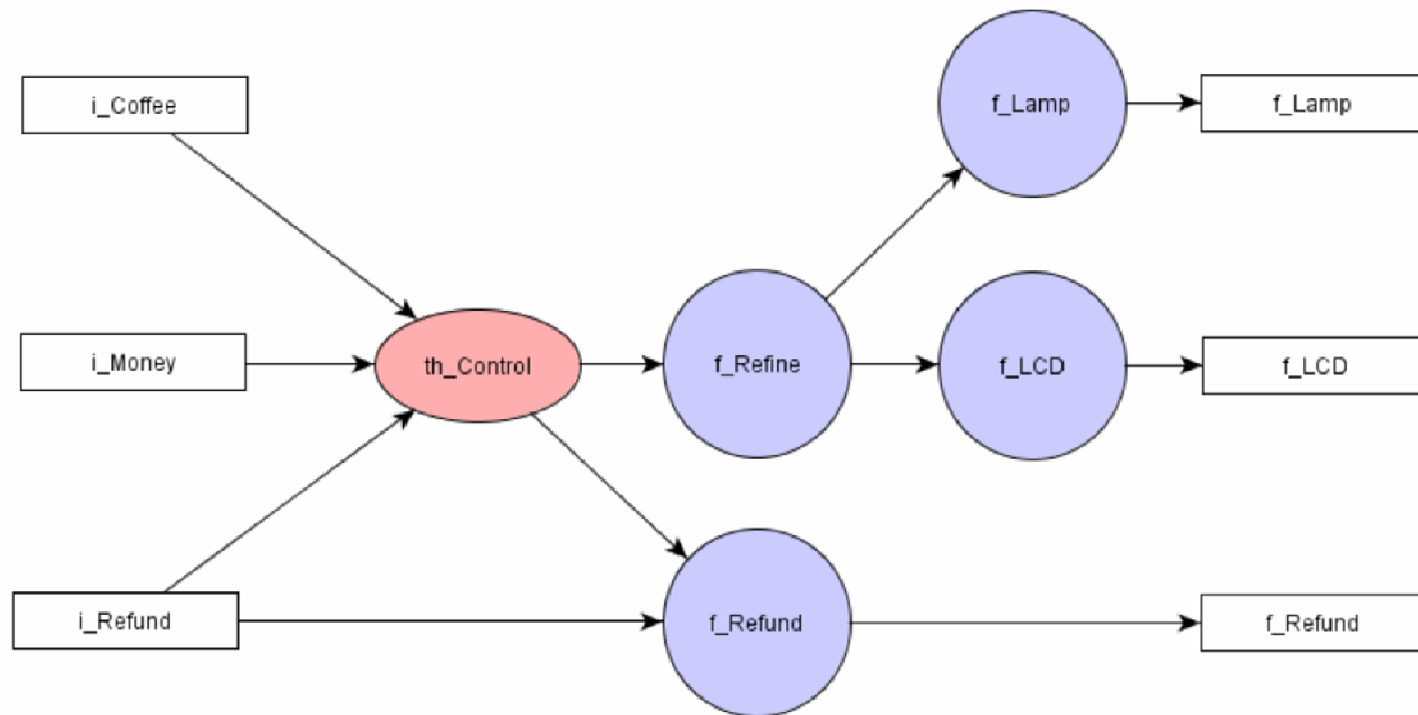
1st version by 3.27 (3)



