REPORT

1. MDA-EFSM model for the Vending Machine components

a. A list of meta events for the MDA-EFSM

MDA-EFSM Events:

1. create()
2. insert_cups(int n) // n represents # of cups
3. coin(int f) // f=1: sufficient funds inserted for a drink

   // f=0: not sufficient funds for a drink
4. card()
5. cancel()
6. set_price()
7. dispose_drink(int d) // d represents a drink id
8. additive(int a) // a represents additive id

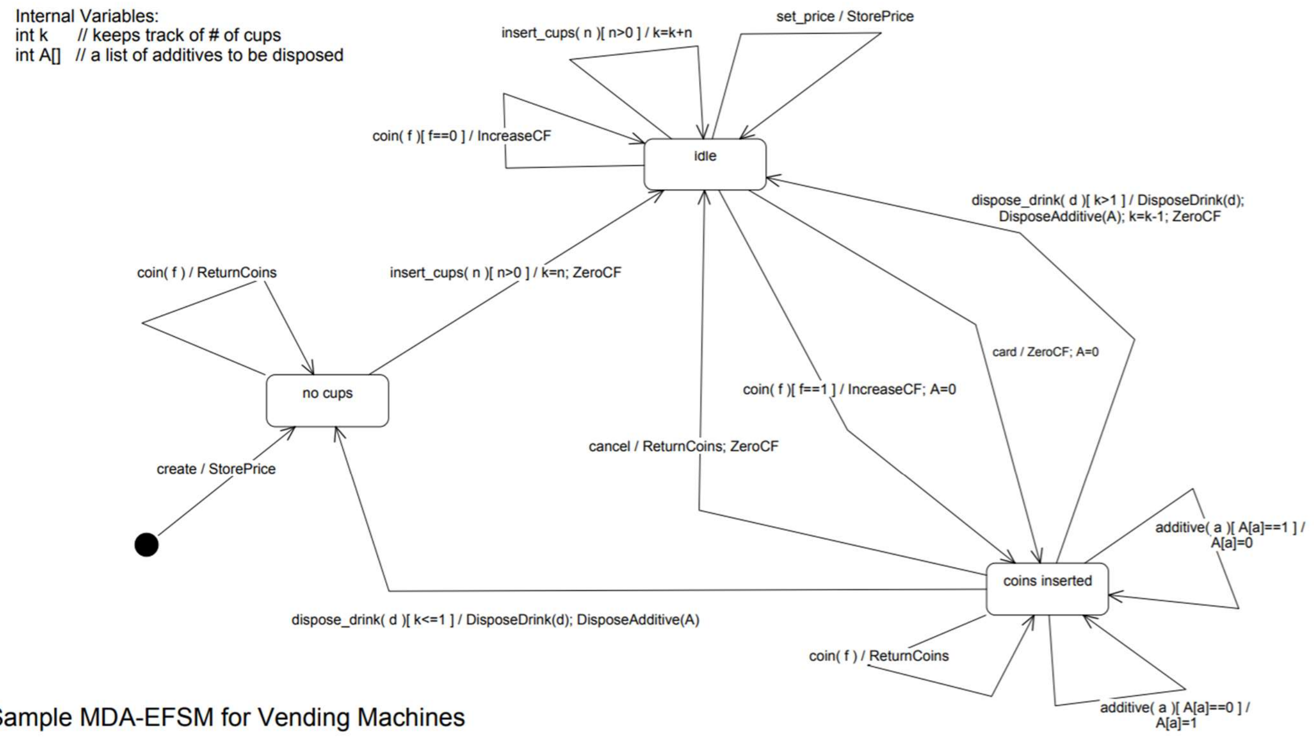
b. A list of meta actions for the MDA-EFSM with their descriptions

MDA-EFSM Actions:

1. StorePrice()
2. ZeroCF() // zero Cumulative Fund cf
3. IncreaseCF() // increase Cumulative Fund cf
4. ReturnCoins() // return coins inserted for a drink
5. DisposeDrink(int d) // dispose a drink with d id
6. DisposeAdditive(int A[]) //dispose marked additives in A list,

   // where additive with i id is disposed when A[i]=1

c. A state diagram of the MDA-EFSM


Internal Variables:
int k // keeps track of # of cups
int A[] // a list of additives to be disposed
insert_cups(n)[n>0] / k=k+n
set_price / StorePrice
coin(f)[f==0] / IncreaseCF
idle
dispose_drink(d)[k>1] / DisposeDrink(d); DisposeAdditive(A); k=k-1; ZeroCF
coin(f) / ReturnCoins
insert_cups(n)[n>0] / k=n; ZeroCF
card / ZeroCF; A=0
coin(f)[f==1] / IncreaseCF; A=0
no cups
cancel / ReturnCoins; ZeroCF
create / StorePrice
additive(a)[A[a]==1] / A[a]=0
coins inserted
dispose_drink(d)[k<=1] / DisposeDrink(d); DisposeAdditive(A)
coin(f) / ReturnCoins
additive(a)[A[a]==0] / A[a]=1

Sample MDA-EFSM for Vending Machines

d. Pseudo-code of all operations of Input Processors of Vending Machines: VM-1 and VM-2

Vending-Machine-1

```
create(int p) {
 d->temp_p=p;
 m->create();
}
coin(int v) {
 d->temp_v=v;
 if (d->cf+v>=d->price) m->coin(1);
else m->coin(0);
}
card(float x) {
 if (x>=d->price) m->card();
}
sugar() {
 m->additive(1);
}
tea() {
 m->dispose_drink(1);
}
chocolate() {
 m->dispose_drink(2);
}
insert_cups(int n) {
 m->insert_cups(n);
}
set_price(int p) {
 d->temp_p=p;
 m->set_price()
}
cancel() {
 m->cancel();
}
```

where,

m: pointer to the MDA-EFSM

d: pointer to the data store DS-1

In the data store:

cf: represents a cumulative fund

price: represents a price for a drink

Vending-Machine-2

```
CREATE(float p) {
 d->temp_p=p;
 m->create();
}
COIN(float v) {
 d->temp_v=v;
 if (d->cf+v>=d->price) m->coin(1);
else m->coin(0);
}
SUGAR() {
 m->additive(2);
}
CREAM() {
 m->additive(1);
}
COFFEE() {
 m->dispose_drink(1);
}
InsertCups(int n) {
m->insert_cups(n);
}
SetPrice(float p) {
 d->temp_p=p;
 m->set_price()
}
CANCEL() {
 m->cancel();
}
```

where,

m: pointer to the MDA-EFSM

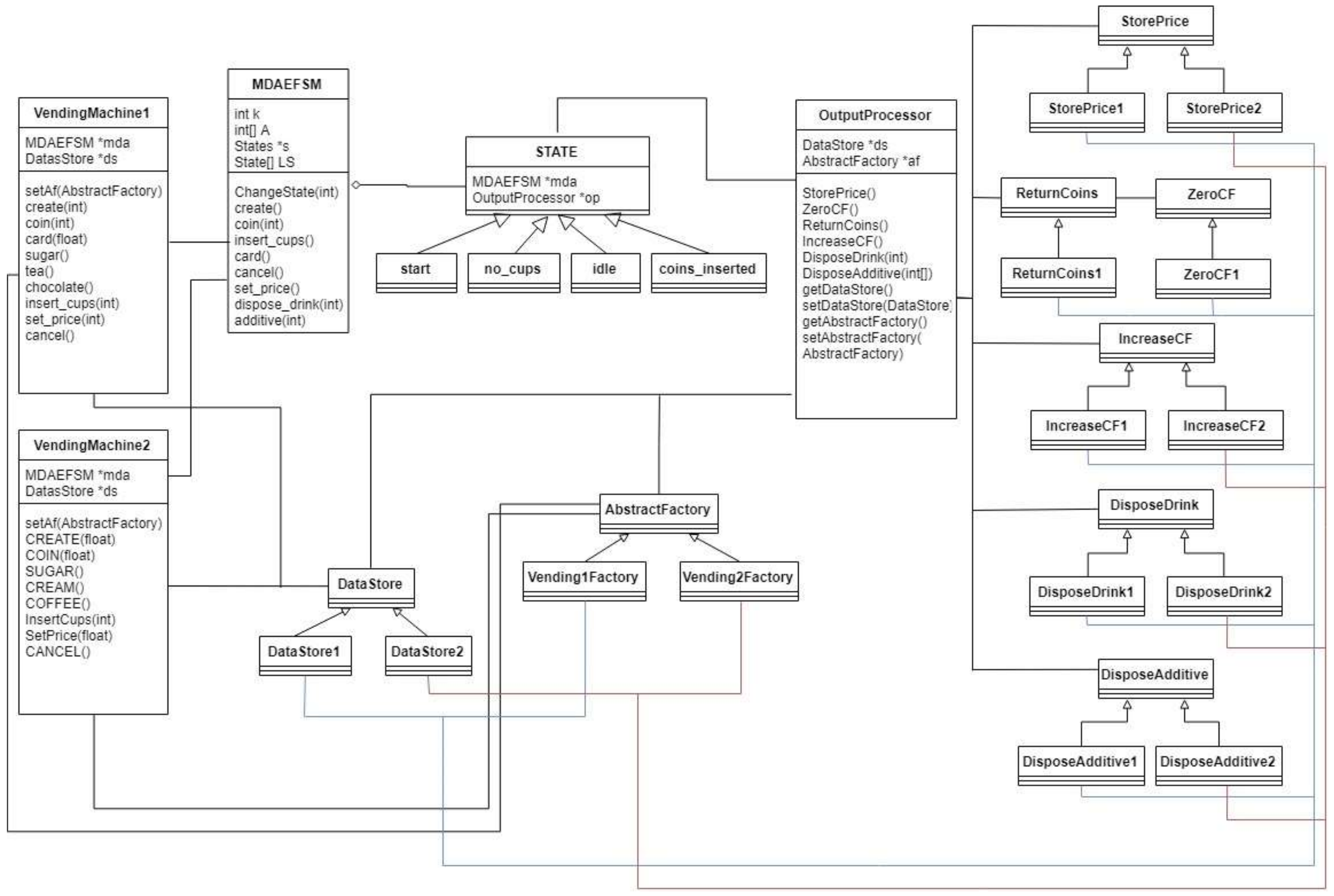
d: pointer to the data store DS-2

In the data store:

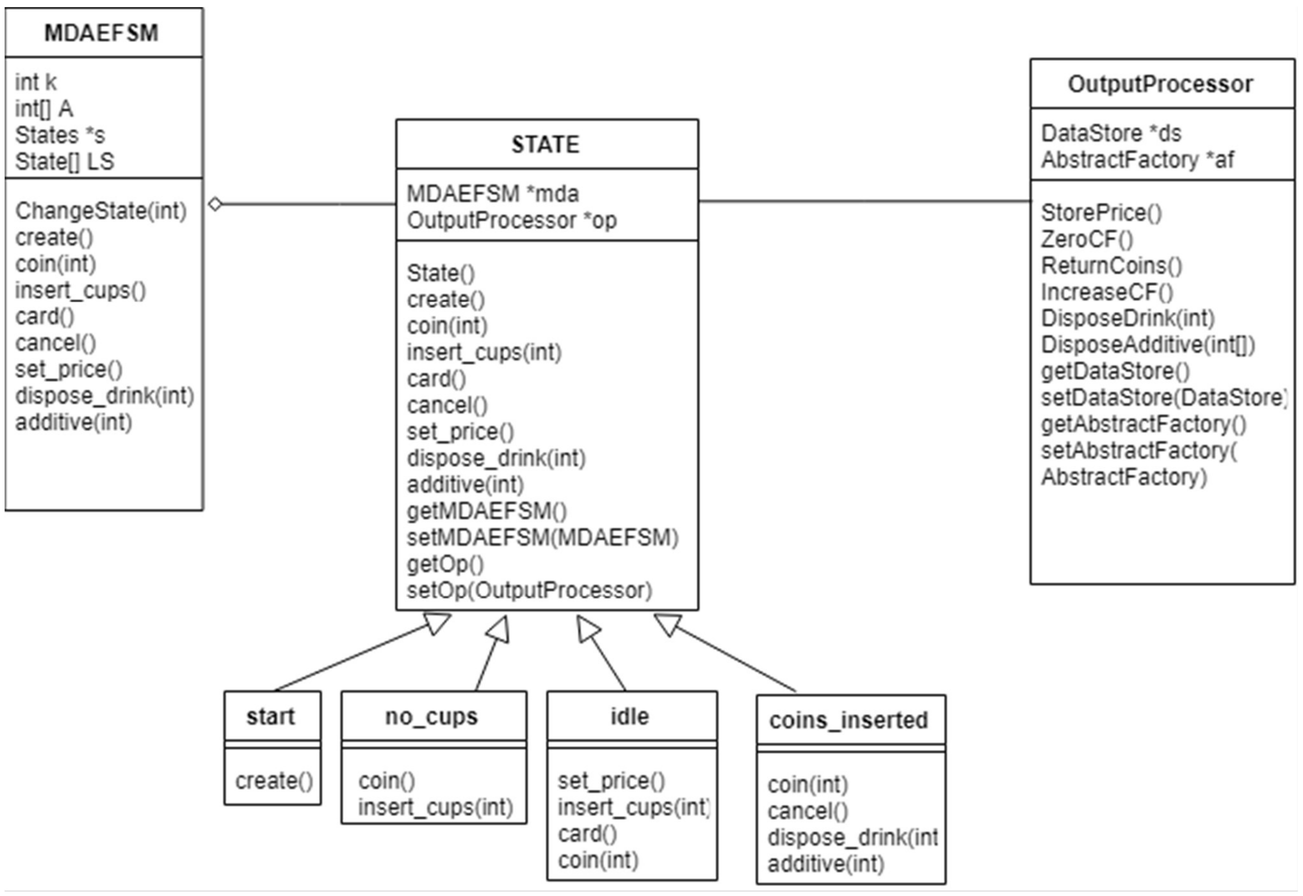
cf: represents a cumulative fund

price: represents a price for a drink

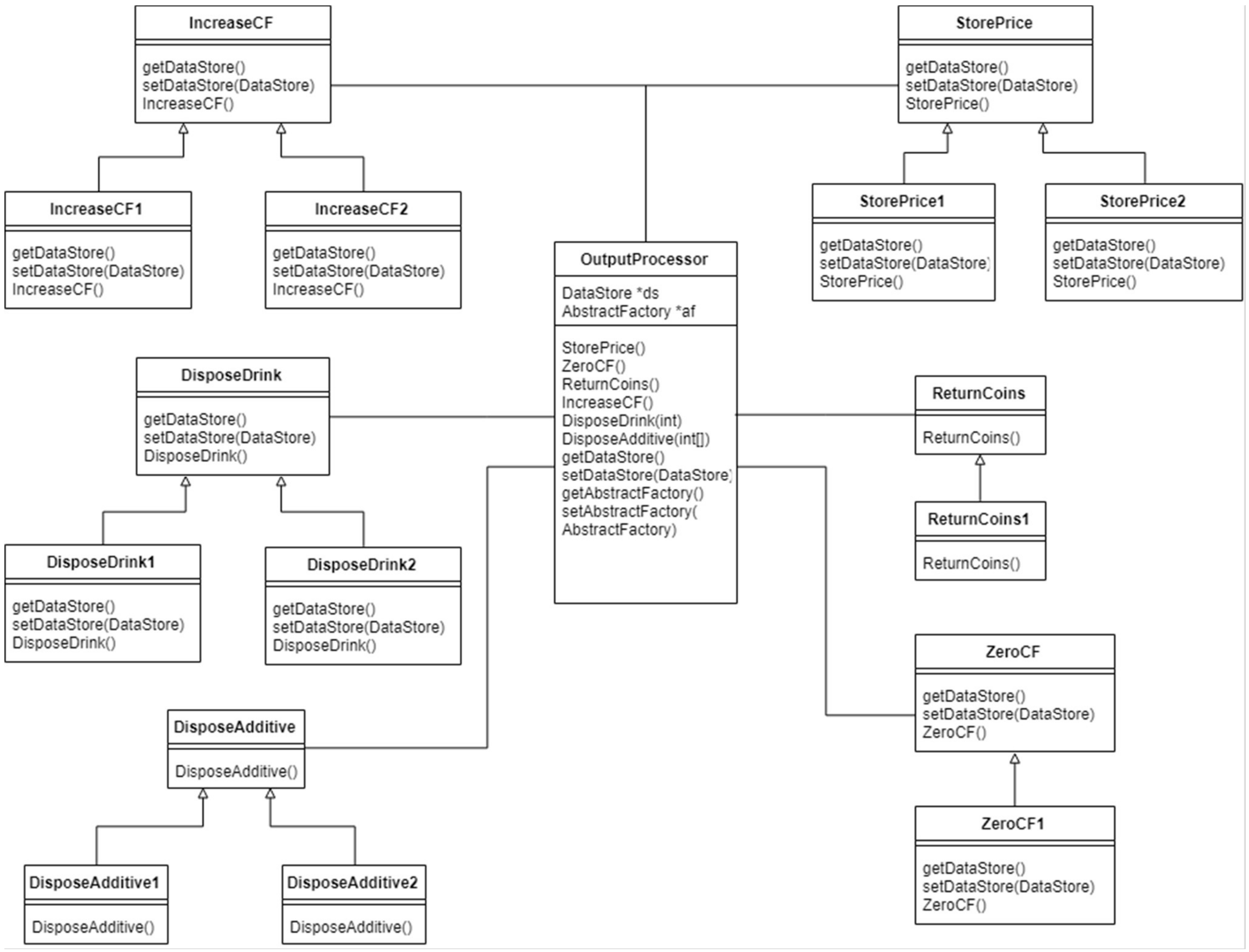
2. Class diagram(s) of the MDA of the Vending Machine components. In your design, you MUST use the following OO design patterns:



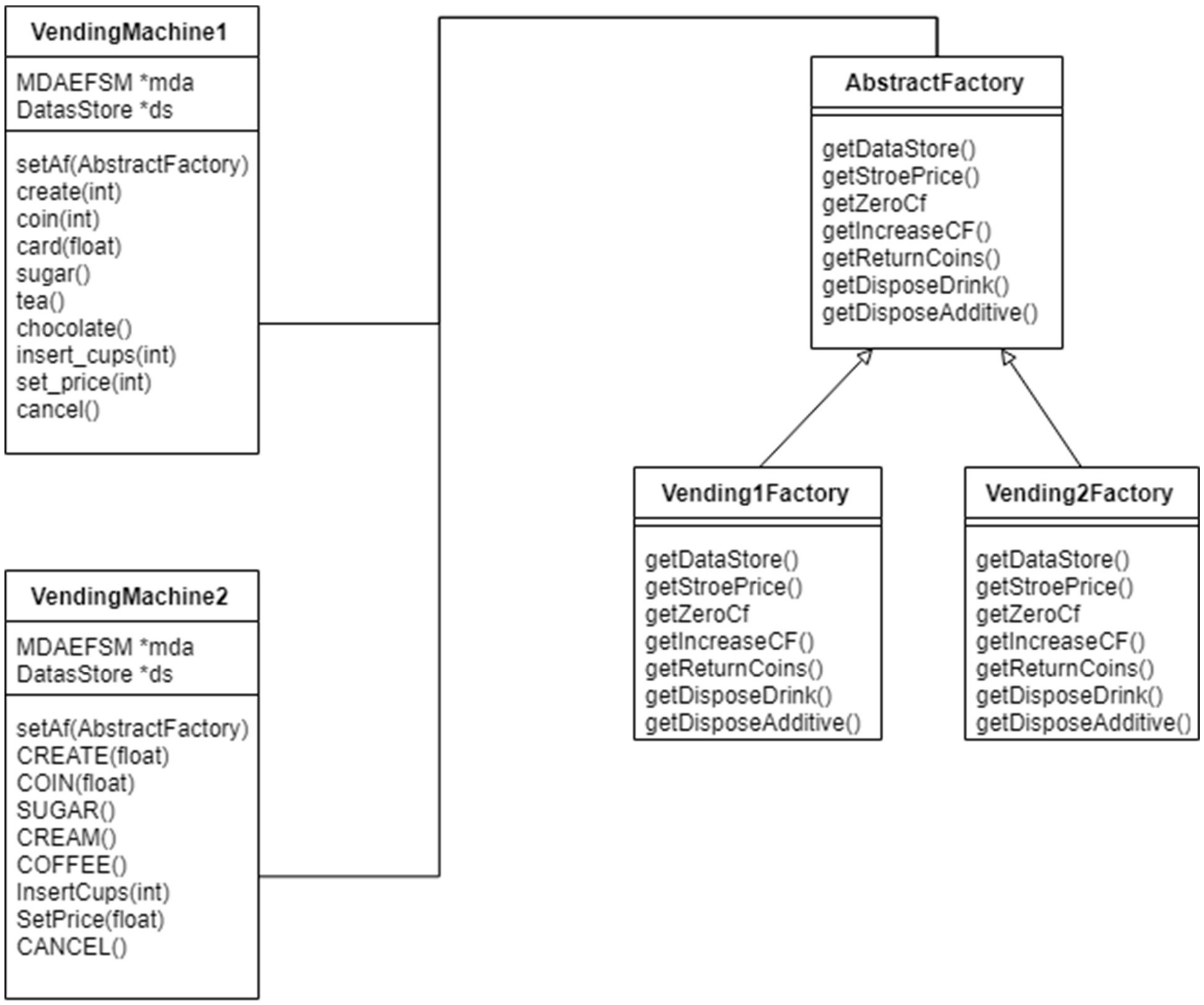
a. State pattern



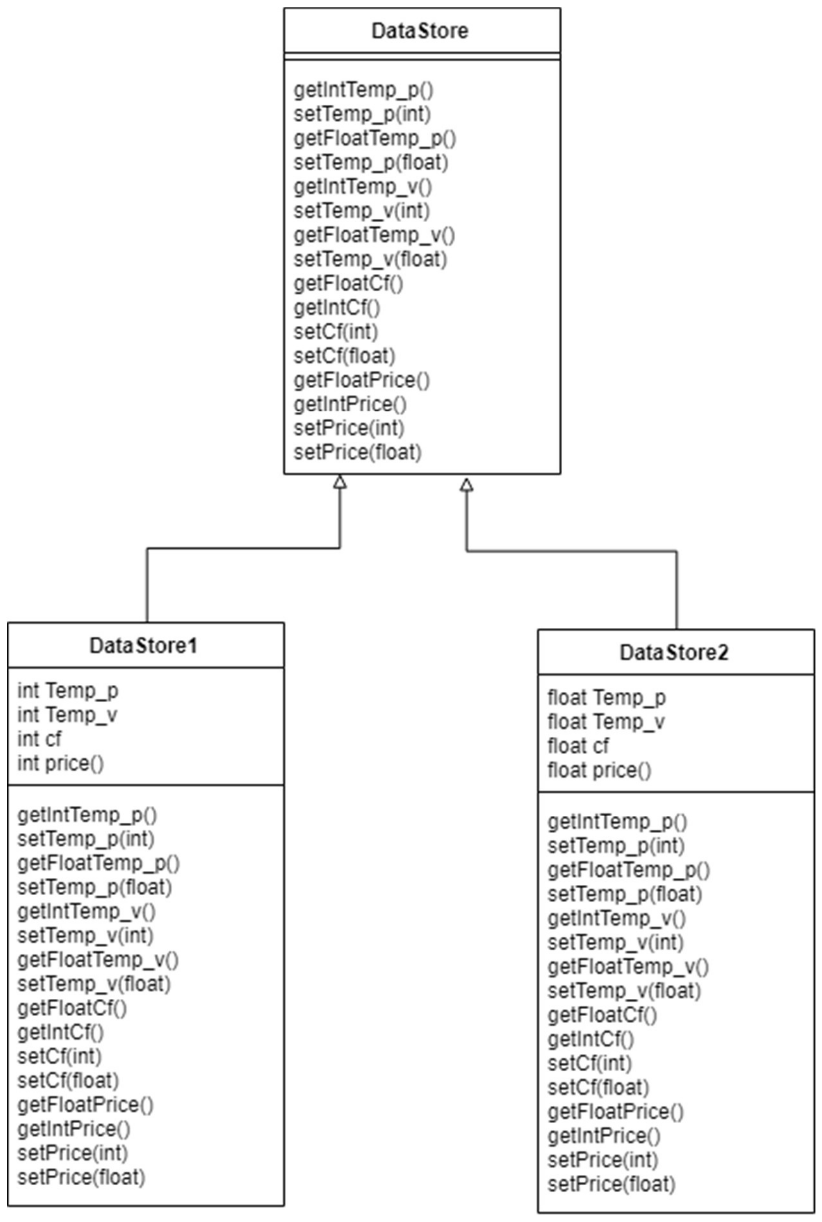
b. Strategy pattern



c. Abstract factory pattern



DataStore


DataStore
getIntTemp_p()
setTemp_p(int)
getFloatTemp_p()
setTemp_p(float)
getIntTemp_v()
setTemp_v(int)
getFloatTemp_v()
setTemp_v(float)
getFloatCf()
getIntCf()
setCf(int)
setCf(float)
getFloatPrice()
getIntPrice()
setPrice(int)
setPrice(float)
DataStore1
int Temp_p
int Temp_v
int cf
int price()
getIntTemp_p()
setTemp_p(int)
getFloatTemp_p()
setTemp_p(float)
getIntTemp_v()
setTemp_v(int)
getFloatTemp_v()
setTemp_v(float)
getFloatCf()
getIntCf()
setCf(int)
setCf(float)
getFloatPrice()
getIntPrice()
setPrice(int)
setPrice(float)
DataStore2
float Temp_p
float Temp_v
float cf
float price()
getIntTemp_p()
setTemp_p(int)
getFloatTemp_p()
setTemp_p(float)
getIntTemp_v()
setTemp_v(int)
getFloatTemp_v()
setTemp_v(float)
getFloatCf()
getIntCf()
setCf(int)
setCf(float)
getFloatPrice()
getIntPrice()
setPrice(int)
setPrice(float)

3. For each class in the class diagram(s) you should:

a. Describe the purpose of the class, i.e., responsibilities.

b. Describe the responsibility of each operation supported by each class.

DRIVER

class Driver	
Purpose	This class allows the user to select VM and perform operations on them.
Methods	
Main(String[] args)	This method allows to user to input different operations that can be performed by the VM.

INPUT PROCESSOR

Class VendingMachine1	
Purpose	This class supports all the operations Vending Machine 1 should provide
Attributes	
MDAFSM *mda	Pointer to MDAEFSM object.
DataStore *ds	Pointer to DataStore object
Methods	
create(int)	This method creates a vending machine and sets the price for the items
coin(int)	This method takes parameter indicating the coins inserted and compares it with the price based on which 2 paths are taken.
card(float)	This method selects card as the method of payment.
sugar()	This method is used to add Sugar as a Additive.
tea()	This method is used to dispose tea.
chocolate()	This method is used to dispose chocolate
insert_cups()	This method is used to insert cups
set_price()	This price is used to override the previously set price value during create
cancel()	This methods used to end any transcations like revoking command after inserting coin.

Class VendingMachine2	
Purpose	This class supports all the operations Vending Machine 2 should provide
Attributes	
MDAFSM *mda	Pointer to MDAEFSM object.
DataStore *ds	Pointer to DataStore object
Methods	
CREATE(float)	This method creates a vending machine and sets the price for the items
COIN(float)	This method takes parameter indicating the coins inserted and compares it with the price based on which 2 paths are taken.
CREAM()	This method is used to add cream as an Additive.
SUGAR()	This method is used to add Sugar as an Additive.
COFFEE()	This method is used to dispose coffee.
InsertCups(int)	This method is used to insert cups
SetPrice(flaot)	This price is used to override the previously set price value during create
CANCEL()	This methods used to end any transcations like revoking command after inserting coin.

MDAEFSM

Class MDAEFSM	
Purpose	This class contains the events which would be triggered by the input processor vm1 and vm2
Attributes	
State *S	Pointer to current state of MDAEFSM.
State[] LS	Stores the objects of different state classes.
Int k	Internal data variable contains number of cups
Int[] A	Contains a array of additives based on which we performs actions later on.
Methods	
ChangeState(int)	This method is used to change state.
create()	This method is used to create and set price.
coin(int)	This method is used to add coins.
insert_cups(int)	This method is used to insert cups
card()	This method id used to pay via card.
cancel()	This method is used to cancel after addition of money
set_price()	This method is used to update the price.
dispose_drink(int)	This method select and dispose particular drink
additive(int)	This method is used to select additive.

Class State	
Purpose	It represents the state for MDAEFSM. It's a abstract class.
Attributes	
MDAEFSM *mda	Pointer to MDAEFSM object.
OutputProcessor *op	Pointer to OutputProcessor class object
Abstract Methods	
create()	This method is used to create and set price.
coin(int)	This method is used to add coins.
insert_cups(int)	This method is used to insert cups
card()	This method id used to pay via card.
cancel()	This method is used to cancel after addition of money
set_price()	This method is used to update the price.
dispose_drink(int)	This method select and dispose particular drink
additive(int)	This method is used to select additive.
Methods	
getMDAEFSM()	This method is used to get MDAEFSM object.
setMDAEFSM(MDAEFSM)	This method is used to set MDAEFSM object
getOp()	This method is used to get OutputProcessor object.
setOp(OutputProcessor)	This method is used to set OutputProcessor object.

Class start	
Purpose	extends of State class and represents start state.
Methods	
create()	Stores the price and changes the state to no_cups

Class no_cups	
Purpose	extends of State class and represents no_cups state.
Methods	
coin(int)	Returns any coins inserted

insert_cup(int)	If parameter is > 0 store the number of cups set cf to 0 and change state to idle.

