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COA LAB
Experiment – 6

Write an assembly language program for the following problem statements:

1. A routine that pushes numbers 6 and 4 on top of the stack, then pops the two numbers one by one from stack, add them and pushes the result back to the top of stack.
2. First loop places 15 numbers from 1-15 on top of stack using push instruction. In the second loop, use the pop instruction to pop two numbers from the top of the stack, add them, and push the result back to the stack. Repeat the second loop until only one number is left on top of the stack.

Program no. 1

Algorithm:

1. Mark the start of the frame
2. Create a label ‘pushpopadd’ to represent the routine name.
3. Call routine ‘pushpopadd’.
4. Place the halt instruction below the call instruction and move the label ‘pushpopadd’ below the halt instruction.
5. Inside the label/routine ‘pushpopadd’, push numbers 6 and 4 on top of stack, then pop the two numbers one by one from stack, add them and push the result back to the top of stack.
6. Pop to any general-purpose register to get the return address on top of the stack
7. Returns to Halt instruction and exit.

Assembly Language code:

```
MSF ;Main start function
CAL $pushpopadd ;Call the function pushpopadd
HLT ;Halt the program execution
pushpopadd: ;Define the function pushpopadd
PSH #6 ;Push the value 6 onto the stack
PSH #4 ;Push the value 4 onto the stack
POP R01 ;Pop the top value from the stack into register R01
POP R02 ;Pop the second value from the stack into register R02
ADD R01, R02 ;Add the values in R01 and R02 and store the result in R02
PSH R02 ;Push the result onto the stack
POP R03 ;Pop the result from the stack into register R03
RET ;Return from the function
```

Result:

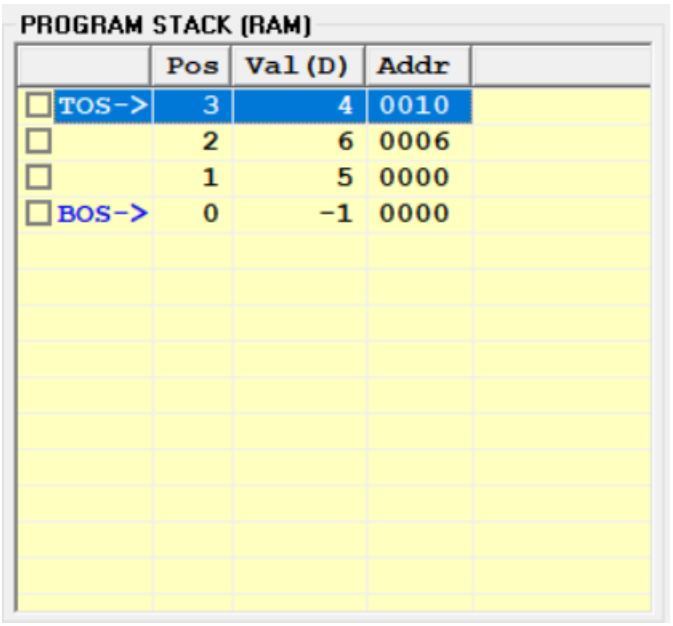


Fig-6.1.a: Program Stack window after pushing all the values

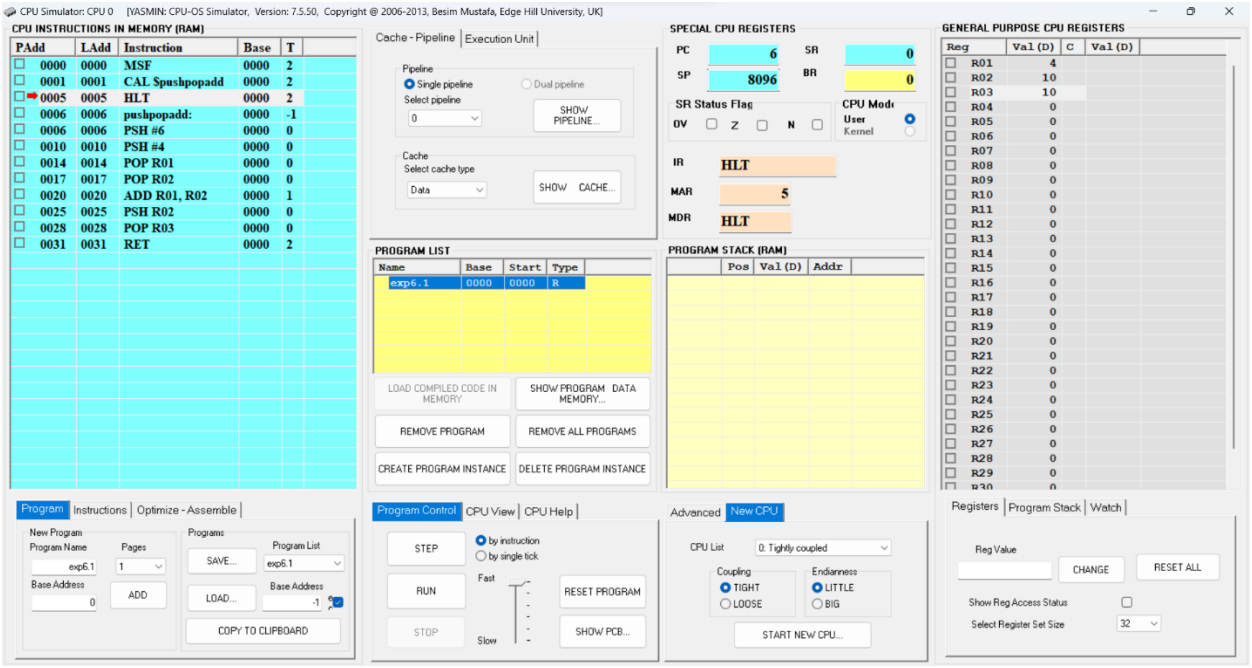


Fig-6.1.b: CPU Simulator Window

Program no. 2

Algorithm:

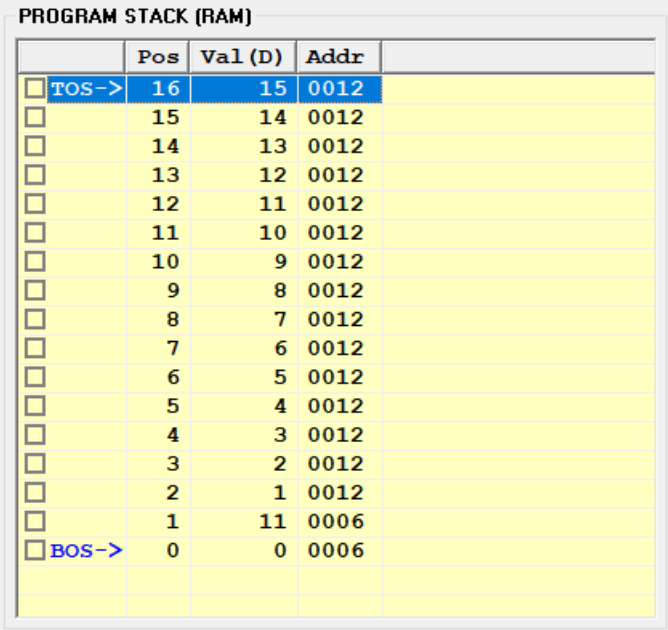
1. Initialize register R01 to 1 to hold the value of the first number to be pushed onto the stack.
2. Enter a loop to push 15 numbers onto the stack using the PUSH instruction, incrementing R01 each time to hold the value of the next number.

3. After the first loop completes, enter a second loop to pop two numbers from the top of the stack, add them, and push the result back to the stack.
4. Repeat the second loop until only one number is left on top of the stack.
5. The final result will be the value left on top of the stack.
6. Halt the program after the second loop completes.

Assembly Language code:

```
MOV #1, R01 ;Initialize register R01 to 1
MSF ;Main start function
CAL $pushpoploop ;Call the function pushpoploop
HLT ;Halt the program execution
pushpoploop: ;Define the function pushpoploop
PSH R01 ;Push the value of register R01 onto the stack
INC R01 ;Incrementing value of R01 by 1
CMP #15, R01 ;Compare value of R01 with 15
JLE $pushpoploop ;Jump back to pushpoploop if R01 <= 15
addloop ;Define the function addloop
POP R01 ;Pop the top value from the stack into register R01
POP R02 ;Pop the second value from the stack into register R02
ADD R01, R02 ;Add the values in R01 and R02 and store the result in R02
PSH R02 ;Push the value of register R02 onto the stack
CMP #120, R02 ;Compare value of R02 with 120
JNE $addloop ;Jump back to addloop if the result is not equal to 120
POP R03 ;Pop the final result from the top of the stack
RET ; Return from the subroutine
```