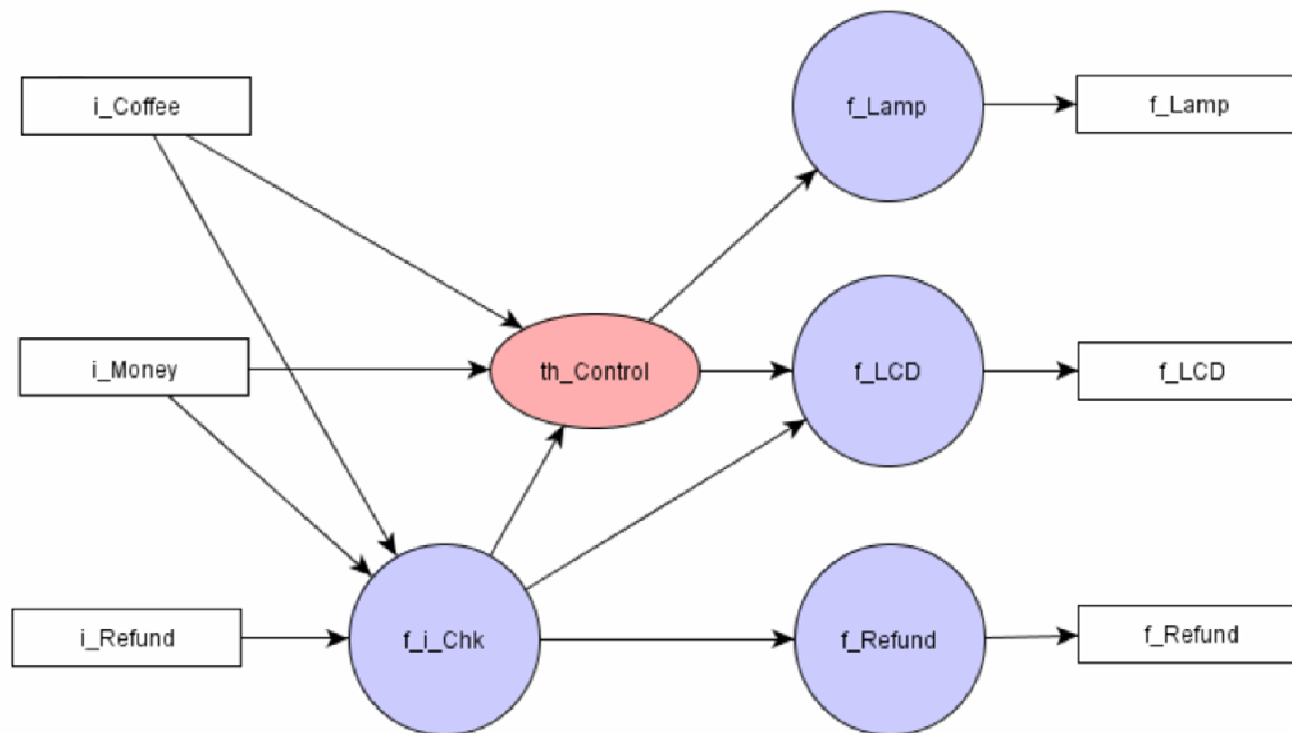
2nd version



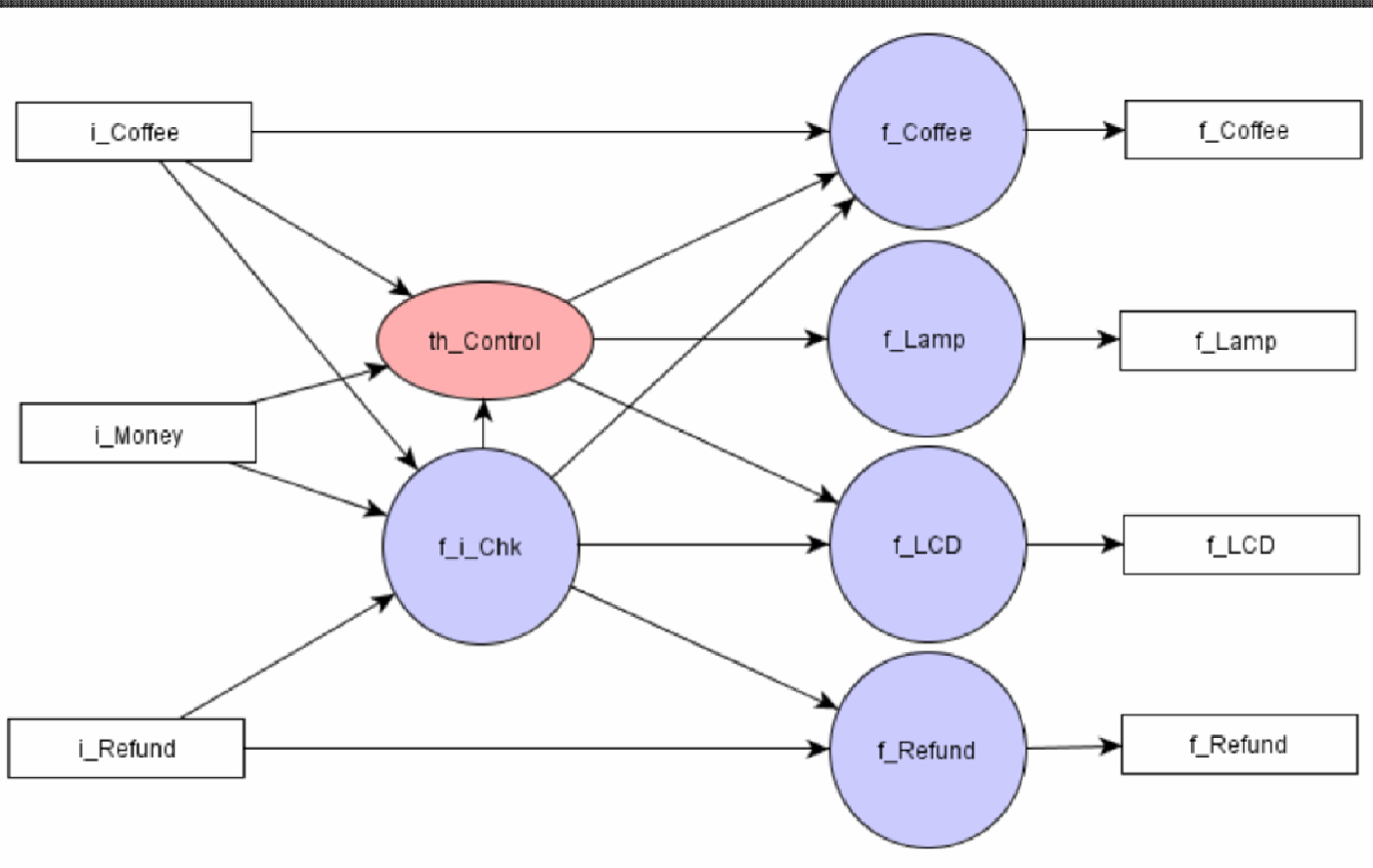
3rd version



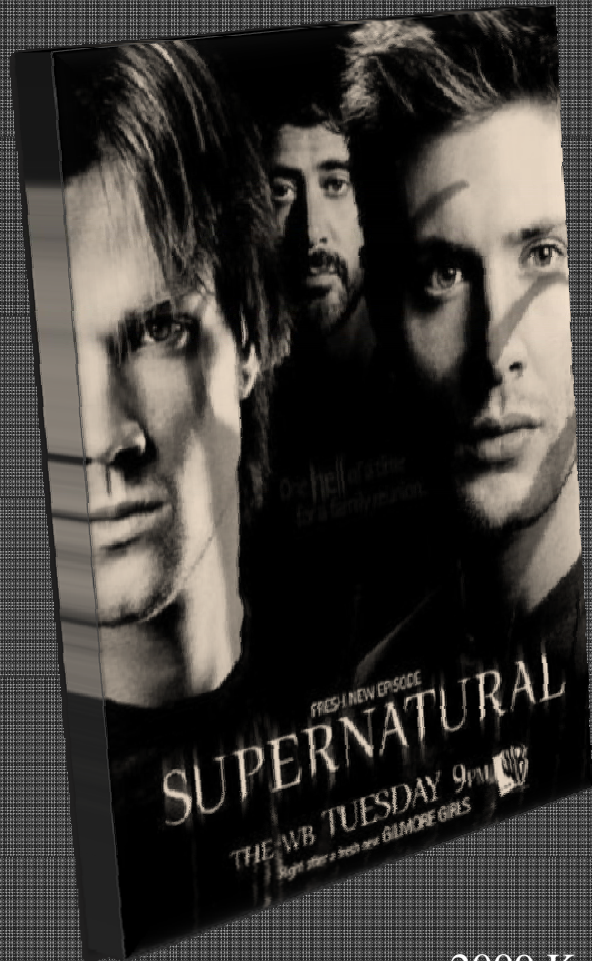
4th version



final version

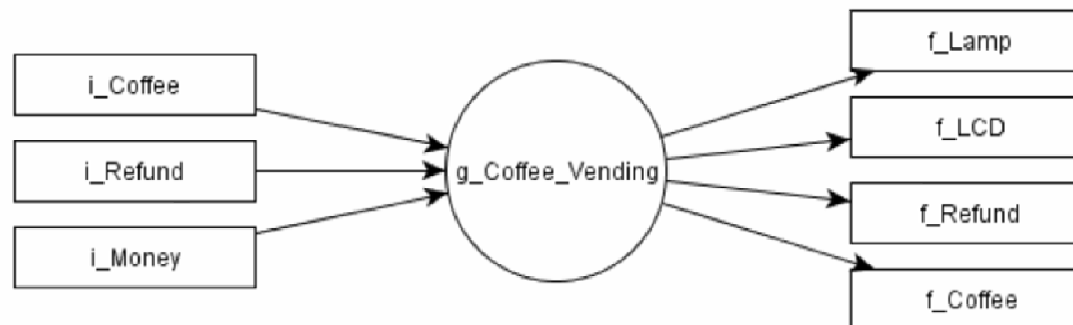


Requirements



- one input at a time.
- two kinds of coffee.
- four kinds of money.
- if two or more input at a time, then LED shows the error.
- available automatic refund.

Root



Root



- `i_Refund` : **boolean**
 - `false` : no signal.
 - `true` : refund signal.
- `i_Money` : **enum{0, 5, 10, 50, 100}**
 - `0` : no signal.
 - `5` : 50 won.
 - `10` : 100 won.
 - `50` : 500 won.
 - `100` : 1000 won.

Root

- i_Coffee : **enum{0, 15, 20}**
 - 0 : no signal.
 - 15 : 150 won. 'Milk Coffee'.
 - 20 : 200 won. 'Mocha Coffee'.
- f_Coffee : **value(0..2)**
 - 0 : no output.
 - 1 : 'Milk Coffee'.
 - 2 : 'Mocha Coffee'.