Class idle	
Purpose	extends of State class and represents idle state.
Methods	
set_price()	Stores the price value
Insert_cups(int)	If the parameter is positive we add it to the no of cups stored before
Card()	Set cf to zero and changes state to coins_inserted
Coin(int)	If argv is 1 increase cf create an array for additives and change states to coins_inserted

Class coins_inserted	
Purpose	extends of State class and represents coins_inserted state.
Methods	
coin(int)	Returns any coins inserted
cancel()	Changes state to idle
dispose_drink(int)	Disposes drink with additive and changes the state based on number of cups.
additive(int)	Sets the particular additive to 1 if 0 or otherwise

Class AbstractFactory	
Purpose	This is a abstract class is used to create DataStore and actions objects. Abstract Factory design pattern.
Abstract Method	
getDataStore()	This is an abstract method to create and return DataStore object
getStorePrice()	This is an abstract method to create and return StorePrice object (OutputProcessor)
getZeroCf()	This is an abstract method to create and return ZeroCF object (OutputProcessor)
getIncreaseCf()	This is an abstract method to create and return IncreaseCF object (OutputProcessor)
getReturnCoins()	This is an abstract method to create and return ReturnCoins object (OutputProcessor)
getDisposeDrink()	This is an abstract method to create and return DisposeDrink object (OutputProcessor)
getDisposeAdditive()	This is an abstract method to create and return DisposeAdditive object (OutputProcessor)

Class Vending1Factory	Concreate Factory
Purpose	This class is used to create the data store and actions objects for VendingMachine1
Method	
getDataStore()	This is an method to create and return DataStore object
getStorePrice()	This is an method to create and return StorePrice object (OutputProcessor)
getZeroCf()	This is an method to create and return ZeroCF object (OutputProcessor)
getIncreaseCf()	This is an method to create and return IncreaseCF object (OutputProcessor)
getReturnCoins()	This is an method to create and return ReturnCoins object (OutputProcessor)
getDisposeDrink()	This is an method to create and return DisposeDrink object (OutputProcessor)
getDisposeAdditive()	This is an method to create and return DisposeAdditive object (OutputProcessor)

Class Vending2Factory	Concreate Factory

Purpose	This class is used to create the data store and actions objects for VendingMachine2
Method	
getDataStore()	This is an method to create and return DataStore object
getStorePrice()	This is an method to create and return StorePrice object (OutputProcessor)
getZeroCf()	This is an method to create and return ZeroCF object (OutputProcessor)
getIncreaseCf()	This is an method to create and return IncreaseCF object (OutputProcessor)
getReturnCoins()	This is an method to create and return ReturnCoins object (OutputProcessor)
getDisposeDrink()	This is an method to create and return DisposeDrink object (OutputProcessor)
getDisposeAdditive()	This is an method to create and return DisposeAdditive object (OutputProcessor)

Class DataStore	
Purpose	This is an abstract class and is used to store platform dependent data.
Method	
getIntTemp_p()	This is abstract method to get the value of temporary variable int temp_p.
setTemp_p(int)	This is abstract method to set the value of temporary variable int temp_p.
getFloatTemp_p()	This is abstract method to get the value of temporary variable float temp_p.
setTemp_p(float)	This is abstract method to set the value of temporary variable float temp_p.
getIntTemp_v()	This is abstract method to get the value of temporary variable int temp_v
setTemp_v(int)	This is abstract method to set the value of temporary variable int temp_v.
getFloatTemp_v()	This is abstract method to get the value of temporary variable float temp_v.
setTemp_v(float)	This is abstract method to set the value of temporary variable float temp_v.
getFloatCf()	This is abstract method to get the value of float cf.
getIntCf()	This is abstract method to get the value of int cf.
setCf(int)	This is abstract method to set the value of int cf.
setCf(float)	This is abstract method to set the value of float cf.
getFloatPrice()	This is abstract method to get the value of float price
getIntPrice()	This is abstract method to get the value of int price.
setPrice(int)	This is abstract method to set the value of int Price
setPrice(float)	This is abstract method to set the value of float Price

Class DataStore1	
Purpose	This class is used to store platform dependent data for vm1
Method	
getIntTemp_p()	This method is used to get the value of temporary variable int temp_p.
setTemp_p(int)	This method is used to set the value of temporary variable int temp_p.
getIntTemp_v()	This method is used to get the value of temporary variable int temp_v.
setTemp_v(int)	This method is used to set the value of temporary variable int temp_v.
getIntCf()	This method is used to get the value of variable int Cf.
setCf(int)	This method is used to set the value of variable int Cf.
getIntPrice()	This method is used to get the value of variable int price.
setPrice(int)	This method is used to set the value of variable int price.

Class DataStore2	
Purpose	This class is used to store platform dependent data for vm2

Method	
getFloatTemp_p()	This method is used to get the value of temporary variable float temp_p.
setTemp_p(float)	This method is used to set the value of temporary variable float temp_p.
getFloatTemp_v()	This method is used to get the value of temporary variable float temp_v.
setTemp_v(float)	This method is used to set the value of temporary variable float temp_v.
getFloatCf()	This method is used to get the value of variable float Cf.
setCf(float)	This method is used to set the value of variable float Cf.
getFloatPrice()	This method is used to get the value of variable float price.
setPrice(float)	This method is used to set the value of variable float price.

Class OutputProcessor	
Purpose	This class is the Output processor which is used to execute actions called by the mdaefsm.
Attributes	

private DataStore ds;
private AbstractFactory af;
private StorePrice StorePrice;
private ZeroCF ZeroCF;
private ReturnCoins ReturnCoins;
private IncreaseCF IncreaseCF;
private DisposeDrink DisposeDrink;
private DisposeAdditive DisposeAdditive;
	pointer to DataStore
	pointer to AbstractFactory
	pointer to StorePrice
	pointer to ZeroCF
	pointer to ReturnCoins
	pointer to IncreaseCF
	pointer to DisposeDrink
	pointer to DisposeAdditive

Methods	
StorePrice()	This method creates StorePrices object using AbstractFactory class and It executes the storePrices() method of StorePrices class.
ZeroCF()	This method creates ZeroCf object using AbstractFactory class and It executes the ZeroCF() method of ZeroCf class.
ReturnCoins()	This method creates ReturnCoinobject using AbstractFactory class and It executes the ReturnCoin () method of ReturnCoinclass.
IncreaseCf()	This method creates IncreaseCf object using AbstractFactory class and It executes the IncreaseCf () method of IncreaseCf class.
DisposeDrink(int)	This method creates DisposeDrink object using AbstractFactory class and It executes the DisposeDrink () method of DisposeDrink class.
DisposeAdditive(int)	This method creates DisposeAdditive object using AbstractFactory class and It executes the DisposeAdditive () method of DisposeAdditive class.
getDataStore()	Get DataStore object
setDataStore(DataStore)	set DataStore object
getAbstractFactory()	Get AbstractFactory object
setAbstractFactory(AbstractFactory)	set AbstractFactory object

Class StorePrice	
Purpose	Interface class to store price
Attributes	
DataStore *ds	Pointer to DataStore
Method	
StorePrice()	This is an Interface method for storing price.
getDataStore()	Get DataStore object
setDataStore(DataStore ds)	set DataStore object

Class StorePrice1	
Purpose	This class implements StorePrice
Method	
StorePrice()	This method is used for storing the integer price

Class StorePrice2	
Purpose	This class implements StorePrice
Method	
StorePrice()	This method is used for storing the float price

Class ReturnCoins	Interface class to return coins
Purpose	
Method	
ReturnCoins()	Interface metod for returning coins

Class ReturnCoins1	This class implements ReturnCoins
Purpose	
Method	
ReturnCoins()	Displays a message to return coins

Class IncreaseCF	Interface class to increasecf
Purpose	
Attributes	
DataStore *ds	Pointer to DataStore
Method	
IncreaseCF ()	This Interface method is used to increase cf
getDataStore()	Get DataStore object
setDataStore(DataStore ds)	set DataStore object

Class IncreaseCF1	
Purpose	This class implemets IncreaseCF
Method	

IncreaseCF ()	This methods adds the coins to cumulative funds integers only.
getDataStore()	Get DataStore object
setDataStore(DataStore ds)	set DataStore object

Class IncreaseCF2	
Purpose	This class implemets IncreaseCF
Method	
IncreaseCF ()	This methods adds the coins to cumulative funds float.
getDataStore()	Get DataStore object
setDataStore(DataStore ds)	set DataStore object

Class ZeroCF	Interface class to ZeroCF
Purpose	
Method	
ZeroCF ()	Interface method to set cf to 0

Class ZeroCF1	This class implemets ZeroCF
Purpose	
Method	
ZeroCF ()	This method reads the value of cf from the datastore and sets it to 0

Class DisposeDrink	Interface class to DisposeDrink
Purpose	
Method	
DisposeDrink (int)	Interface method to dispose drink

Class DisposeDrink1	
Purpose	Implements DisposeDrink
Method	
DisposeDrink (int)	Based on the integer passed a drink to disposed

Class DisposeDrink2	
Purpose	Implements DisposeDrink
Method	
DisposeDrink (int)	Based on the integer passed a drink to disposed

Class DisposeAdditive	Interface class to DisposeAdditive
Purpose	
Method	
DisposeAdditive (int[])	Interface method to dispose additive

Class DisposeAdditive1	This class implements from DisposeAdditive
Purpose	
Method	
DisposeAdditive (int[])	Based on the items chosen in array different additives are added.

