Assignment 1 "Best CPU Setup"

Group - SS05

Memory: 2048 locations of 1 bytes each (mem[2048]) = 2KB of memory

1. **OS memory:** 256 locations of 4 bytes each (mem[0] to mem[511])
2. **Instruction memory:** 256 locations of 4 bytes each (mem[512] to mem[1023])
3. **Data memory:** 512 locations of 4 bytes each (mem[1024] to mem[2047])

Instruction size: 4 bytes = 32 bits

1. **Opcode:** 8bits
2. **Operand 1:** 8 bits
3. **Operand 2:** 8 bits
4. **Operand 3:** 8 bits

Instructions:

1. lw r0,0400,0

It will load the contents at memory location 0x0400 into register r0.
Opcode for lw is 0x00
Operand 1 r0 is 0x00
Memory location 0x0400 is divided into two parts (8 bits each)
Operand 2 is bits from d8 to d15
Operand 3 is bits from d0 to d7

Initially,
Content at memory location 0x0400h = 0x11
Content of register r0 is 0x00

After execution
Content at memory location 0x0400h = 0x11
Content of register r0 is 0x11

2. sw r1,0401,0

It will load the contents at memory location 0x0401 into register r0.
Opcode for sw is 0x01
Operand 1 r1 is 0x01
Memory location 1025 is divided into two parts (8 bits each)
Operand 2 is bits from d8 to d15
Operand 3 is bits from d0 to d7

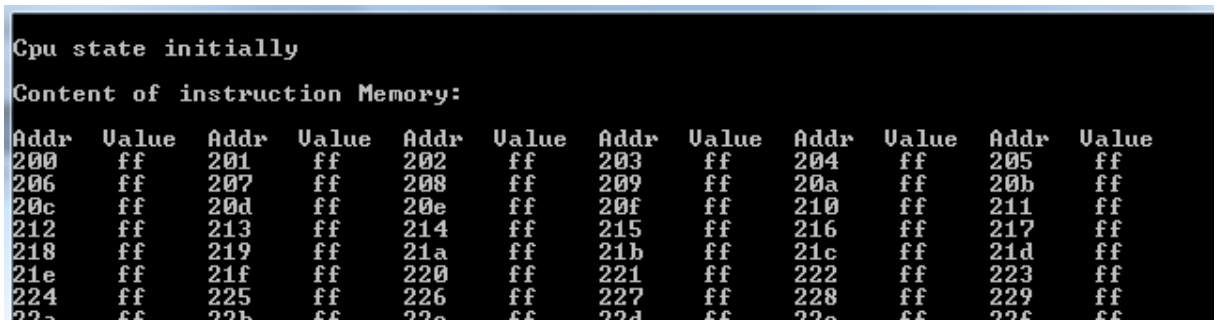
Initially,
Content of register r1 is 0x12
Content at memory location 0x0401h = 0x00

After execution

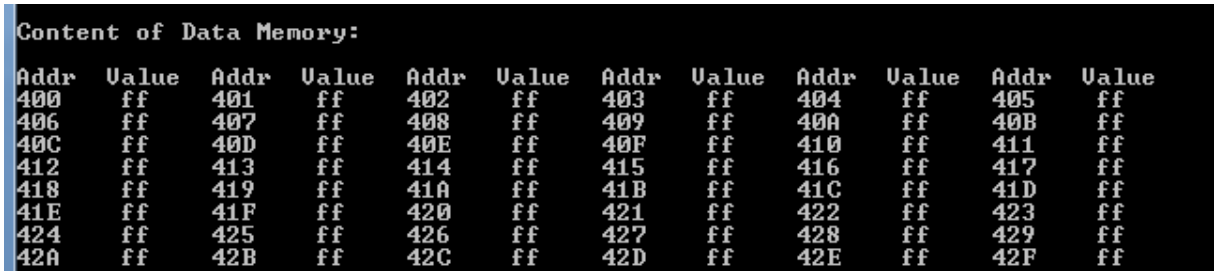
Content of register r1 is 0x12
Content at memory location 0x0401h = 0x12