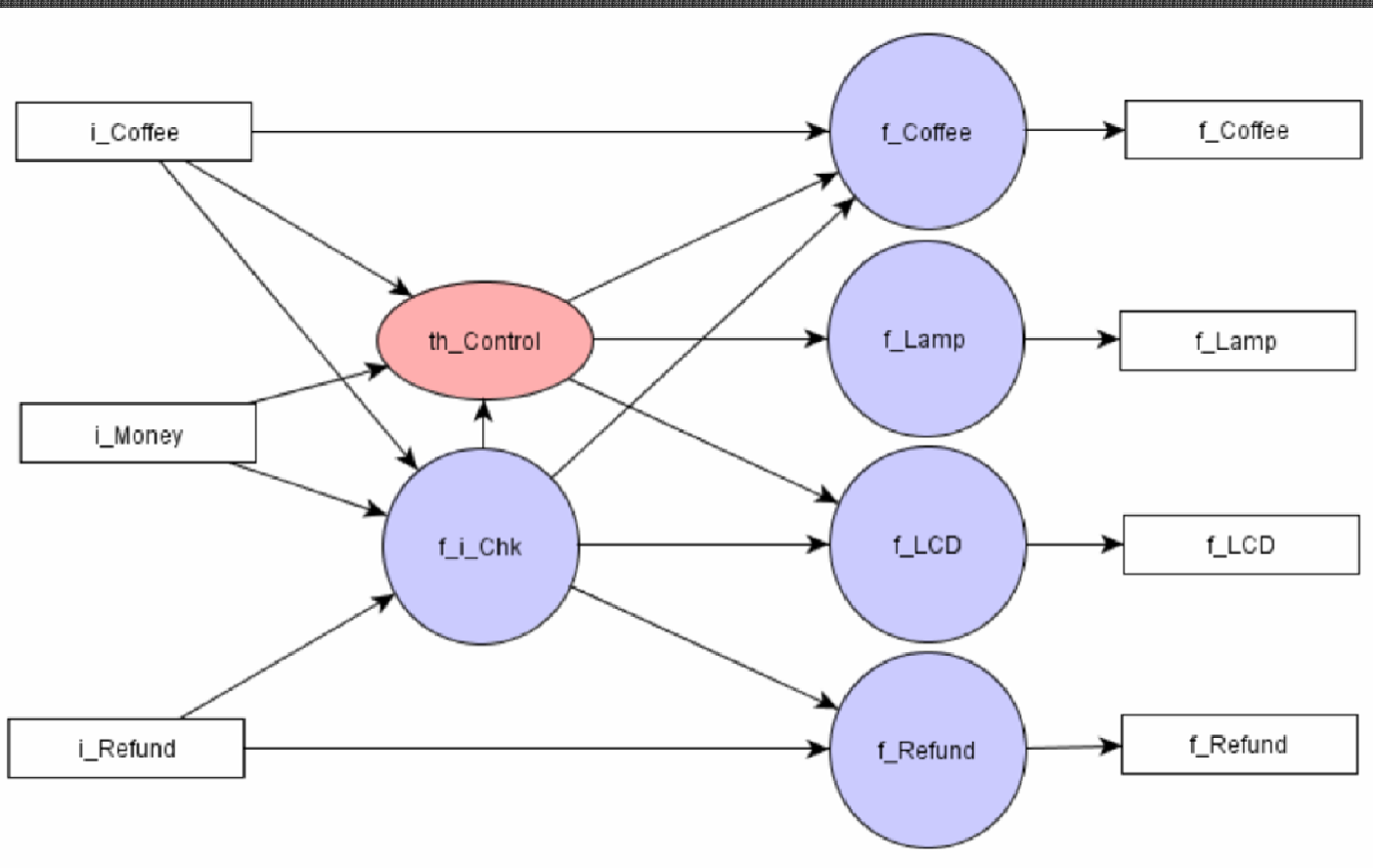


Root



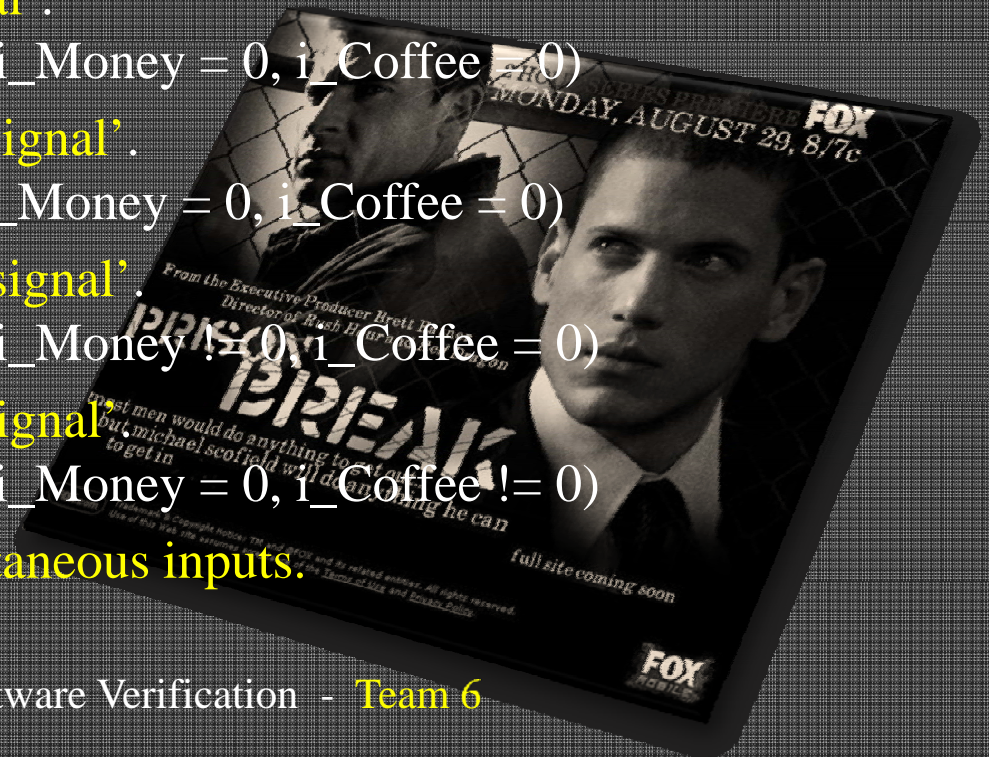
- f_Lamp : **value(0..2)**
 - 0 : all off.
 - 1 : on one. (Milk Coffee)
 - 2 : on both. (Milk Coffee, Mocha Coffee)
- f_LCD : **value(0..300)**
 - 0, 5~300 : printing current money.
 - 1 : printing **'ERROR'**.
- f_Refund : **boolean**
 - false : no signal.
 - true : refund signal.

