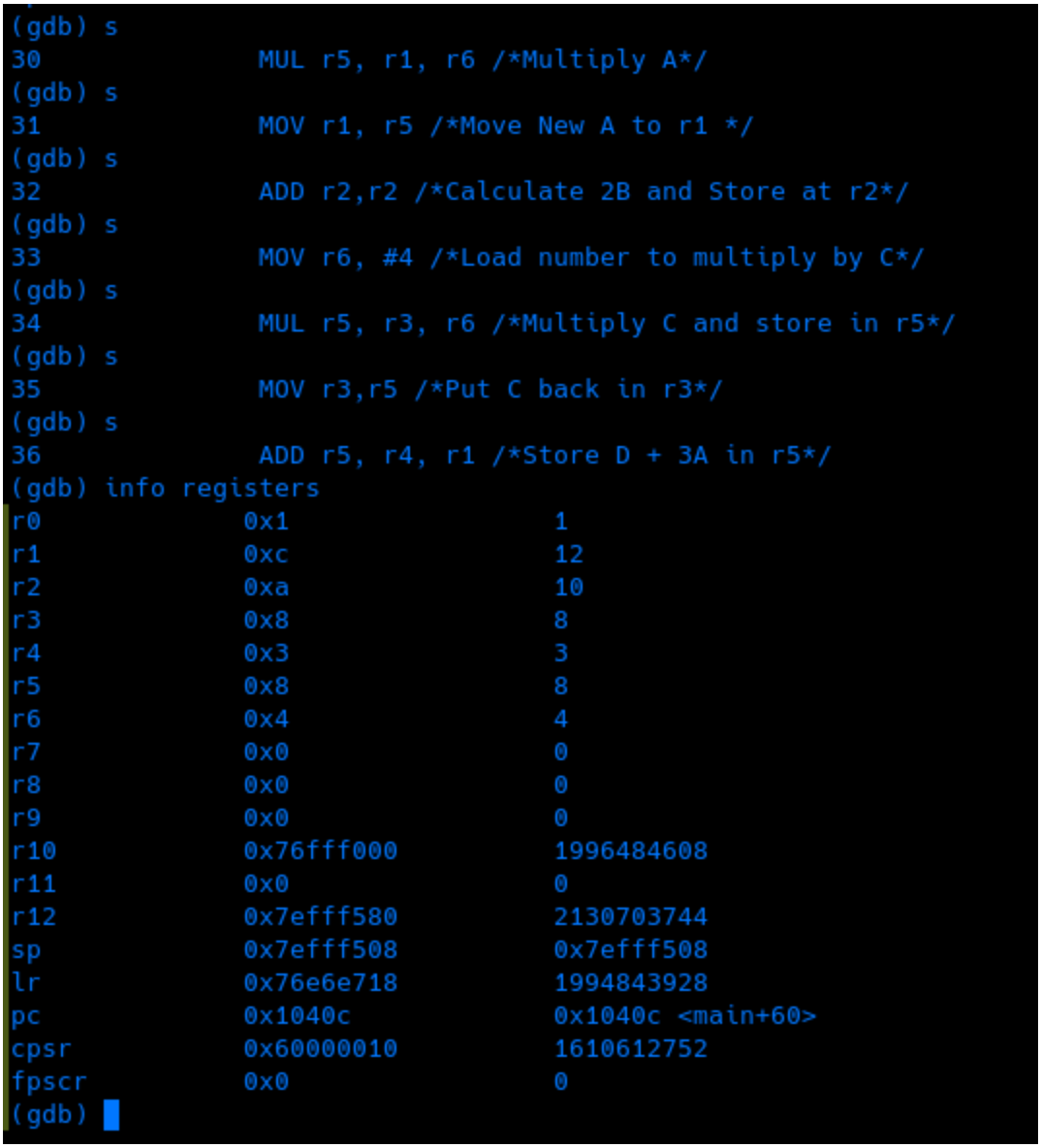
19484286 – Lab Exercise 1

```
.data

.balign 4

A: .word 4
B: .word 5
C: .word 2
D: .word 3

.text

.global main

main:
        /*Write Instructions Here*/
        /* Program must compute  D = D + 3A + 2B - 4C*/
        /*r1:A r2:B r3:C r4:D r5:newD*/
        /*Load Operations*/
        LDR r1, addr_A
        LDR r1, [r1] /*Load actual data rather than the memory address*/
        LDR r2, addr_B
        LDR r2, [r2]
        LDR r3, addr_C
        LDR r3, [r3]
        LDR r4, addr_D
        LDR r4, [r4]

        /*Calculations*/
        MOV r6, #3 /*Get number being multiplied by A*/
        MUL r5, r1, r6 /*Multiply A*/
        MOV r1, r5 /*Move New A to r1 */
        ADD r2,r2 /*Calculate 2B and Store at r2*/
        MOV r6, #4 /*Load number to multiply by C*/
        MUL r5, r3, r6 /*Multiply C and store in r5*/
        MOV r1, r5 /*Move New A to r1 */
        ADD r2,r2 /*Calculate 2B and Store at r2*/
        MOV r6, #4 /*Load number to multiply by C*/
        MUL r5, r3, r6 /*Multiply C and store in r5*/
        MOV r3,r5 /*Put C back in r3*/
        ADD r5, r4, r1 /*Store D + 3A in r5*/
        ADD r5,r2 /*Add 2B*/
        SUB r5, r3 /*Take Away 4C*/
        LDR r0, addr_D /*Load D into Memory*/
        STR r5, [r0] /*Store New D in memory*/
