Artificial Intelligence

Planning : Goal Stack Planning
Currency Exchange Problem

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Problem Descriptions

Given a set of money exchange currency table and we are expected to be able to design a planning method with goal stack planning to exchange money from IDR through all another currency and back to IDR with the most profit.
To design the planning, we have to define :
- All conditions of state
- Set of operator to change the current statement

And by using those design that we define, do a Goal Stack Planning method to find the most profit exchange.

Designed Method

By illustrating the currency as a block in the block world

The image above shows that every currency will be represented as a block. We have to stack those blocks in order from bottom to top which means that the most bottom will be the first currency that we will exchange our money with while the most top will be the last one.

a. State Definition

CLEAR(x)
Means there is no other blocks above x, in other words the money is not exchanged to anything.

ON(x,y)
Means x block is on/above y block, in other words the money will be exhanged from y to x

b. Operator Definition

STACK(x,y)
Means we put x block above y block (Exchange currency from y to x)
P : CLEAR(x) ^ CLEAR(y)
A: ON(x,y)
D: CLEAR(y)

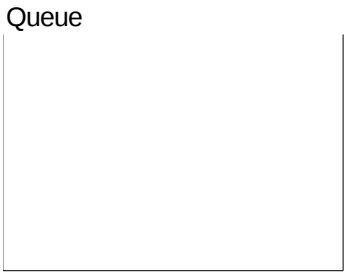
UNSTACK(x,y)
Means we unstack block x from y (Exchange currency from y to x is canceled)
P : ON(x,y) ^ CLEAR(x)
A : CLEAR(y)
D : ON(x,y)

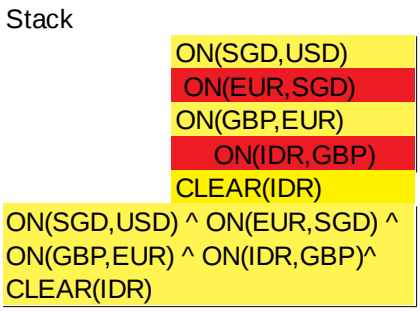
C. Goal Stack Planning

By using brute force to find the most profitable money exchange, I found that :
USD, SGD, EUR, GBP, IDR is the best exchange, so we are going to put these conditions into the stack.

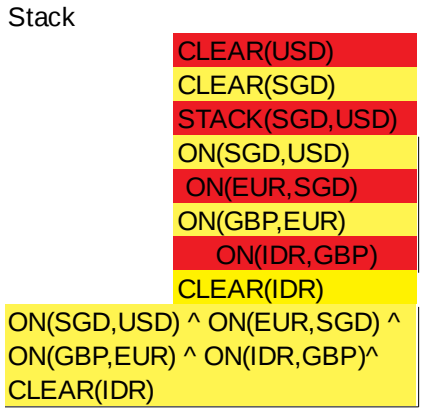
Initial State

Current State: CLEAR(GBP) ^ CLEAR(EUR) ^ CLEAR(USD) ^ CLEAR(SGD) ^ CLEAR(IDR)

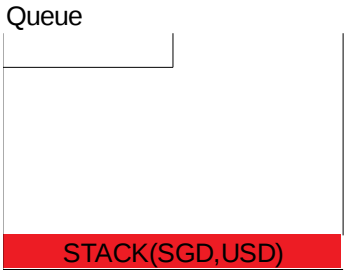


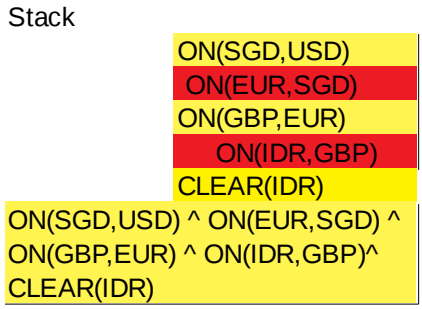


And then solve the problem in the stack, which is ON(SGD,USD) since it is not in the current state, we have to find an operator that could result that. And STACK(SGD,USD) is the most suitable one, so we add it into the stack and add the preconditions there.