g_Coffee_Vending



g_Coffee_Vending

- f_i_Chk : value(0.5)
 - 0 : no signal for 5 cycle. = auto refund signal.
 - 1 : check the 'no signal'.
(i_Refund = false, i_Money = 0, i_Coffee = 0)
 - 2 : check the 'refund signal'.
(i_Refund = true, i_Money = 0, i_Coffee = 0)
 - 3 : check the 'money signal'.
(i_Refund = false, i_Money != 0, i_Coffee = 0)
 - 4 : check the 'coffee signal'.
(i_Refund = false, i_Money = 0, i_Coffee != 0)
 - 5 : two or more simultaneous inputs.



g_Coffee_Vending

- th_Control : **value(0..300)**
 - 0~300 : 0~3000 won. **virtual limited.**



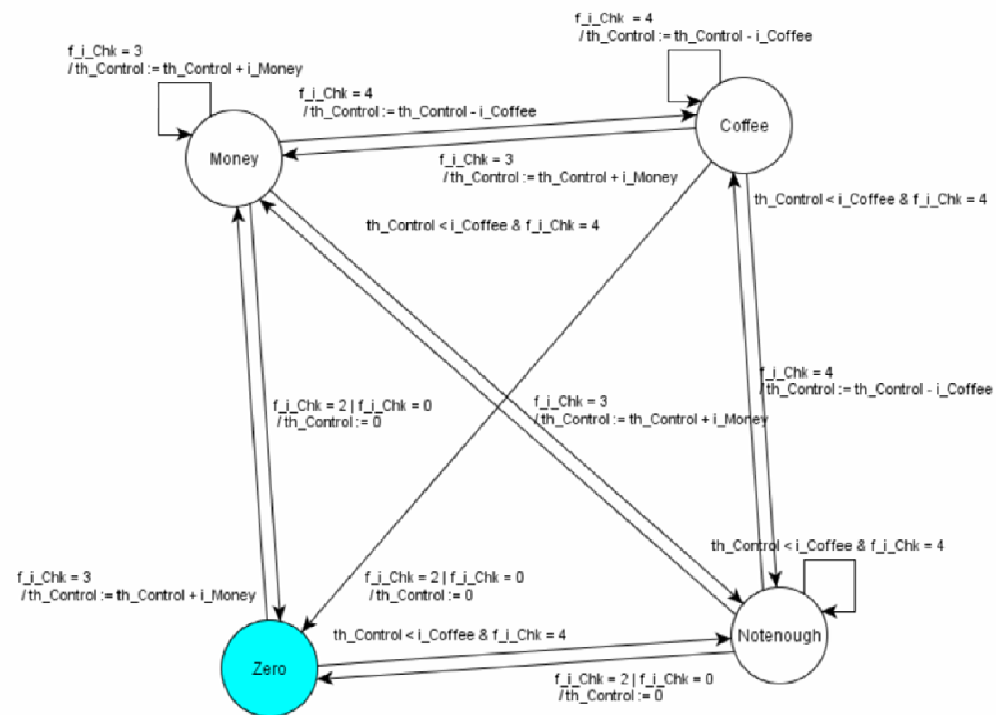


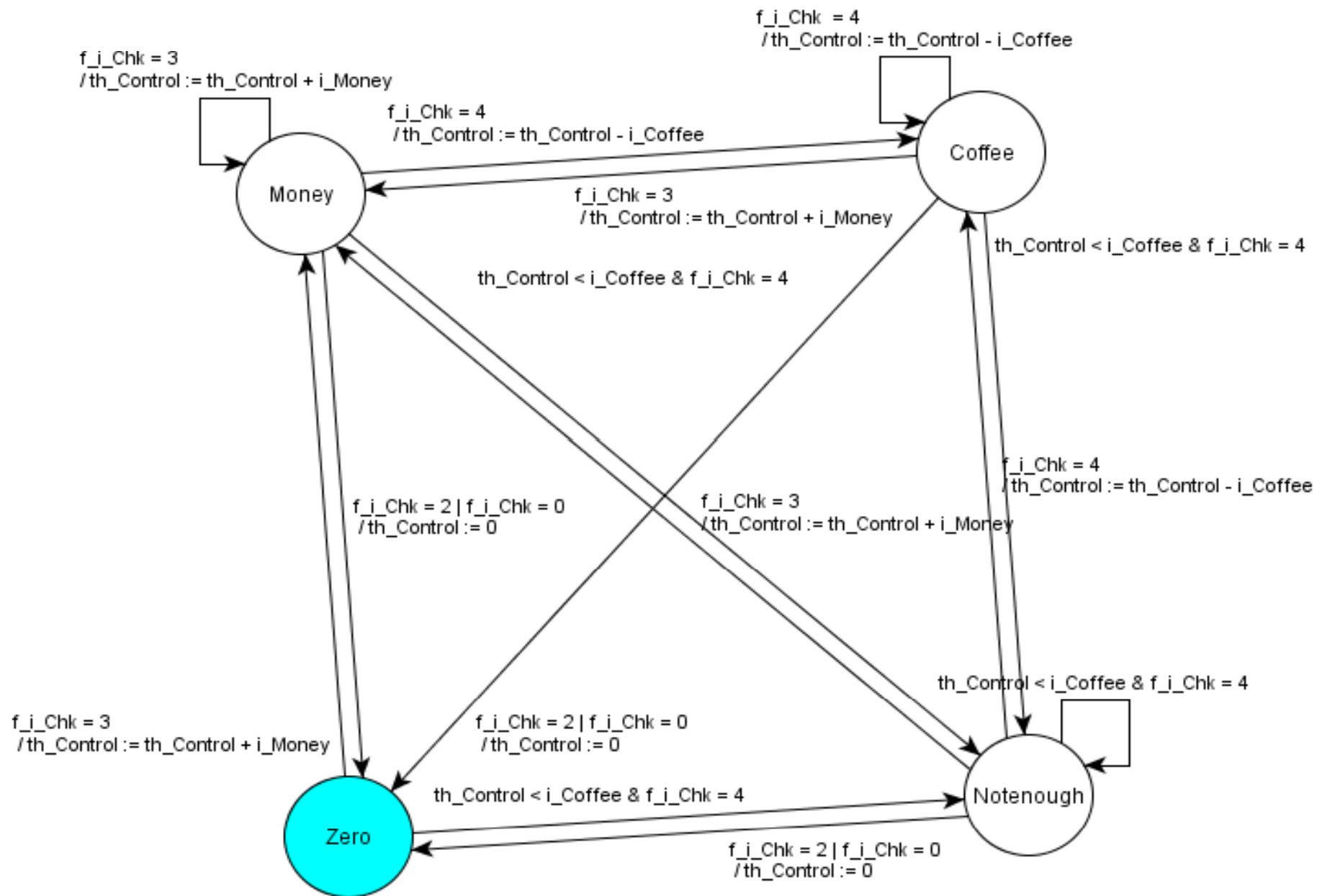
f_i_Chk

Conditions	1	2	3	4	5	6	7	8	9
i_Coffee=0	F	F	F	T	F	T	T	T	T
i_Money=0	F	F	T	F	T	F	T	T	T
i_Refund=0	F	T	F	F	T	T	F	T	T
f_i_Chk_t0 < 2 & f_i_Chk_t1 < 2 & f_i_Chk_t2 < 2 & f_i_Chk_t3 < 2	-	-	-	-	-	-	-	F	T
Action	1	2	3	4	5	6	7	8	9
f_i_Chk := 0									0
f_i_Chk := 1								0	
f_i_Chk := 2							0		
f_i_Chk := 3						0			
f_i_Chk := 4					0				
f_i_Chk := 5	0	0	0	0					

