CPSC 479 Homework 4: Introduction to HPC

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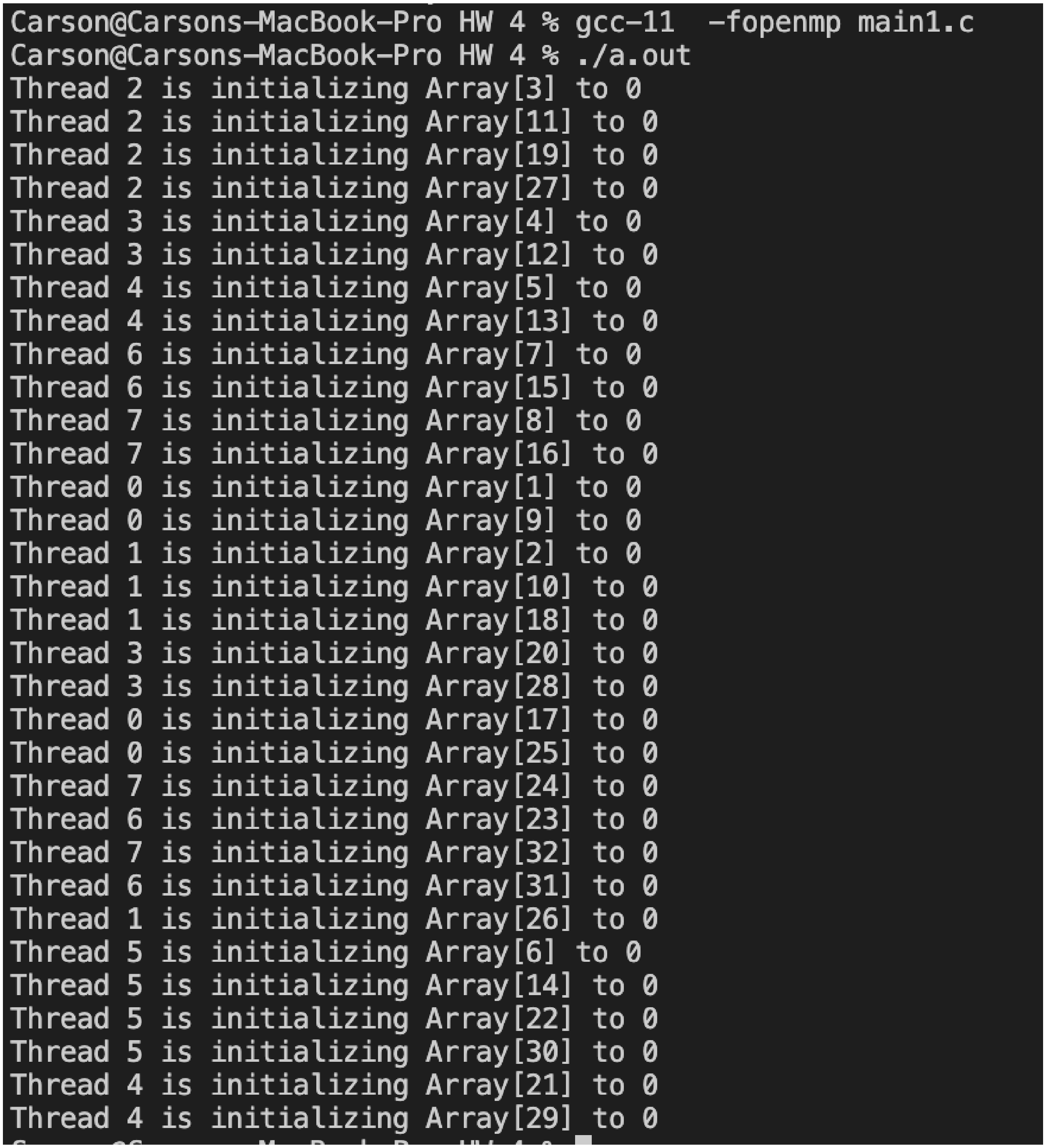
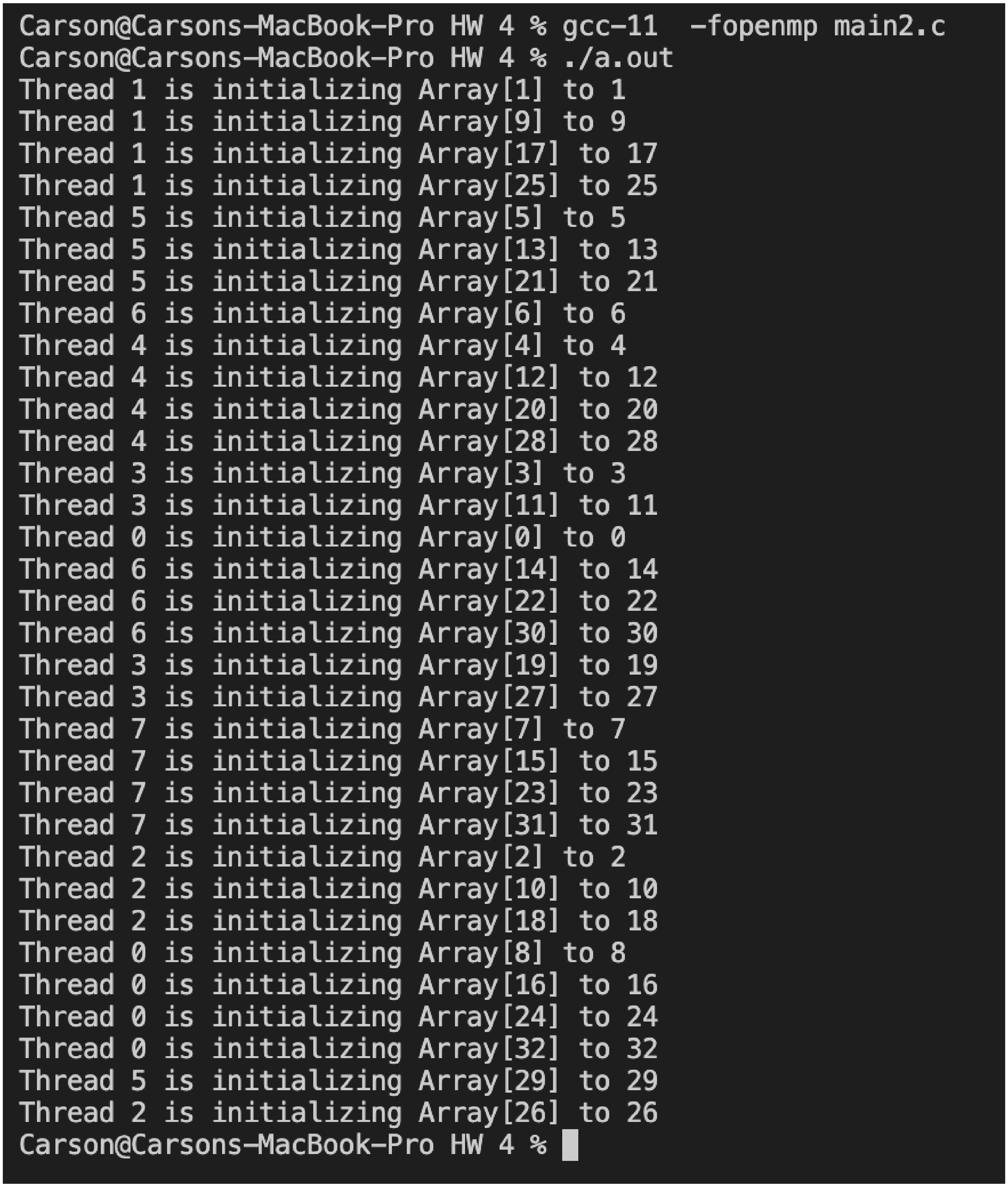
Submission: Upload on Canvas the program(s) and a description file (text, DOC or PDF) on how to execute them. In case of uploading multiple files, clearly labeling each file.

Exercise 1. [4 points] Write an openMP program to initialize an array `array` of size 32 to all zeros in parallel using 8 threads, using one parallel construct and/or parallel for.