Screen Shots

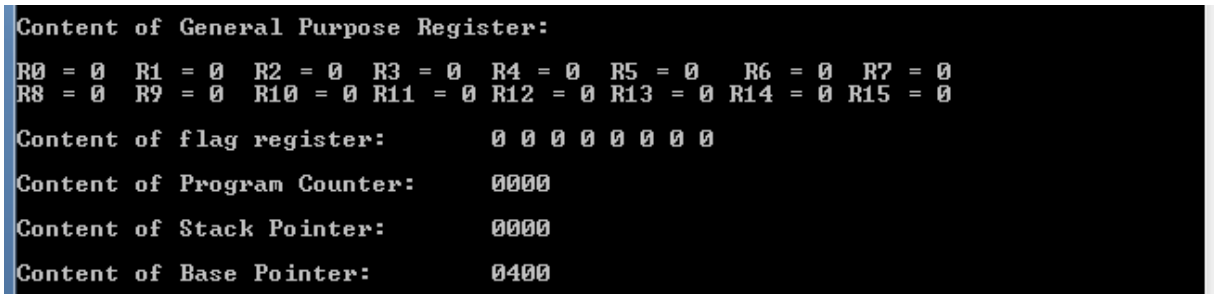
1. Initial CPU state (Without any Instructions)



```
Cpu state initially

Content of instruction Memory:

Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value
200     ff    201     ff    202     ff    203     ff    204     ff    205     ff
206     ff    207     ff    208     ff    209     ff    20a     ff    20b     ff
20c     ff    20d     ff    20e     ff    20f     ff    210     ff    211     ff
212     ff    213     ff    214     ff    215     ff    216     ff    217     ff
218     ff    219     ff    21a     ff    21b     ff    21c     ff    21d     ff
21e     ff    21f     ff    220     ff    221     ff    222     ff    223     ff
224     ff    225     ff    226     ff    227     ff    228     ff    229     ff
```

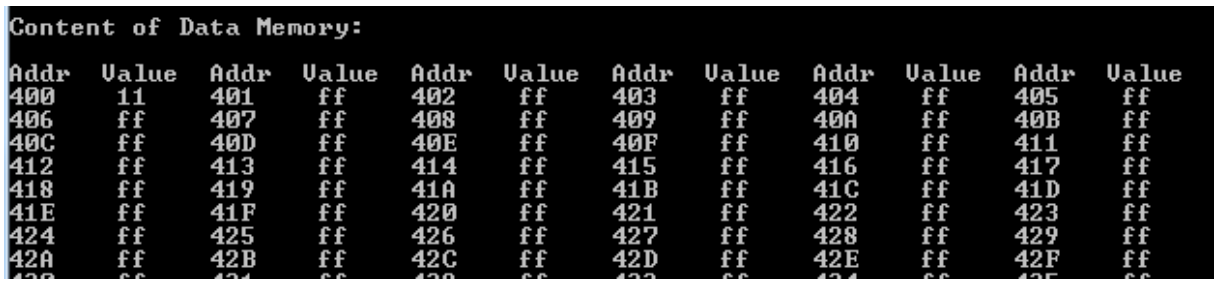


```
Content of Data Memory:

Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value
400     ff    401     ff    402     ff    403     ff    404     ff    405     ff
406     ff    407     ff    408     ff    409     ff    40A     ff    40B     ff
40C     ff    40D     ff    40E     ff    40F     ff    410     ff    411     ff
412     ff    413     ff    414     ff    415     ff    416     ff    417     ff
418     ff    419     ff    41A     ff    41B     ff    41C     ff    41D     ff
41E     ff    41F     ff    420     ff    421     ff    422     ff    423     ff
424     ff    425     ff    426     ff    427     ff    428     ff    429     ff
42A     ff    42B     ff    42C     ff    42D     ff    42E     ff    42F     ff
```



```
Content of General Purpose Register:

R0 = 0  R1 = 0  R2 = 0  R3 = 0  R4 = 0  R5 = 0   R6 = 0  R7 = 0
R8 = 0  R9 = 0  R10 = 0 R11 = 0 R12 = 0 R13 = 0 R14 = 0 R15 = 0

Content of flag register:       0 0 0 0 0 0 0 0

Content of Program Counter:     0000

Content of Stack Pointer:       0000

Content of Base Pointer:        0400
```

