Assignment-1
Computer Architecture

Directory Structure:

- The directory contains a package named *IAS* which has all the classes like Registers(*MAR,MBR*,*PC*etc),Memory,DecodeExecute Logic,Fetch,Instructions
- There are two java Programs for test benches.I have defined both the programs in this pdf for reference.
- There are two images of terminal output when each of the programs is tested.
- **To test the programs:**
    - First *javac Program_1.java* Then *java Program_1*
    - First *javac Program_2.java* Then *java Program_2*

Design Implementation of *IAS*:

- The test bench creates a instance of *Memory,Accumulator* and *Registers*
- Then the *Memory* for each of the test bench is pre-programmed and program begins at *PC=0*
- The *halt* instruction is defined as ‘11111111’
- The loop executes till halt is reached.The sequence of steps is:
    - Fetch cycle,which assigns appropriate values to *IR,MAR,IBR*
    - Decode and Execute cycle.

Assumptions:

- The Memory is a 2-d array of 1000 rows and 2 columns.In each row 1st column is for left instruction and 2nd is for right instruction.

OpCode	Address	OpCode	Address

Left Instruction Right Instruction

- The instructions are placed till 500th row of array and after 500th row we store data in Right Instruction Address

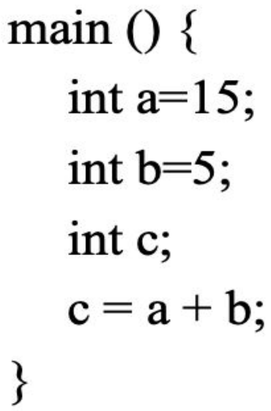
From 500th row onwards

			Data

Left Instruction Right Instruction

- The OpCode and Address is initialized to ‘00000000’ and ‘000000000000’ respectively which means no operation

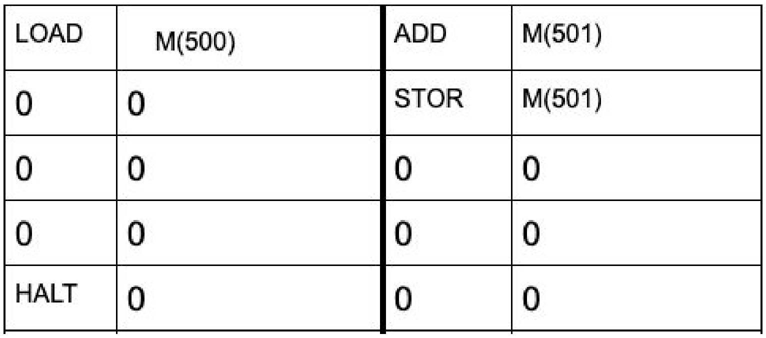
Program-1:



```
main () {
    int a=15;
    int b=5;
    int c;
    c = a + b;
}
```

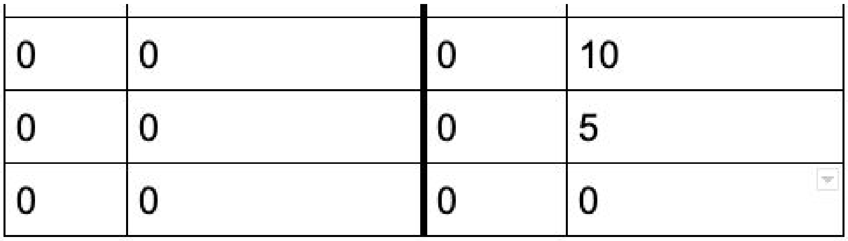
Memory for this program(0 indicates no instruction i.e default instruction)

Instructions(starting from index 0) :



LOAD	M(500)	ADD	M(501)
0	0	STOR	M(501)
0	0	0	0
0	0	0	0
HALT	0	0	0

Data(starting from index 500):

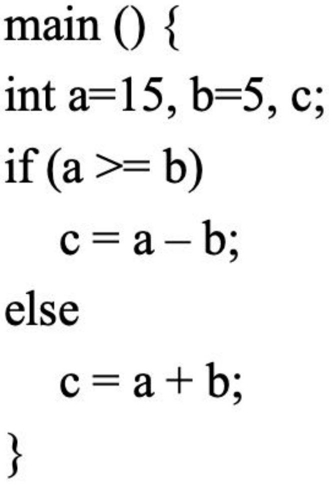


0	0	0	10
0	0	0	5
0	0	0	0

Steps followed:

- LOAD M(500) -- 10 stored at location 500 gets to Accumulator
- ADD M(501) -- 5 stored at location 501 gets added to Acc and result stored back in Acc
- STOR M(502) -- 15 in Acc will be stored at 502

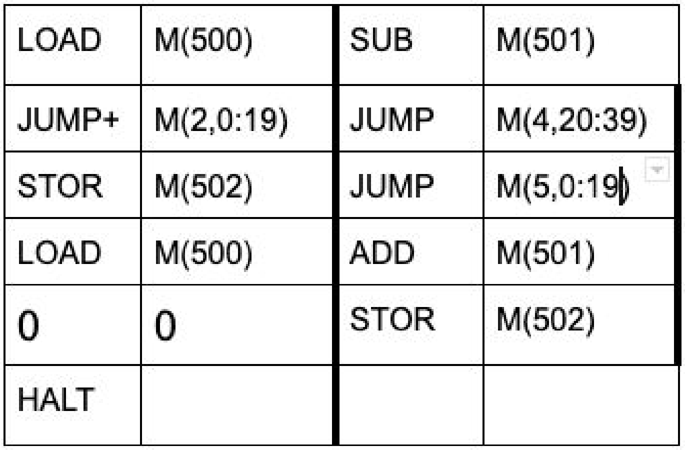
Program-2:



```
main () {
int a=15, b=5, c;
if (a >= b)
    c = a – b;
else
    c = a + b;
}
```

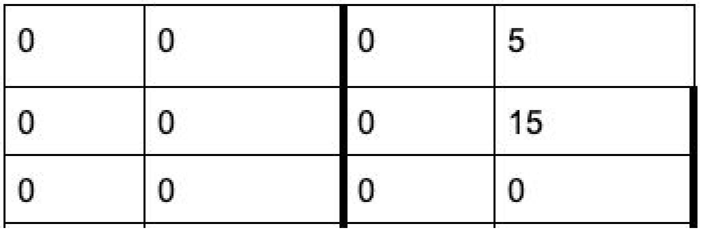
Memory for this program(0 indicates no instruction i.e default instruction)

Instructions(starting from index 0) :



LOAD	M(500)	SUB	M(501)
JUMP+	M(2,0:19)	JUMP	M(4,20:39)
STOR	M(502)	JUMP	M(5,0:19)
LOAD	M(500)	ADD	M(501)
0	0	STOR	M(502)
HALT			

Data(starting from index 500):



0	0	0	5
0	0	0	15
0	0	0	0