CSCI 592
LAB ASSIGNMENT – 3

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OBJECTIVE:
The objective of this lab was to understand and implement memory manipulation and register operations using assembly language. The focus was on observing how data moves within registers and memory locations, modifying values, and analyzing execution logs.

TECHNOLOGY USED

- Easy68K Assembler software to run the code.
- Hypothetical or real CPU with registers and memory

PROCEDURE

- Initialize Address Registers: Assign memory locations to registers (A3, A4, A6) using the LEA.L instruction.
- Store Values in Memory: Use the MOVE.L instruction to place predefined values at specific memory locations.
- Modify Registers: Perform operations on data registers (D0–D7) to observe changes.
- Execute the Program: Run the assembly code in EASy68K to observe memory and register changes.
- Analyze Execution Log: Compare initial and final register/memory values to confirm correct execution.
- Verify Results: Ensure that values in registers and memory match expected outputs.

OPERATIONS

- Load Effective Address (LEA.L): Used to load addresses into registers.
- Move Operations (MOVE.L): Used to transfer values between registers and memory.
- Register Manipulation: Observed how values change after execution.

ALGORITHM

- Initialize registers and memory addresses.
- Store predefined values in memory locations.
- Modify register values using operations.
- Execute the program and analyze register/memory states.
- Compare execution log with expected output.

CODE LISTING

```
START: ; first instruction of program

 LEA.L $002468FA,A3
 LEA.L $00002544,A4
 LEA.L $00002518,A6

 MOVE.L #$44334241, $00002518
 MOVE.L #$00000000, $0000251C
 MOVE.L #$25530000, $00002520
 MOVE.L #$01EFABCD, $00002524
 MOVE.L #$5467CC22, $00002528
 MOVE.L #$FF3412FF, $0000252C
 MOVE.L #$A2671FEE, $00002544
 MOVE.L #$FFFFFFFF, $00002548
 MOVE.L #$01000000, $0000254C
 MOVE.L #$ABCDFFFF, $00002550
 MOVE.L #$00000000, $00002554

 MOVE.L $00000000, D3
 MOVE.L $FFFFFFFF, D5
 MOVE.L $00000000, D6

 MOVE.B 3(A6) ,D3
 MOVE.B 4(A4) ,6(A6)
 MOVE.B (A6)+,D5
 MOVE.B (A4)+,$002522
 MOVE.B $00252E, -(A4)
 LEA.L $00252A, A3
 MOVE.W (A3),D6

 SIMHALT ; halt simulator
 END START ; last line of source
```

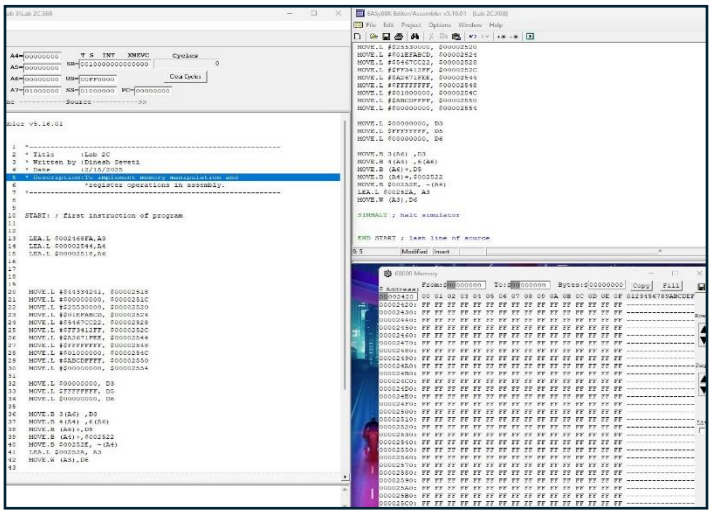
DESCRIPTION

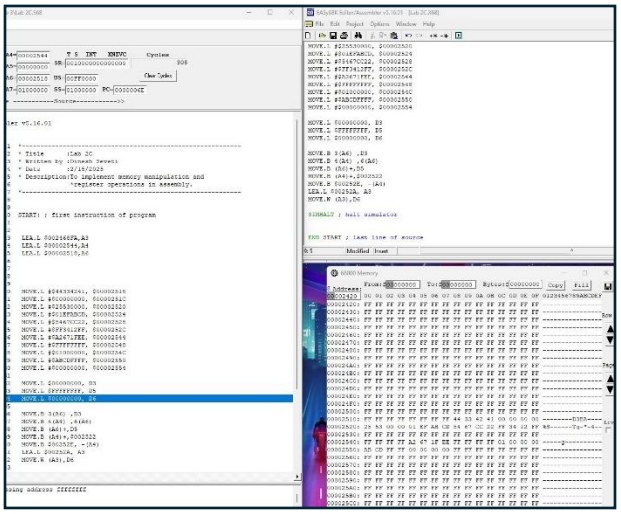
This lab involved executing a sequence of assembly instructions to manipulate memory and registers. Initially, memory locations were assigned to specific address registers using LEA.L. Values were then stored in memory using MOVE.L instructions. The final execution log was analyzed to confirm changes in both memory and register states.

