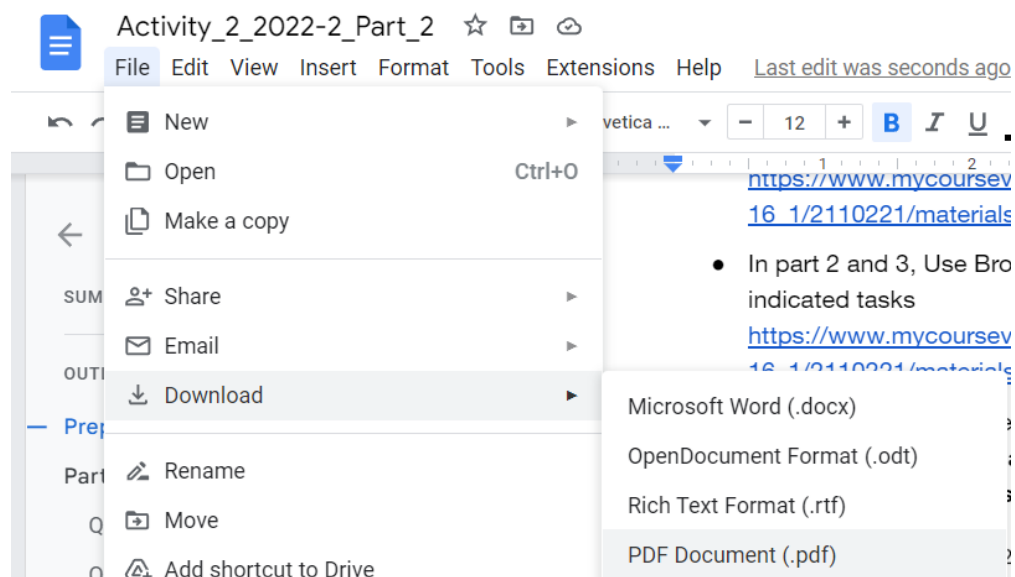**Activity 2: Central Processing Unit (Part 2)**

Group No : 5

Group Member :

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Preparation

- In part 1, use Activity 2 Reference: SML Instruction Set, which can be downloaded from myCourseVille or the link below:
  https://www.mycourseville.com/sites/all/modules/courseville/files/uploads/2016_1/2110221/materials/sml_instruction_set.333.1471674877.pdf

- In part 2 and 3, Use Brookshear Simple Machine Emulator to perform the indicated tasks
  https://www.mycourseville.com/sites/all/modules/courseville/files/uploads/2016_1/2110221/materials/bme.333.1471675276.htm

- Make a copy of this sheet. Answer the questions in the boxes given. After finishing, **save this file as a PDF** and **submit it to the assignment published on myCourseVille**.

Activity 2: Central Processing Unit (Part 2)

Part 2 : Playing with Emulator (8 Questions)

Once you finish this part, <mark>students must inform instructors or TAs for inspection.</mark>

Suppose the CPU is started with PC=0 and the following values in cells 00-0F and F0-F2 in memory.

Address	Content
00	10
01	F0
02	11
03	F1
04	12
05	F2
06	23
07	01
08	54
09	03
0A	55
0B	41
0C	56
0D	52
0E	57
0F	66
10	37
11	F3
12	C0
13	00

Address	Content
F0	02
F1	03
F2	05

Start the program using the "step" button until it completes the first machine cycle (fetch -> decode -> execute).

Question 2.1 At this point, what is the value stored in:

PC	02
IR	10F0
R0	02

Question 2.2 Execute a single machine cycle again, Record the changes in the registers.

PC	04

Activity 2: Central Processing Unit (Part 2)

IR	11F1
R1	03

Question 2.3 Execute a single machine cycle again, Record the changes in the registers.

PC	06
IR	12F2
R2	05

Question 2.4 Execute a single machine cycle again, Record the changes in the registers.

PC	08
IR	2301
R3	01

Question 2.5 Execute a single machine cycle again, Record the changes in the registers.

PC	0A
IR	5403
R4	03

Question 2.6 What is the PC value when the program changes the value in Register 6?

0E

Activity 2: Central Processing Unit (Part 2)

Question 2.7 After the program ends, what value does the program store in memory cell F3?

```
16
```

The value in memory cell F3 depends on what is initially stored in cells F0-F2; experiment by starting the machine with different values in those cells, <u>trace the execution of the program step by step, and determine what is being computed</u>

Question 2.8 What is being computed?

```
LOAD r0 <- *(0xF0)
LOAD r1 <- *(0xF1)
LOAD r2 <- *(0xF2)
LOAD r3 <- 0x01
ADD r4 <- r0 + r3
ADD r5 <- r4 + r1
ADD r6 <- r5 + r2
ADD r7 <- r6 + r6
STORE r7 -> *(0xF3)
HALT
```

1. LOAD the register r0 with the bit pattern found in the memory cell whose address is F0.
2. LOAD the register r1 with the bit pattern found in the memory cell whose address is F1.
3. LOAD the register r2 with the bit pattern found in the memory cell whose address is F2.
4. LOAD the register r3 with the bit pattern 01.
5. ADD the bit patterns in registers r0 and r3, then leave the result in register r4.
6. ADD the bit patterns in registers r4 and r1, then leave the result in register r5.
7. ADD the bit patterns in registers r5 and r2, then leave the result in register r6.
8. ADD the bit patterns in registers r6 and r6, then leave the result in register r7.
9. STORE the bit pattern found in register r7 in the memory cell whose address is F3.
10. HALT execution.

r0=2
r1=3
r2=5
r3=1

4

Activity 2: Central Processing Unit (Part 2)

```
r4=r0+r3=2+1=3
r5=r4+r1=3+3=6
r6=r5+r2=6+5=B
r7=r6+r6=B+B=16
r3=r7=16
```

— THIS IS THE END OF PART 2 —