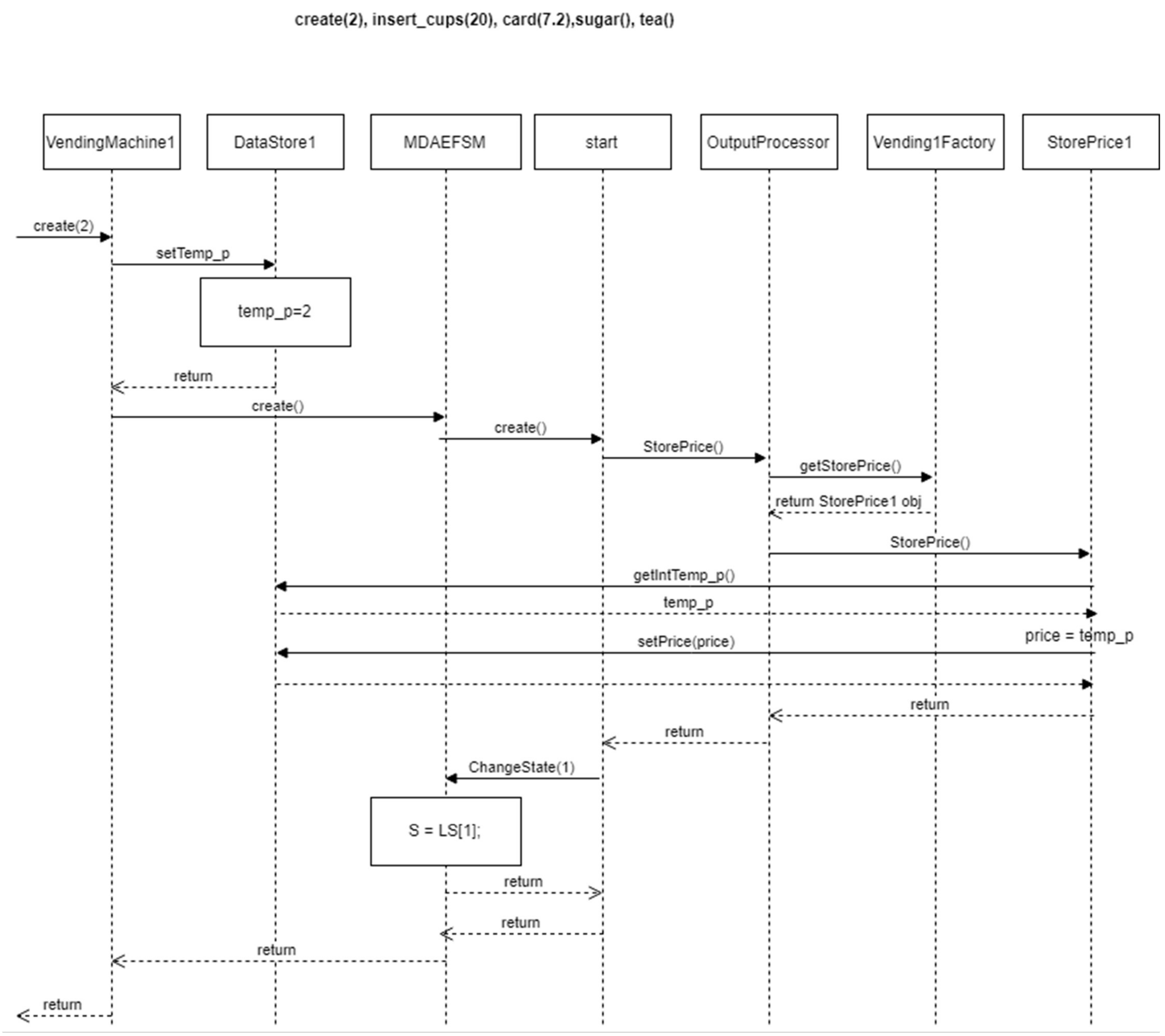
Class DisposeAdditive2	This class implements from DisposeAdditive
Purpose	
Method	
DisposeAdditive (int[])	Based on the items chosen in array different additives are added.

4. Dynamics. Provide two sequence diagrams for two Scenarios:

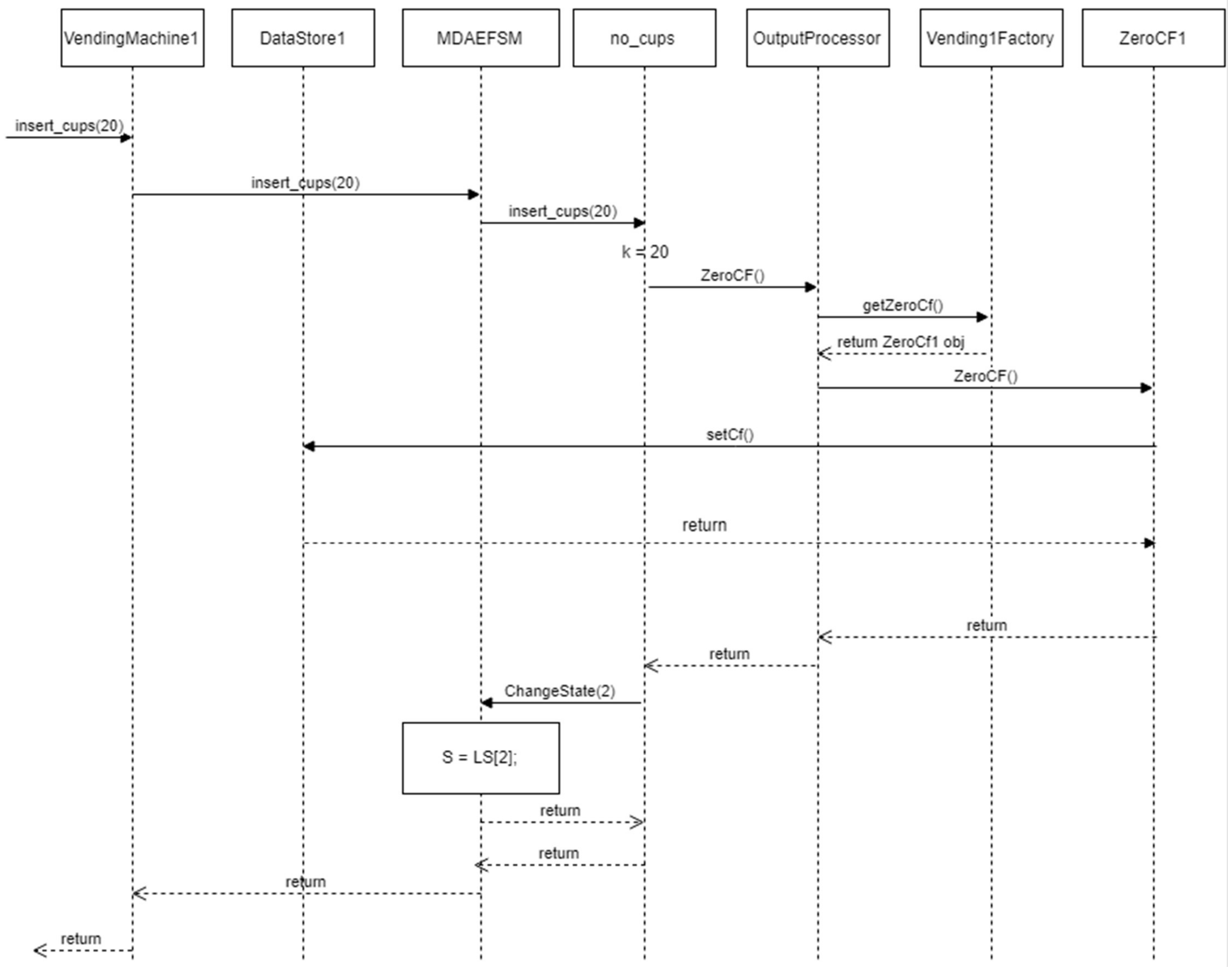
a. Scenario-I should show as to how the cup of tea is disposed in the Vending Machine VM-1

component, i.e., the following sequence of operations is issued:

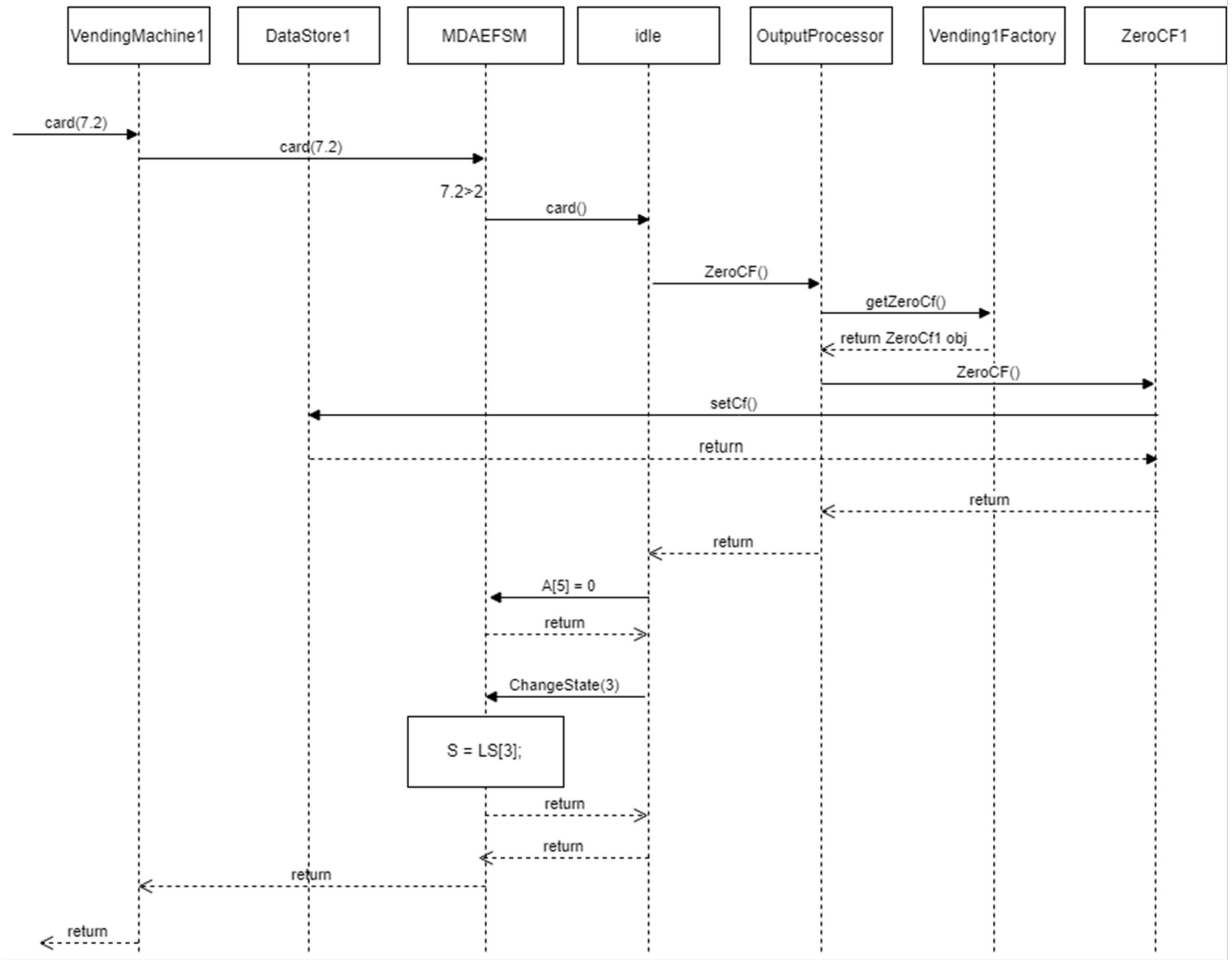
create(2), insert_cups(20), card(7.2), sugar(), tea()