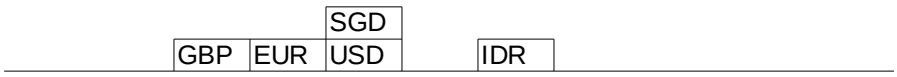


Since we have CLEAR(USD) and CLEAR(SGD) so we have to delete those from the stack, and do STACK(SGD,USD) which would change the content of queue and change the current state.

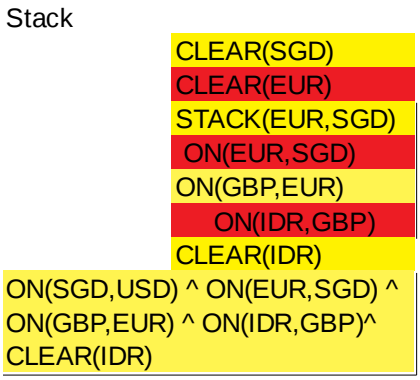




Current State: CLEAR(GBP) ^ CLEAR(EUR) ^ CLEAR(SGD) ^ CLEAR(IDR) ^ ON(SGD,USD)
Current State Illustration :

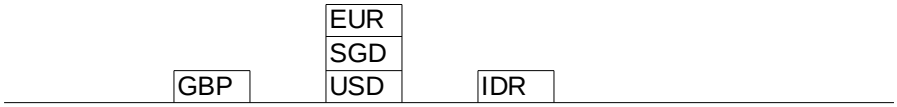


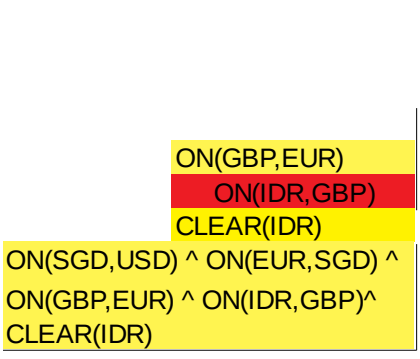
Since we have ON(SGD,USD) now, we may remove it from the stack and move to the next one which is ON(EUR,SGD). Since we dont have ON(EUR,SGD) we have to find an operator that could result that, in this case STACK(EUR,SGD) would be the appropriate one.

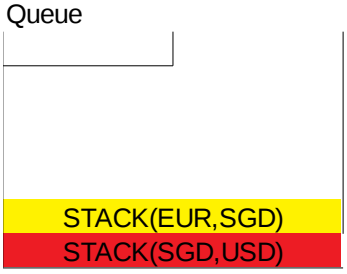


Since we have CLEAR(SGD) and CLEAR(EUR) lets remove it from the stack and also remove STACK(EUR,SGD) and move it into the queue and renew the current state.

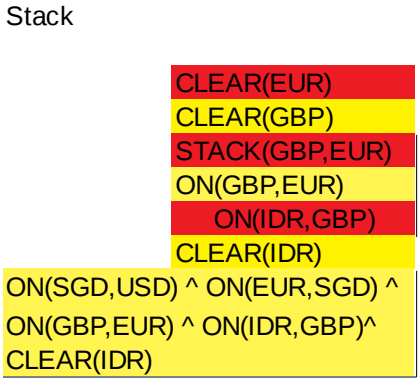
Current State: CLEAR(GBP) ^ CLEAR(EUR) ^ CLEAR(IDR) ^ ON(SGD,USD) ^ ON(EUR,SGD)





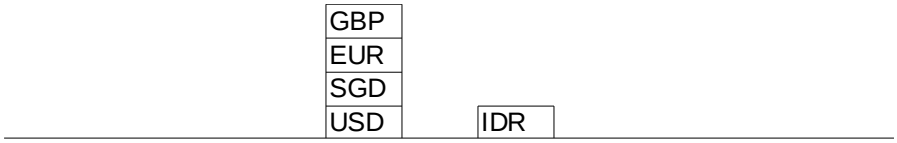


Move to the next one, we have to do ON(GBP, EUR), put into the stack STACK(GBP,EUR) and its precondition to have ON(GBP,EUR).

