

EXERCISE

1. Modify the given code to perform Vector Subtraction ($A[i] - B[i]$).

SOURCE CODE

```
1  #CODE BY TAMIA NAEEM CTAI-004
2  .data
3  A:.word 1, 3, 14, 9, 11
4  B:.word 33, 22, 33, 7, 4
5  C:.space 20
6  size:.word 5
7  spacing: .ascii " "
8
9  .text
10 main:
11     la $t0, A
12     la $t1, B
13     la $t2, C
14     lw $t3, size
15     li $t4, 0
16
17 loop:
18     bge $t4, $t3, print_result
19     mul $t5, $t4, 4
20     add $t6, $t0, $t5
21     add $t7, $t1, $t5
22     lw $t8, 0($t6)
```

```

        lw $t9, 0($t7)
        sub $s0, $t8, $t9
        add $t6, $t2, $t5
        sw $s0, 0($t6)
        addi $t4, $t4, 1
        j loop

print_result:
        li $t4, 0

print_loop:
        bge $t4, $t3, end
        mul $t5, $t4, 4
        add $t6, $t2, $t5
        lw $a0, 0($t6)
        li $v0, 1
        syscall
        li $v0, 4
        la $a0, spacing
        syscall
        addi $t4, $t4, 1
        j print_loop

```

```

end:
        li $v0, 10
        syscall

```

OUTPUT

```

-32 -19 -19 2 7
-- program is finished running --

```

2. Implement Vector Multiplication of two arrays.

SOURCE CODE

```
1  #CODE BY TAMIA NAEEM CTAI-004
2  .data
3  A:      .word 6,7,82,3,3
4  B:      .word 2,3,2,1,5
5  C:      .space 20
6  size:   .word 5
7  spacing:.asciiz " "
8
9  .text
10 main:
11     la $t0, A
12     la $t1, B
13     la $t2, C
14     lw $t3, size
15     li $t4, 0
16
17 loop:
18     bge $t4, $t3, print_result
19     mul $t5, $t4, 4
20     add $t6, $t0, $t5
21     add $t7, $t1, $t5
22     add $t8, $t2, $t5
```

```

3      lw $t6, 0($t6)
4      lw $t7, 0($t7)
5      mul $t9, $t6, $t7
6      sw $t9, 0($t8)
7      addi $t4, $t4, 1
8      j loop
9
0  print_result:
1      li $t4, 0
2
3  print_loop:
4      bge $t4, $t3, end
5      mul $t5, $t4, 4
6      add $t6, $t2, $t5
7      lw $a0, 0($t6)
8      li $v0, 1
9      syscall
0      li $v0, 4
1      la $a0, spacing
2      syscall
3      addi $t4, $t4, 1

      j print_loop

end:
      li $v0, 10
      syscall
      syscall

```

OUTPUT

```

12 21 164 3 15
-- program is finished running --

```

3. Change the program to handle 10 elements instead of 5.

SOURCE CODE

```
#CODE BY TAMIA NAEEM CTAI-004
.data
A:      .word 1,3,5,7,9,1,13,2,9,2
B:      .word 2,4,6,3,14,15,16,3,3,10
C:      .space 40
size:   .word 10
spacing: .asciiz " "

.text
main:
    la    $t0, A
    la    $t1, B
    la    $t2, C
    lw    $t3, size
    li    $t4, 0

compute_loop:
    bge    $t4, $t3, print_result
    mul    $t5, $t4, 4
    add    $t6, $t0, $t5
    add    $t7, $t1, $t5
    add    $t8, $t2, $t5
    lw     $t9, 0($t6)
    lw     $s0, 0($t7)
    mul    $s1, $t9, $s0
    sw     $s1, 0($t8)
    addi   $t4, $t4, 1
```

```
28     j    compute_loop
29
30 print_result:
31     li    $t4, 0
32
33 print_loop:
34     bge   $t4, $t3, end
35     mul   $t5, $t4, 4
36     add   $t6, $t2, $t5
37     lw    $a0, 0($t6)
38     li    $v0, 1
39     syscall
40     li    $v0, 4
41     la    $a0, spacing
42     syscall
43     addi  $t4, $t4, 1
44     j     print_loop
45
46 end:
47     li    $v0, 10
48     syscall
```

OUTPUT

```
ear 2 12 30 21 126 15 208 6 27 20
    -- program is finished running --
```

4. Implement Scalar Multiplication: Multiply each element of A by a constant value (e.g.,

SOURCE CODE

```
1  #CODE BY TAMIA NAEEM CTAI-004
2  .data
3  A: .word 12,52,4,89,2
4  constant_value: .word 4
5  size: .word 5
6  spacing: .asciiz " "
7
8  .text
9  main:
10     la $t0, A
11     lw $t1, constant_value
12     lw $t2, size
13     li $t3, 0
14
15  loop:
16     bge $t3, $t2, print_result
17     mul $t4, $t3, 4
18     add $t5, $t0, $t4
19     lw $t6, 0($t5)
20     mul $t6, $t6, $t1
21     sw $t6, 0($t5)
22     addi $t3, $t3, 1
23     j loop
24
25  print_result:
26     li $t3, 0
27
```

```
8 print_loop:
9     bge $t3, $t2, end
0     mul $t4, $t3, 4
1     add $t5, $t0, $t4
2     lw $a0, 0($t5)
3     li $v0, 1
4     syscall
5     li $v0, 4
6     la $a0, spacing
7     syscall
8     addi $t3, $t3, 1
9     j print_loop
0
1 end:
2     li $v0, 10
3     syscall
```

OUTPUT

```
] 48 208 16 356 8
] -- program is finished running --
```


5. Extend the code to calculate the dot product of two vectors.

SOURCE CODE

```
1  #CODE BY TAMIA NAEEM CTAI-004
2  .data
3  A: .word 9,8,72
4  B: .word 7,8,22
5  size: .word 3
6  dot_product: .word 0
7
8  .text
9  main:
10     la $t0, A
11     la $t1, B
12     lw $t2, size
13     li $t3, 0
14     lw $t4, dot_product
15
16  loop:
17     bge $t3, $t2, print_result
18     mul $t5, $t3, 4
19     add $t6, $t0, $t5
20     add $t7, $t1, $t5
21     lw $t6, 0($t6)
22     lw $t7, 0($t7)
23     mul $t8, $t6, $t7
24     add $t4, $t4, $t8
25     addi $t3, $t3, 1
26     j loop
27
28  print_result:
29     li $v0, 1
30     move $a0, $t4
31     syscall
32
33  end:
34     li $v0, 10
35     syscall
```

OUTPUT

```
1711
-- program is finished running --
```