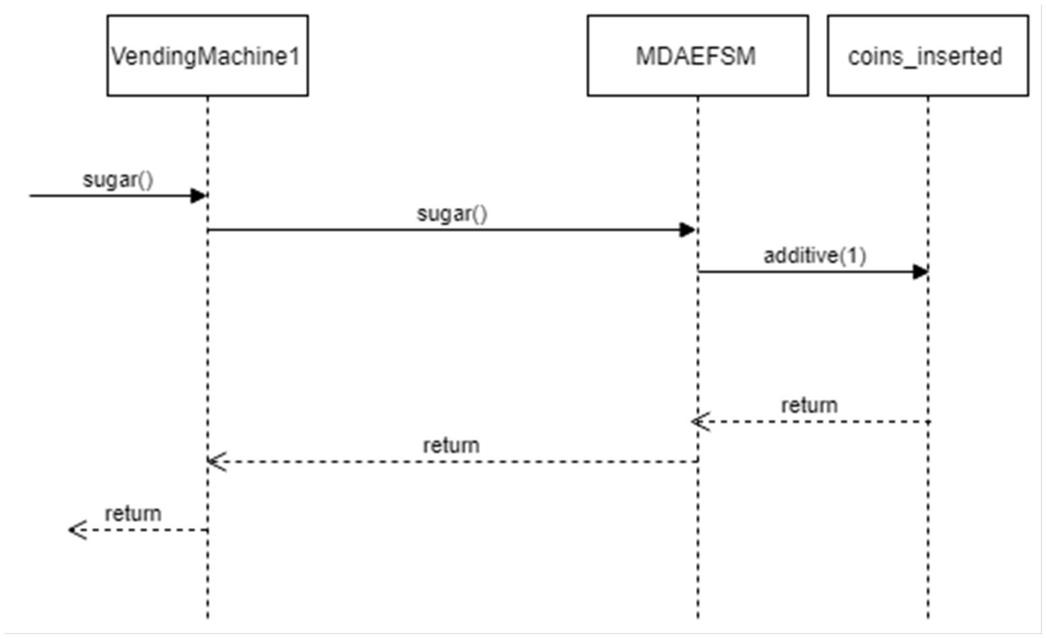


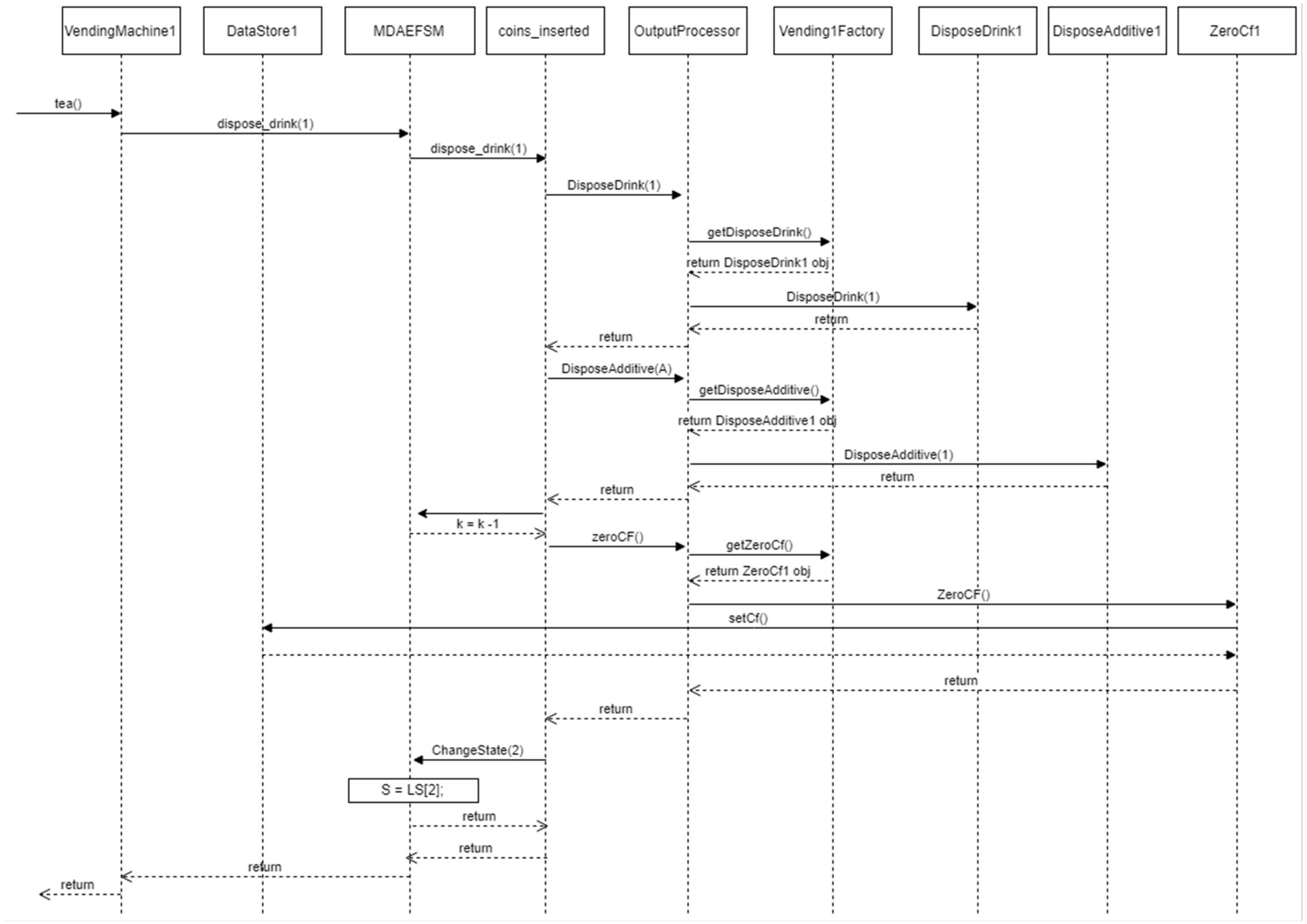
insert_cups(20)



card(7.2),


VendingMachine1
DataStore1
MDAEFSM
idle
OutputProcessor
Vending1Factory
ZeroCF1
card(7.2)
card(7.2)
7.2>2
card()
ZeroCF()
getZeroCf()
return ZeroCf1 obj
ZeroCF()
setCf()
return
return
return
A[5] = 0
return
ChangeState(3)
S = LS[3];
return
return
return
return

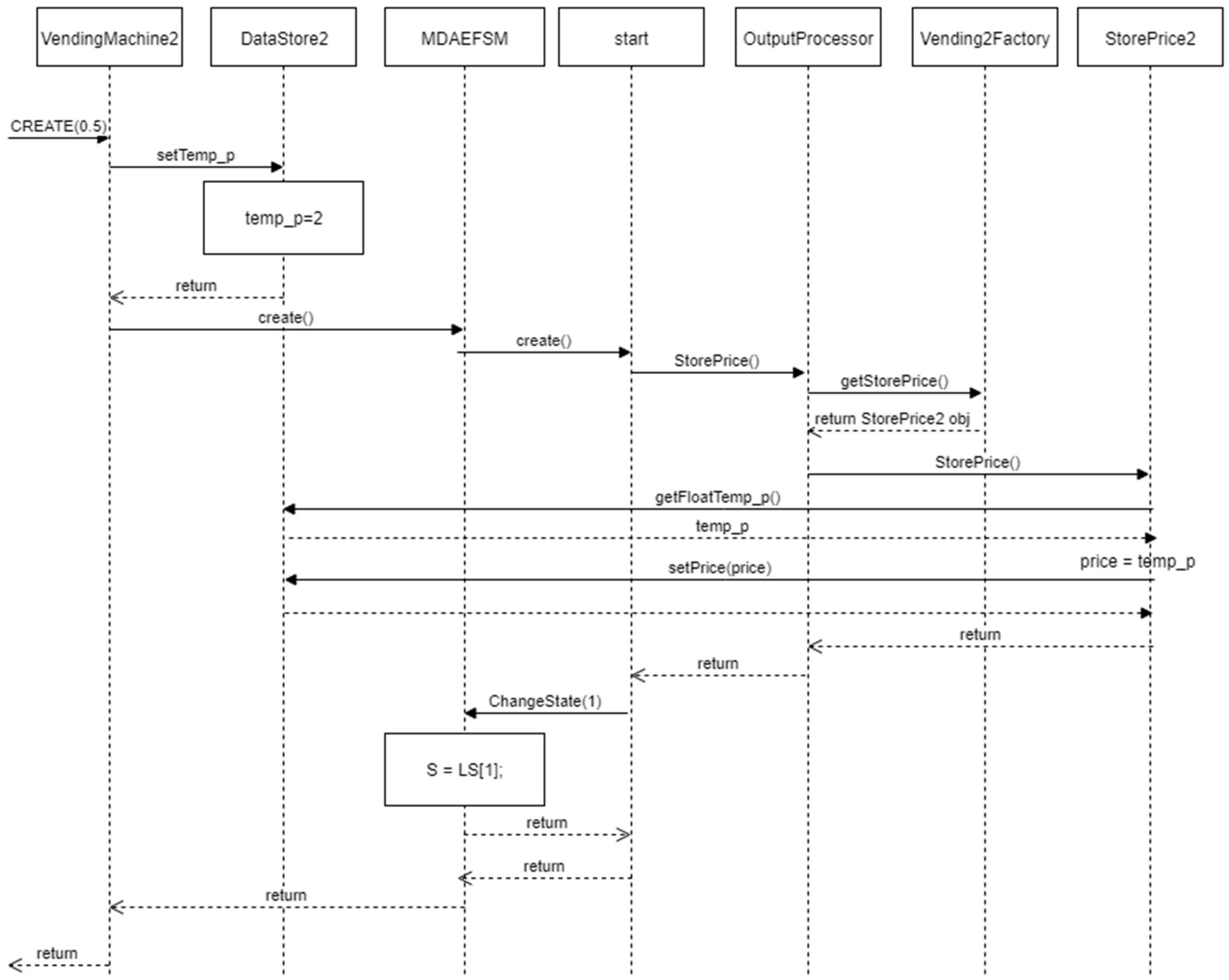

VendingMachine1
MDAEFSM
coins_inserted
sugar()
sugar()
additive(1)
return
return
return