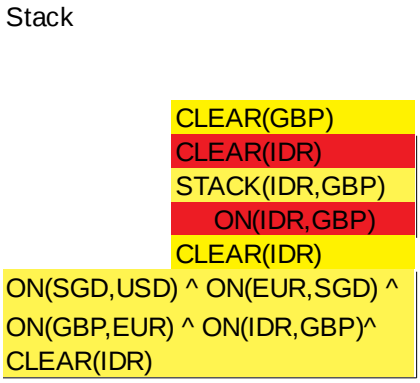


Since we have CLEAR(EUR) and CLEAR(GBP) we can move the STACK(GBP,EUR) into the queue and renew the current state.

Current State: CLEAR(GBP) ^ CLEAR(IDR) ^ ON(SGD,USD) ^ ON(EUR,SGD) ^ ON(GBP,EUR)

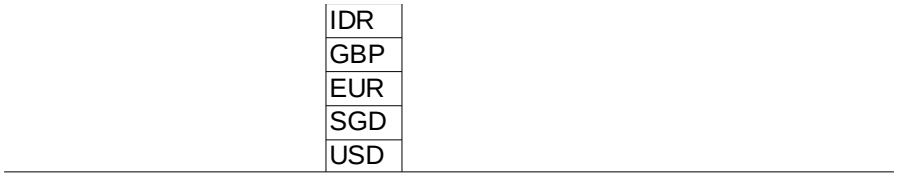


Move to next one, we have finished ON(GBP,EUR) so we have to delete it from the stack and then we need to do ON(IDR,GBP) by STACK(IDR,GBP) and put its precondition on the stack

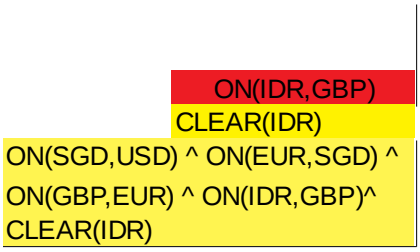


Since we have CLEAR(GBP) and CLEAR(IDR) we can remove them from stack and remove STACK(IDR,GBP) and put it into the queue and then renew the current state

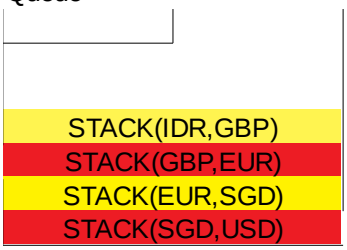
Current State: CLEAR(IDR) ^ ON(SGD,USD) ^ ON(EUR,SGD) ^ ON(GBP,EUR) ^ ON(IDR,GBP)



Stack



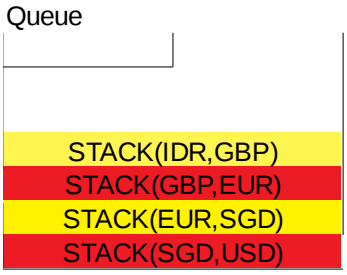
Queue



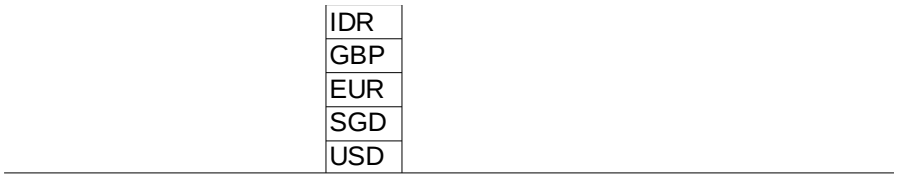
And since we have ON(IDR,GBP) and CLEAR(IDR) on our current state we may delete them from our stack

Stack

And now we check whether our current state has reached the goal state or not. And it seems yes, so we remove it from the goal state and finished. All job needed to reach the goal state has been recorded in the queue



D. Results



Based on the planning, we find that by exchanging our money from IDR → USD → SGD → EUR → GBP → IDR we will have the most profitable exchange.

If we have Rp. 100.000.000 and exchange it based on our result we will have the money back by Rp 156.414.979,81

Profit : Rp.56.414.979,81 // 56.41% Profit