the **Big**
BANG
THEORY

th_Control





f_Coffee



Conditions	1	2	3	4	5
f_i_Chk = 4	T	T	T	T	F
th_Control >= 15	T	F	T	-	-
th_Control >= 20	-	F	T	F	-
i_Coffee = 15	T	T	F	F	-
i_Coffee = 20	F	F	T	T	-
Action	1	2	3	4	5
f_Coffee := 0		0		0	0
f_Coffee := 1	0				
f_Coffee := 2			0		

f_Lamp



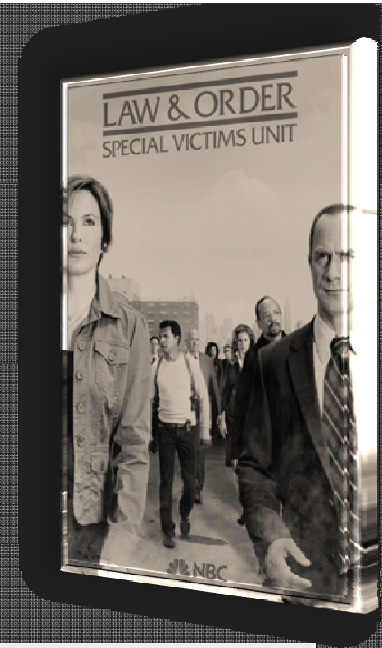
Conditions	1	2	3
th_Control >= 15	F	T	T
th_Control >= 20	F	F	T
Action	1	2	3
f_Lamp := 0	0		
f_Lamp := 1		0	
f_Lamp := 2			0



f_LCD

Conditions	1	2
f_i_Chk = 5	T	F
Action	1	2
f_LCD := 1	0	
f_LCD := th_Control		0

f_Refund



Conditions	1	2	3	4
i_Refund = true	F	F	T	T
f_i_Chk = 0	F	T	F	T
Action	1	2	3	4
f_Refund := 1		0	0	0
f_Refund := 0	0			

SMV verification

Target	Proposition	Results
g_Coffee_Vending	SPEC AG EX 1	true
	SPEC AG(i_Money.i_Money = 0 -> AX f_Coffee.f_Coffee = 1)	false
	SPEC AG(th_Control.th_Control >= 20 & f_i_Chk.f_i_Chk = 4 -> AX !f_Coffee = 0)	true
f_i_Chk	SPEC AG(!i_Coffee = 0 & !i_Money = 0 -> AX f_i_Chk = 5)	true
	SPEC AG(i_Coffee = 20 & i_Money = 0 & i_Refund = 0 -> AX f_i_Chk = 4)	true
	SPEC AG(!(f_i_Chk_t0 < 2 & f_i_Chk_t1 < 2 & f_i_Chk_t2 < 2 & f_i_Chk_t3 < 2) -> AX !f_i_Chk = 0)	true
th_Control	SPEC AG EX 1	true
	SPEC AG(f_i_Chk = 2 -> AX th_Control = 0)	true
	SPEC AG(th_Control = 0 & f_i_Chk = 5 -> AX !th_Control = 0)	false

SMV verification

Target	Proposition	Results
f_Coffee	SPEC AG (!f_i_Chk = 4 -> AX f_Coffee = 0)	true
	SPEC AG (th_Control < 15 -> AX f_Coffee = 1 f_Coffee = 2)	false
	SPEC AG (th_Control = 15 & f_i_Chk=4 & i_Coffee = 15-> AX f_Coffee=1)	true
f_Lamp	SPEC AG((th_Control >= 15)&!(th_Control >= 20) -> AX f_Lamp=1)	true
	SPEC AG((th_Control >= 15)&!(th_Control >= 20) -> AX f_Lamp=2)	false
f_LCD	SPEC AG(f_i_Chk = 5 -> AX f_LCD = 1)	true
f_Refund	SPEC AG(!f_i_Chk = 5 -> AX f_LCD = th_Control)	true
	SPEC AG (i_Refund = 0 & !f_i_Chk = 0 -> AX f_Refund = 0)	true

Any questions?

Thanks!