VendingMachine1
DataStore1
MDAEFSM
coins_inserted
OutputProcessor
Vending1Factory
DisposeDrink1
DisposeAdditive1
ZeroCf1
tea()
dispose_drink(1)
dispose_drink(1)
DisposeDrink(1)
getDisposeDrink()
return DisposeDrink1 obj
DisposeDrink(1)
return
return
DisposeAdditive(A)
getDisposeAdditive()
return DisposeAdditive1 obj
DisposeAdditive(1)
return
return
k = k -1
zeroCF()
getZeroCf()
return ZeroCf1 obj
ZeroCF()
setCf()
return
return
ChangeState(2)
S = LS[2];
return
return
return
return

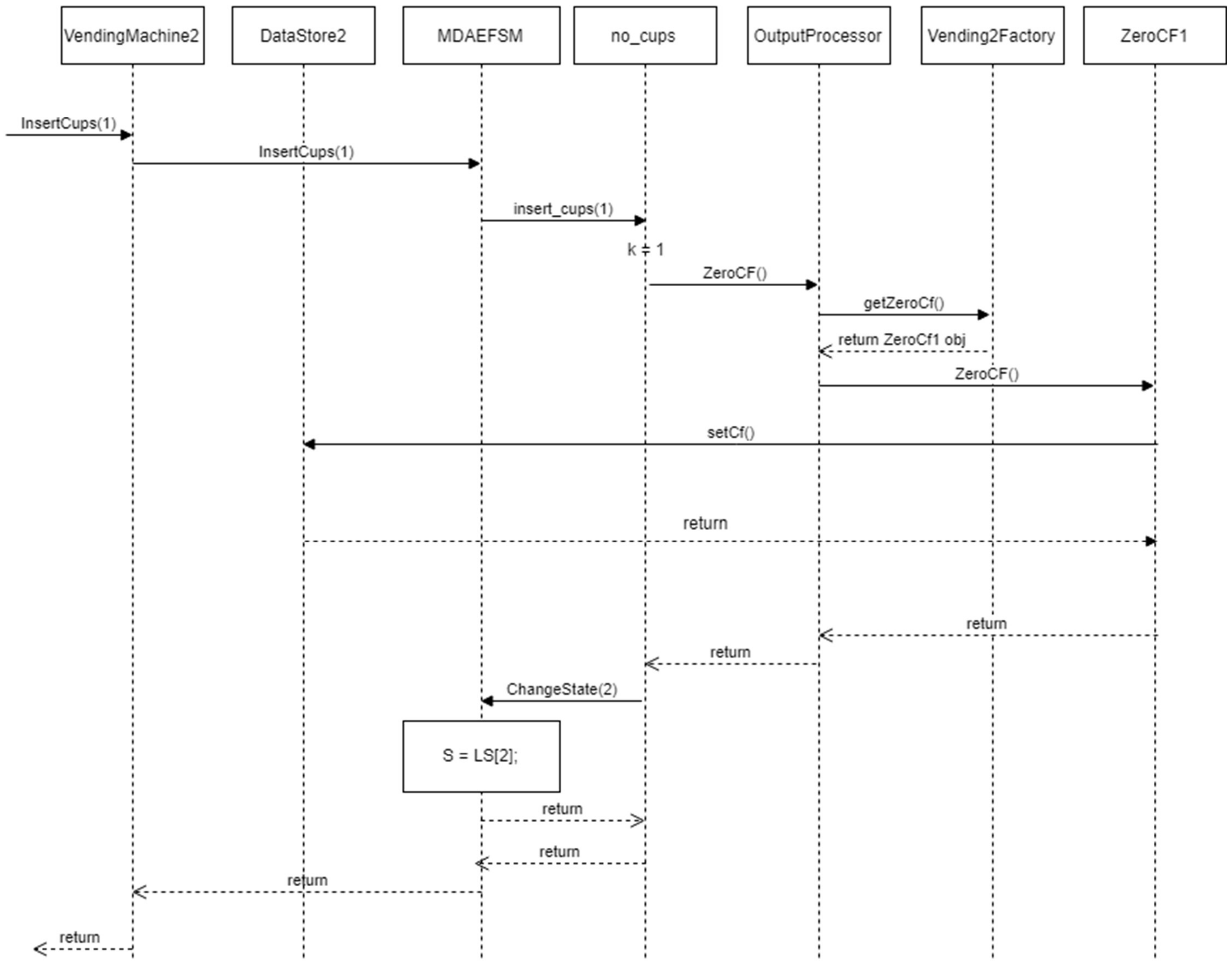
b. Scenario-II should show as to how a cup of coffee is disposed in the Vending Machine VM-2 component, i.e., the following sequence of operations is issued:

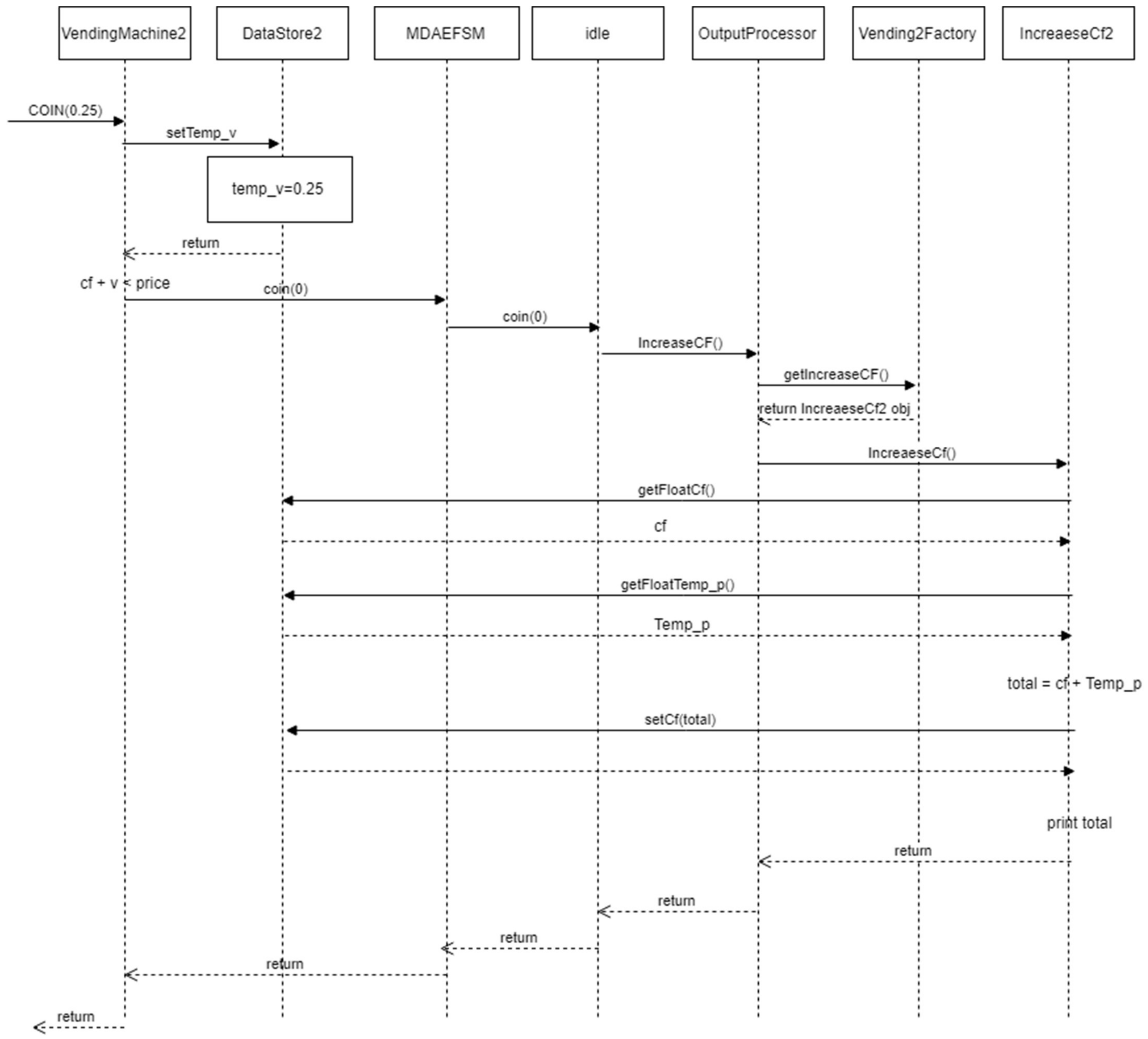
CREATE(0.5), InsertCups(1), COIN(0.25), COIN(0.25), CREAM(), COFFEE()

