

Homework 9

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Q1

Using the format of Figure 10.6, please draw the stack usage procedure during the computation of $(51 - 49) * (172 + 205) - (17 * 2)$. The stack pointer is x4000 initially. Hint: you may refer the whole process sequence in Page 396 of textbook.

x3FFB							
x3FFC							
x3FFD							205
x3FFE			49	-49	-49	172	172
x3FFF		51	51	51	2	2	2
SP	x4000	x3FFF	x3FFE	x3FFE	x3FFF	x3FFE	x3FFD
operation		Push(51)	Push(49)	Minus(49)	51 + (-49)	Push(172)	Push(205)
x3FFB							
x3FFC							
x3FFD	205	205	205	2	2	2	2
x3FFE	377	377	17	17	34	-34	-34
x3FFF	2	754	754	754	754	754	720
SP	x3FFE	x3FFF	x3FFE	x3FFD	x3FFE	x3FFE	x3FFF
operation	172 + 205	377 * 2	Push(17)	Push(2)	17 * 2	Minus(34)	754 + (-34)

Q2

There is a 4-dimensional array $A[M, N, P, Q]$, in which $M = 3, N = 5, P = 7, Q = 9$. Each element is a 16-bit integer and stored sequentially in LC-3's memory. The first element, $A[0, 0, 0, 0]$ is stored at address x4000. The access way of this 4D array can be describe in C like:

```
1  int i, j, k, l;
2  for (i=0 ; i<M ; i++) {
3      for (j=0 ; j<N ; j++) {
4          for (k=0 ; k<P ; k++) {
5              for (l=0 ; l<Q ; l++) {
6                  // access A[i, j, k, l]
7              }
8          }
9      }
10 }
```

What's the address of $A[2, 4, 3, 5]$? Also show the calculation procedure of your answer.

index	element
1	$A[0, 0, 0, 0]$
2	$A[0, 0, 0, 1]$
...	...
9	$A[0, 0, 0, 8]$
10	$A[0, 0, 1, 0]$
11	$A[0, 0, 1, 1]$
...	...
64	$A[0, 1, 0, 0]$
...	...

It's easy to find that $A[i, j, k, l]$ is the $(i * (5 * 7 * 9) + j * (7 * 9) + k * 9 + l + 1)^{th}$ element in the array, which means $A[2, 4, 3, 5]$ is the 915th element.

Since the 1st element is stored at `x4000` && each 16-bit integer would take one memory location, the 915th element would locate at the memory address:

$$0x4000 + (915 - 1) = 17298 = 0x4392$$