2. Initial contents of General purpose registers and memory locations done for assignment 1



```
Content of Data Memory:

Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value
400     11    401     ff    402     ff    403     ff    404     ff    405     ff
406     ff    407     ff    408     ff    409     ff    40A     ff    40B     ff
40C     ff    40D     ff    40E     ff    40F     ff    410     ff    411     ff
412     ff    413     ff    414     ff    415     ff    416     ff    417     ff
418     ff    419     ff    41A     ff    41B     ff    41C     ff    41D     ff
41E     ff    41F     ff    420     ff    421     ff    422     ff    423     ff
424     ff    425     ff    426     ff    427     ff    428     ff    429     ff
42A     ff    42B     ff    42C     ff    42D     ff    42E     ff    42F     ff
```

```
Content of General Purpose Register:

R0 = 0  R1 = 12 R2 = 0  R3 = 0  R4 = 0  R5 = 0   R6 = 0  R7 = 0
R8 = 0  R9 = 0  R10 = 0 R11 = 0 R12 = 0 R13 = 0 R14 = 0 R15 = 0

Content of flag register:       0 0 0 0 0 0 0 0

Content of Program Counter:     0000

Content of Stack Pointer:       0000

Content of Base Pointer:        0400
```

3. CPU state after loading all instructions (load 200-203 and store 204-207)

```
Cpu state after loading instructions into memory

Content of instruction Memory:

Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value
200    00    201    00    202    04    203    00    204    01    205    01
206    04    207    01    208    ff    209    ff    20a    ff    20b    ff
20c    ff    20d    ff    20e    ff    20f    ff    210    ff    211    ff
212    ff    213    ff    214    ff    215    ff    216    ff    217    ff
218    ff    219    ff    21a    ff    21b    ff    21c    ff    21d    ff
```

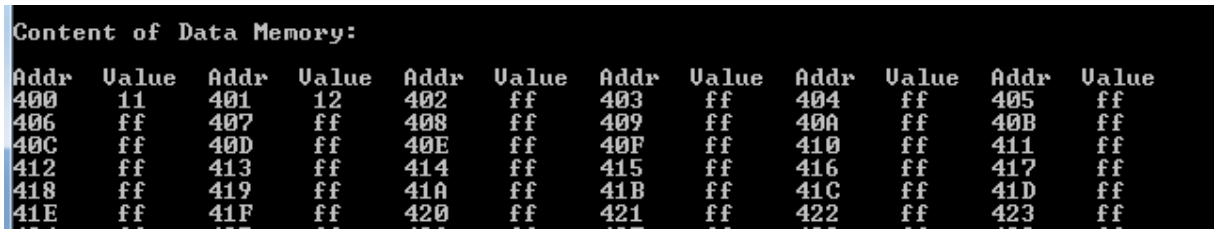
4. CPU state after executing first instruction (Loading data from memory to register)

```
Content of Data Memory:

Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value  Addr  Value
400    11    401    ff    402    ff    403    ff    404    ff    405    ff
406    ff    407    ff    408    ff    409    ff    40A    ff    40B    ff
40C    ff    40D    ff    40E    ff    40F    ff    410    ff    411    ff
412    ff    413    ff    414    ff    415    ff    416    ff    417    ff
418    ff    419    ff    41A    ff    41B    ff    41C    ff    41D    ff
41E    ff    41F    ff    420    ff    421    ff    422    ff    423    ff
```

```
Content of General Purpose Register:

R0 = 11 R1 = 12 R2 = 0  R3 = 0  R4 = 0  R5 = 0   R6 = 0  R7 = 0
R8 = 0  R9 = 0  R10 = 0 R11 = 0 R12 = 0 R13 = 0 R14 = 0 R15 = 0

Content of flag register:       0 0 0 0 0 0 0 0

Content of Program Counter:     0204

Content of Stack Pointer:       0000

Content of Base Pointer:        0400
```

5. CPU state after executing second instruction (Storing data from register to memory

```
Content of General Purpose Register:

R0 = 11 R1 = 12 R2 = 0  R3 = 0  R4 = 0  R5 = 0   R6 = 0  R7 = 0
R8 = 0  R9 = 0  R10 = 0 R11 = 0 R12 = 0 R13 = 0 R14 = 0 R15 = 0

Content of flag register:       0 0 0 0 0 0 0 0

Content of Program Counter:     0204

Content of Stack Pointer:       0000

Content of Base Pointer:        0400
```



Content of Data Memory:

Addr	Value	Addr	Value	Addr	Value	Addr	Value	Addr	Value	Addr	Value
400	11	401	12	402	ff	403	ff	404	ff	405	ff
406	ff	407	ff	408	ff	409	ff	40A	ff	40B	ff
40C	ff	40D	ff	40E	ff	40F	ff	410	ff	411	ff
412	ff	413	ff	414	ff	415	ff	416	ff	417	ff
418	ff	419	ff	41A	ff	41B	ff	41C	ff	41D	ff
41E	ff	41F	ff	420	ff	421	ff	422	ff	423	ff