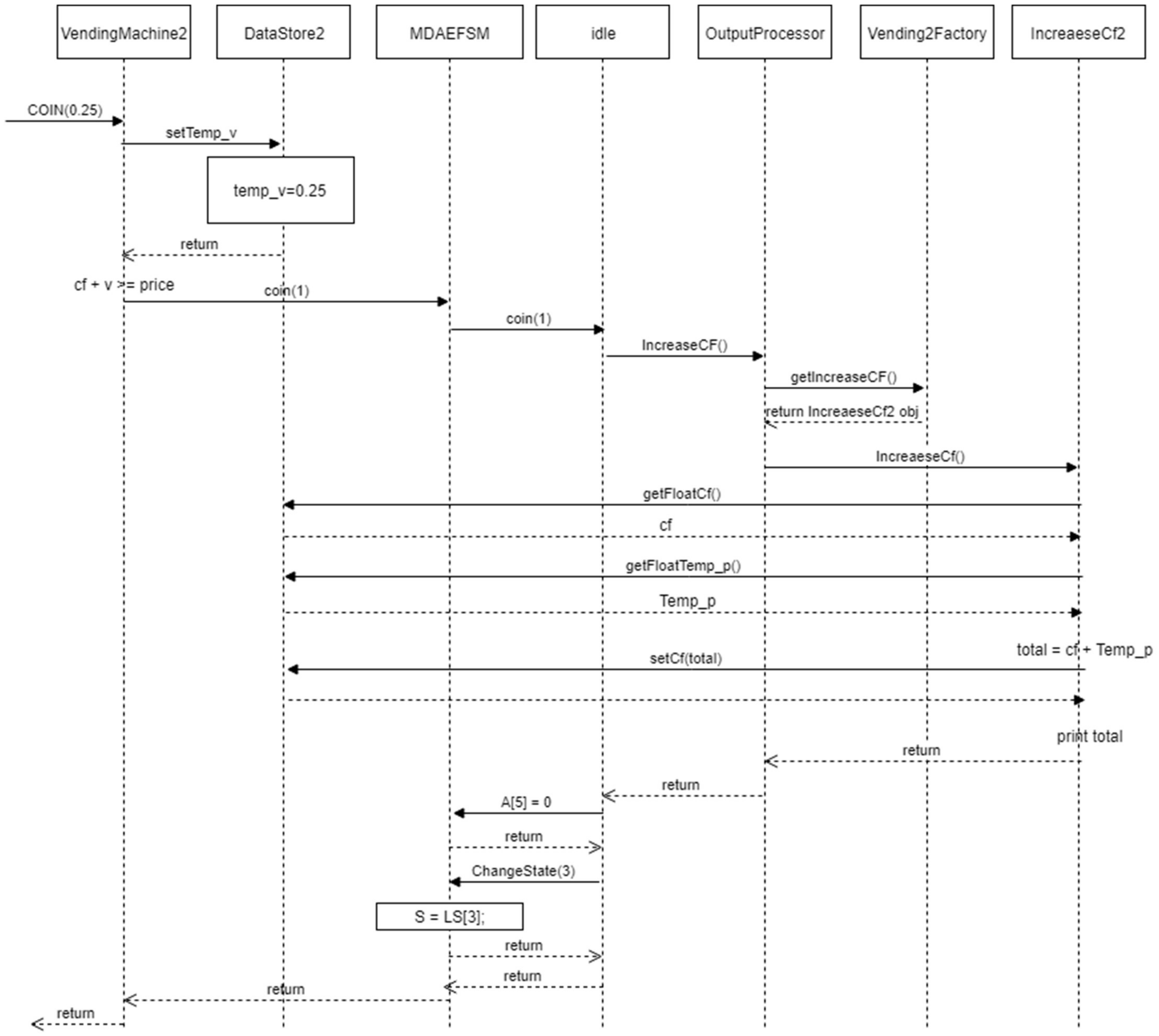
CREATE(0.5)

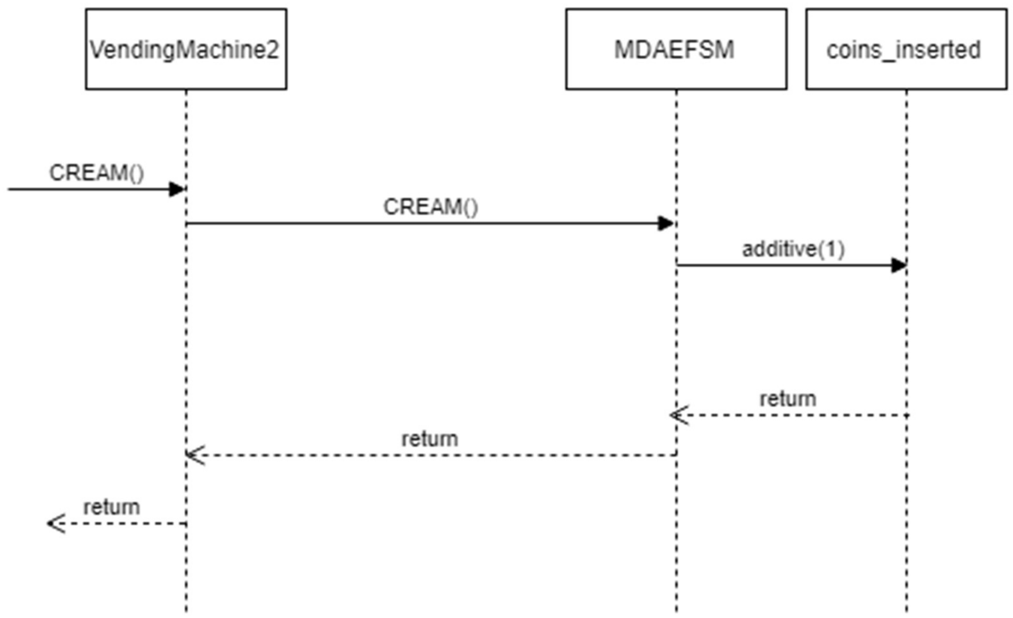


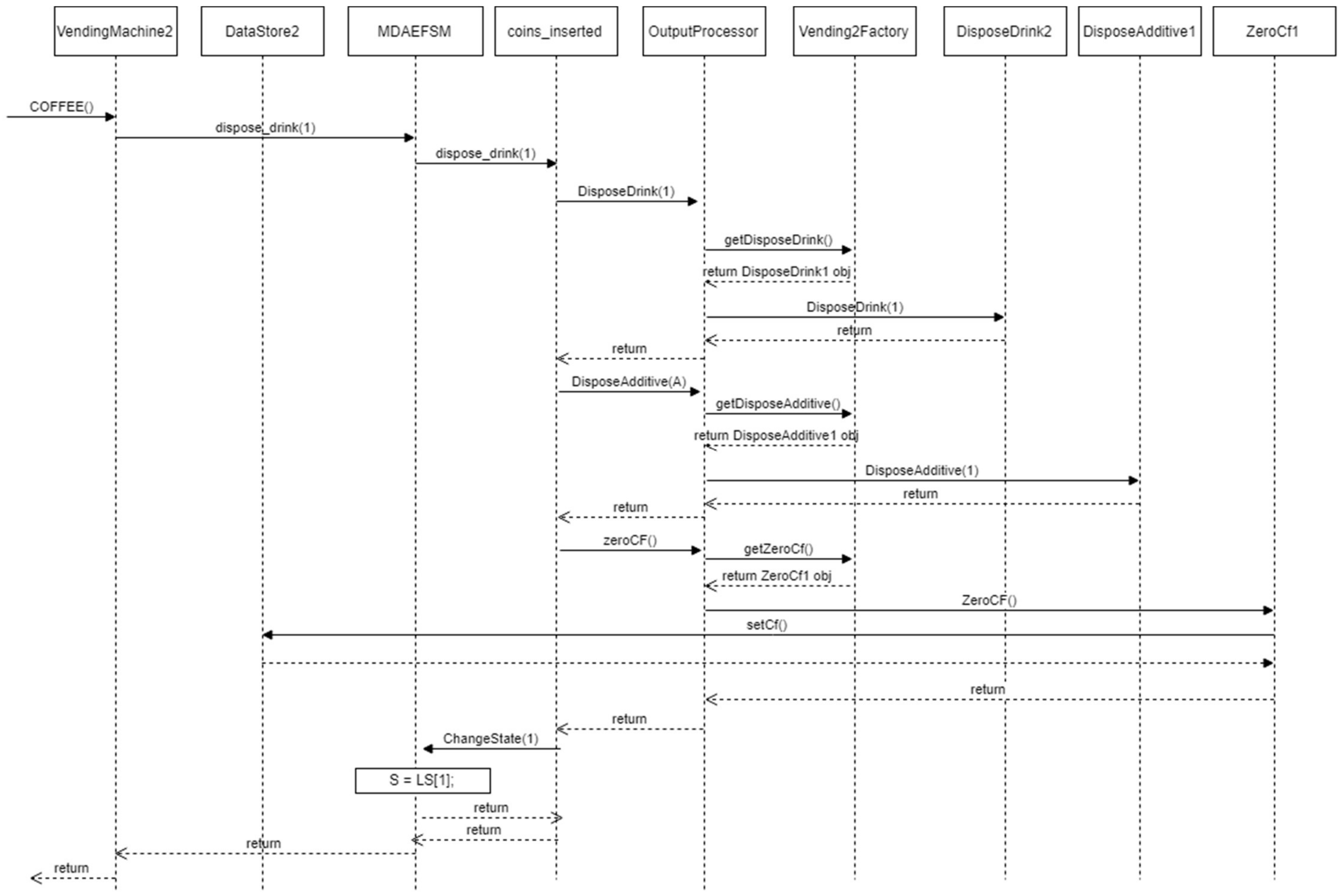
InsertCups(1)




VendingMachine2
DataStore2
MDAEFSM
idle
OutputProcessor
Vending2Factory
IncreaeseCf2
COIN(0.25)
setTemp_v
temp_v=0.25
return
cf + v < price
coin(0)
coin(0)
IncreaseCF()
getIncreaseCF()
return IncreaeseCf2 obj
IncreaeseCf()
getFloatCf()
cf
getFloatTemp_p()
Temp_p
total = cf + Temp_p
setCf(total)
print total
return
return
return
return
return


VendingMachine2
DataStore2
MDAEFSM
idle
OutputProcessor
Vending2Factory
IncreaeseCf2
COIN(0.25)
setTemp_v
temp_v=0.25
return
cf + v >= price
coin(1)
coin(1)
IncreaseCF()
getIncreaseCF()
return IncreaeseCf2 obj
IncreaeseCf()
getFloatCf()
cf
getFloatTemp_p()
Temp_p
total = cf + Temp_p
setCf(total)
print total
return
return
A[5] = 0
return
ChangeState(3)
S = LS[3];
return
return
return
return


VendingMachine2
MDAEFSM
coins_inserted
CREAM()
CREAM()
additive(1)
return
return
return


VendingMachine2
DataStore2
MDAEFSM
coins_inserted
OutputProcessor
Vending2Factory
DisposeDrink2
DisposeAdditive1
ZeroCf1
COFFEE()
dispose_drink(1)
dispose_drink(1)
DisposeDrink(1)
getDisposeDrink()
return DisposeDrink1 obj
DisposeDrink(1)
return
return
DisposeAdditive(A)
getDisposeAdditive()
return DisposeAdditive1 obj
DisposeAdditive(1)
return
return
zeroCF()
getZeroCf()
return ZeroCf1 obj
ZeroCF()
setCf()
return
return
ChangeState(1)
S = LS[1];
return
return
return
return