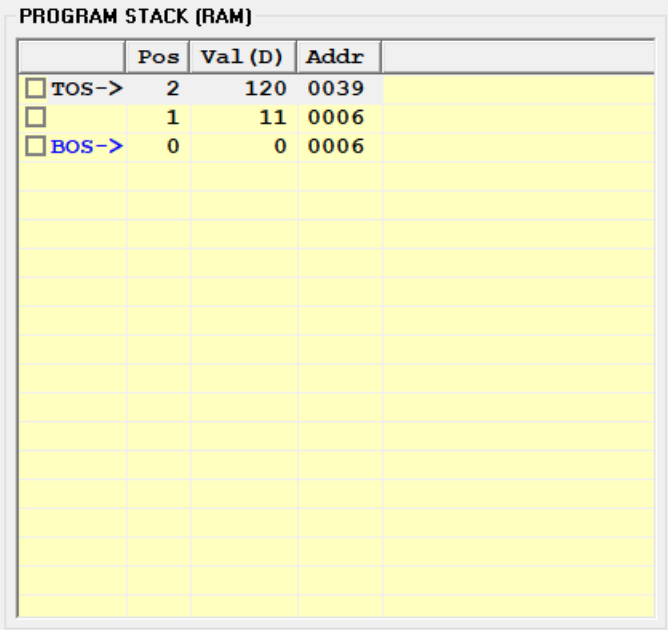
Result:



PROGRAM STACK (RAM)

	Pos	Val (D)	Addr
TOS->	16	15	0012
	15	14	0012
	14	13	0012
	13	12	0012
	12	11	0012
	11	10	0012
	10	9	0012
	9	8	0012
	8	7	0012
	7	6	0012
	6	5	0012
	5	4	0012
	4	3	0012
	3	2	0012
	2	1	0012
	1	11	0006
BOS->	0	0	0006

Fig-6.2.a: Program Stack window before exiting the first loop



PROGRAM STACK (RAM)

	Pos	Val (D)	Addr
TOS->	2	120	0039
	1	11	0006
BOS->	0	0	0006

Fig-6.2.b: Program Stack window before exiting the second loop

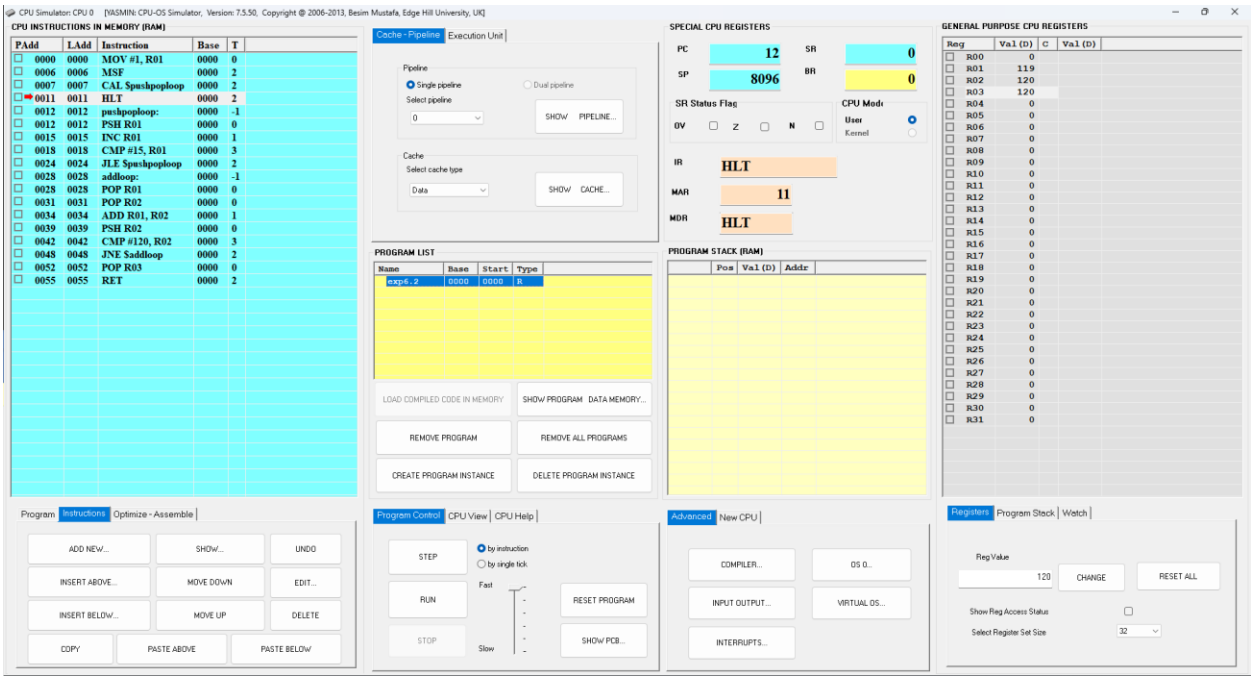


Fig-6.2.c: CPU Simulator Window