OBSERVATIONS

- The LEA.L instruction correctly assigned memory addresses to registers.
- The MOVE.L instructions successfully transferred values to designated memory locations.
- Register and memory values changed as expected, confirming correct execution.
- The execution log matched the expected output, indicating successful implementation.

RESULTS





LOG FILES

Before execution

D0=00000000 D4=00000000 A0=00000000 A4=00000000 T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000000000
D2=00000000 D6=00000000 A2=00000000 A6=00000000 US=00FF0000
D3=00000000 D7=00000000 A3=00000000 A7=01000000 SS=01000000
PC=00000000 Code=47F9 002468FA Line= 12 LEA.L $002468FA,A3

D0=00000000 D4=00000000 A0=00000000 A4=00002544 T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000000000
D2=00000000 D6=00000000 A2=00000000 A6=00000000 US=00FF0000
D3=00000000 D7=00000000 A3=00000000 A7=01000000 SS=01000000
PC=00000006 Code=49F8 2544 Line= 13 LEA.L $00002544,A4

D0=00000000 D4=00000000 A0=00000000 A4=00002544 T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000000000
D2=00000000 D6=00000000 A2=00000000 A6=00000000 US=00FF0000
D3=00000000 D7=00000000 A3=00000000 A7=01000000 SS=01000000
PC=0000000A Code=4DF8 2518 Line= 14 LEA.L $00002518,A6

After Execution

```
D0=00000000 D4=00000000 A0=00000000 A4=00002544    T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000000000
D2=00000000 D6=00000000 A2=00000000 A6=00002518 US=00FF0000
D3=00000000 D7=00000000 A3=002468FA A7=01000000 SS=01000000
PC=00000016  Code=21FC 44334241 2518     Line=   19   MOVE.L #$44334241, $00002518

D0=00000000 D4=00000000 A0=00000000 A4=00002544    T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000000000
D2=00000000 D6=00000000 A2=00000000 A6=00002518 US=00FF0000
D3=00000000 D7=00000000 A3=002468FA A7=01000000 SS=01000000
PC=0000001E  Code=21FC 25530000 2520     Line=   20   MOVE.L #$25530000, $00002520

D0=00000000 D4=00000000 A0=00000000 A4=00002544    T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000000000
D2=00000000 D6=00000000 A2=00000000 A6=00002518 US=00FF0000
D3=00000000 D7=00000000 A3=002468FA A7=01000000 SS=01000000
PC=00000026  Code=21FC 01EFABCD 2524     Line=   22   MOVE.L #$01EFABCD, $00002524

D0=00000000 D4=00000000 A0=00000000 A4=00002544    T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000000000
D2=00000000 D6=00000000 A2=00000000 A6=00002518 US=00FF0000
D3=00000000 D7=00000000 A3=002468FA A7=01000000 SS=01000000
PC=0000002E  Code=21FC 5467CC22 2528     Line=   23   MOVE.L #$5467CC22, $00002528

D0=00000000 D4=00000000 A0=00000000 A4=00002544    T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000000000
D2=00000000 D6=00000000 A2=00000000 A6=00002518 US=00FF0000
D3=00000000 D7=00000000 A3=002468FA A7=01000000 SS=01000000
PC=00000036  Code=21FC FF3412FF 252C     Line=   24   MOVE.L #$FF3412FF, $0000252C

D0=00000000 D4=00000000 A0=00000000 A4=00002544    T_S__INT___XNZVC
D1=00000000 D5=00000000 A1=00000000 A5=00000000 SR=0010000000001000
D2=00000000 D6=00000000 A2=00000000 A6=00002518 US=00FF0000
D3=00000000 D7=00000000 A3=002468FA A7=01000000 SS=01000000
PC=0000003E  Code=21FC A2671FEE 2544     Line=   25   MOVE.L #$A2671FEE, $00002544
```

Before Execution:

Address	Value
0x2518	0x4433
0x251C	0x0000
0x2520	0x2553
0x2524	0x01EF
0x2528	0x5467
0x252C	0xFF34
0x2530	0x12FF
0x2544	0xA267
0x2548	0xFFFF
0x254C	0x0100
0x2550	0xABCD
0x2554	0x0000

After Execution

Address	Value
0x2518	0x44334241
0x251C	0x00000000
0x2520	0x25530000
0x2524	0x01EFABCD
0x2528	0x5467CC22
0x252C	0xFF3412FF
0x2530	0x12FF
0x2544	0xA2671FEE
0x2548	0xFFFFFFF
0x254C	0x01000000
0x2550	0xABCDFFFF
0x2554	0x00000000

CONCLUSIONS

The lab successfully demonstrated memory manipulation and register operations using assembly language. Understanding these low-level operations provides insight into CPU functionality and data management. The ability to track changes in registers and memory is crucial for debugging and optimizing assembly programs.