        MOV r0, r5 /*Move New D to r0*/
        bx lr /*Return Output from main*/

addr_A : .word A
addr_B : .word B
addr_C : .word C
addr_D : .word D
```

DEBUGGING CODE

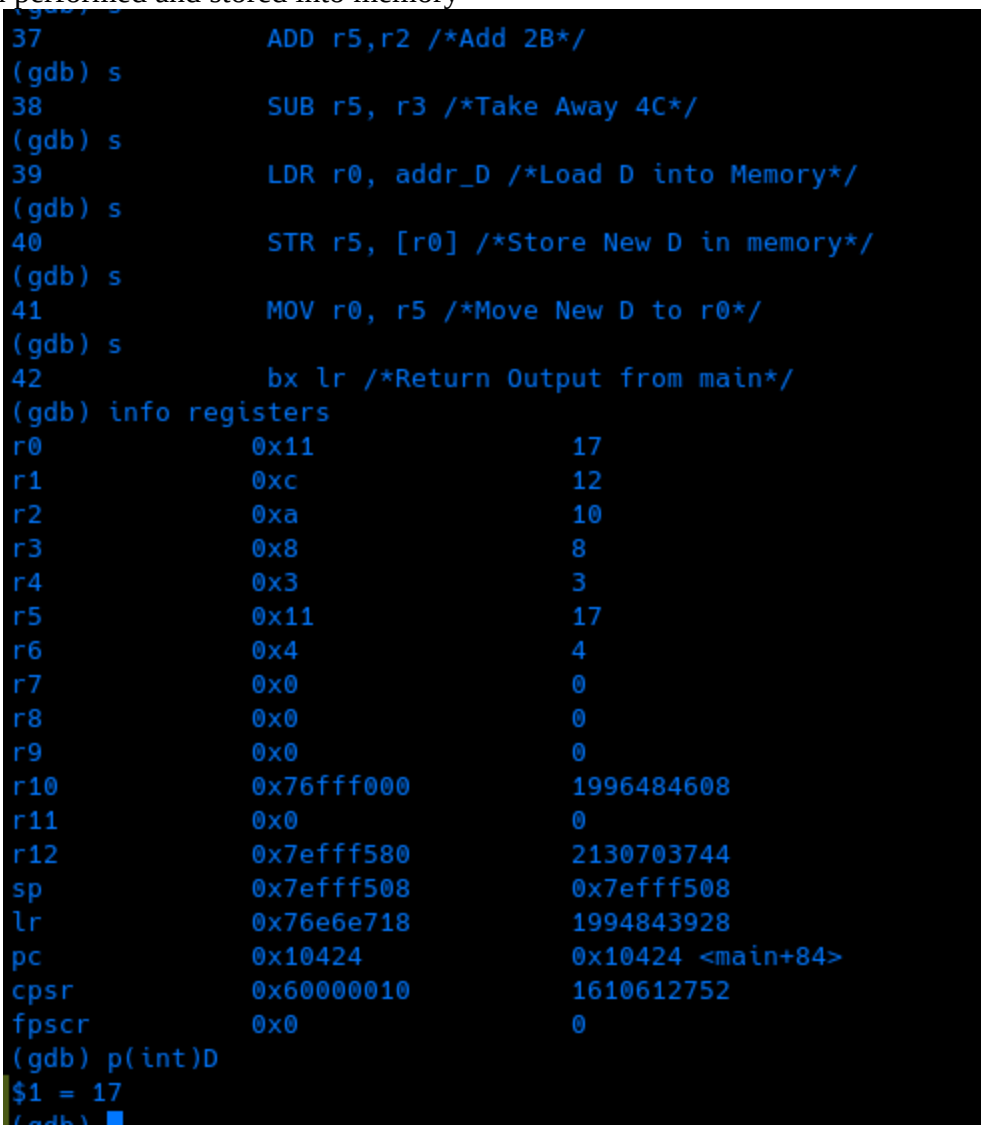
A,B,C,D Loaded into memory

```
Temporary breakpoint 1, main () at prog1.s:19
19              LDR r1, addr_A
(gdb) s
20              LDR r1, [r1] /*Load actual data rather than the memory address*/
(gdb) s
21              LDR r2, addr_B
(gdb) s
22              LDR r2, [r2]
(gdb) s
23              LDR r3, addr_C
(gdb) s
24              LDR r3, [r3]
(gdb) s
25              LDR r4, addr_D
(gdb) s
26              LDR r4, [r4]
(gdb) s
29              MOV r6, #3 /*Get number being multiplied by A*/
(gdb) info registers
r0             0x1                 1
r1             0x4                 4
r2             0x5                 5
r3             0x2                 2
r4             0x3                 3
r5             0x10438             66616
r6             0x102e0             66272
r7             0x0                 0
r8             0x0                 0
r9             0x0                 0
r10            0x76fff000          1996484608
r11            0x0                 0
r12            0x7efff580          2130703744
sp             0x7efff508          0x7efff508
lr             0x76e6e718          1994843928
pc             0x103f0             0x103f0 <main+32>
cpsr           0x60000010          1610612752
fpscr          0x0                 0
(gdb)
```



A,B,C Post Calculations

D Calculation performed and stored into memory



```
37              ADD r5,r2 /*Add 2B*/
(gdb) s
38              SUB r5, r3 /*Take Away 4C*/
(gdb) s
39              LDR r0, addr_D /*Load D into Memory*/
(gdb) s
40              STR r5, [r0] /*Store New D in memory*/
(gdb) s
41              MOV r0, r5 /*Move New D to r0*/
(gdb) s
42              bx lr /*Return Output from main*/
(gdb) info registers
r0             0x11               17
r1             0xc                12
r2             0xa                10
r3             0x8                8
r4             0x3                3
r5             0x11               17
r6             0x4                4
r7             0x0                0
r8             0x0                0
r9             0x0                0
r10            0x76fff000         1996484608
r11            0x0                0
r12            0x7efff580         2130703744
sp             0x7efff508         0x7efff508
lr             0x76e6e718         1994843928
pc             0x10424            0x10424 <main+84>
cpsr           0x60000010         1610612752
fpscr          0x0                0
(gdb) p(int)D
$1 = 17
```