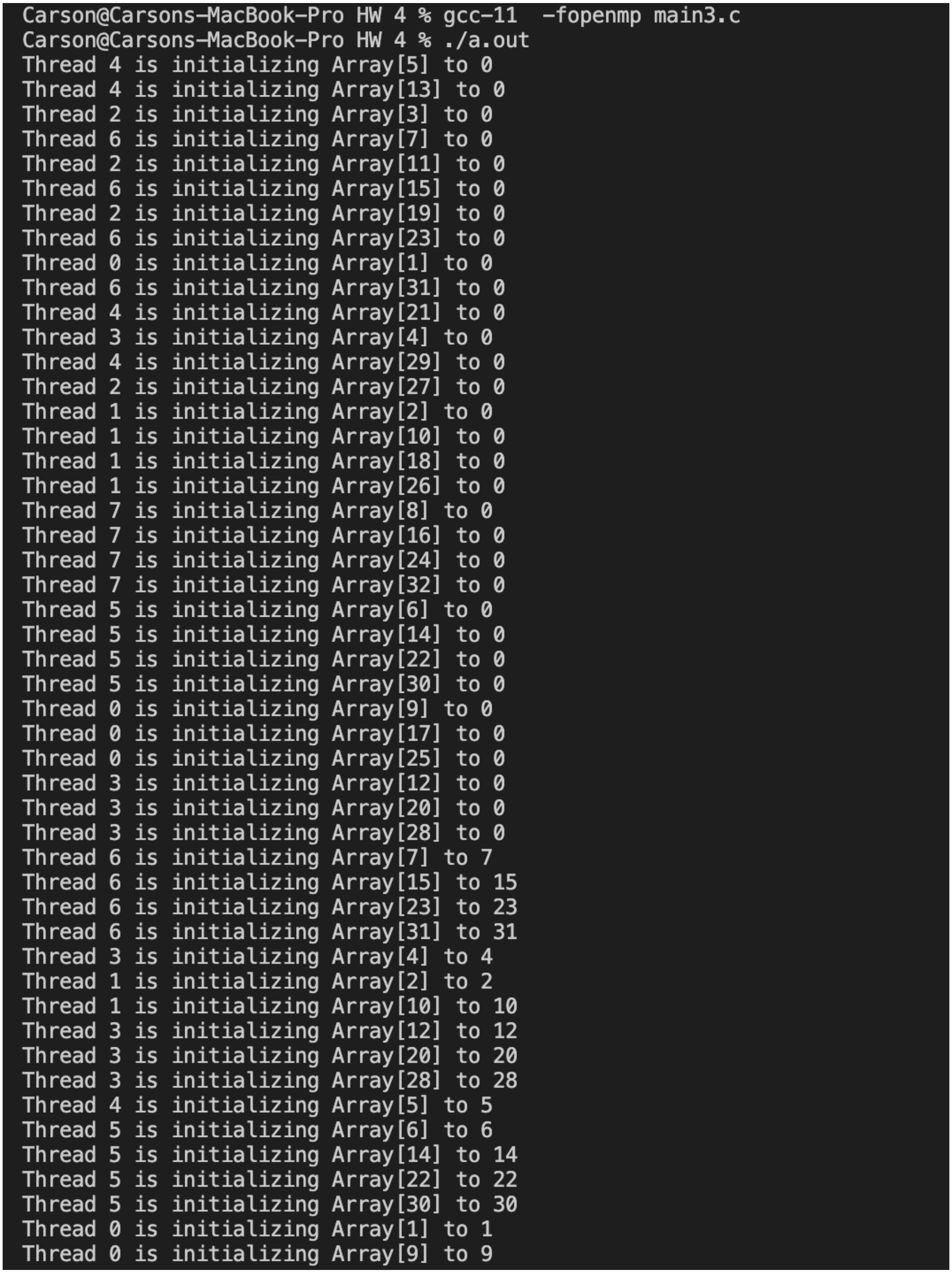
```
Carson@Carsons-MacBook-Pro HW 4 % gcc-11  -fopenmp main1.c
Carson@Carsons-MacBook-Pro HW 4 % ./a.out
Thread 2 is initializing Array[3] to 0
Thread 2 is initializing Array[11] to 0
Thread 2 is initializing Array[19] to 0
Thread 2 is initializing Array[27] to 0
Thread 3 is initializing Array[4] to 0
Thread 3 is initializing Array[12] to 0
Thread 4 is initializing Array[5] to 0
Thread 4 is initializing Array[13] to 0
Thread 6 is initializing Array[7] to 0
Thread 6 is initializing Array[15] to 0
Thread 7 is initializing Array[8] to 0
Thread 7 is initializing Array[16] to 0
Thread 0 is initializing Array[1] to 0
Thread 0 is initializing Array[9] to 0
Thread 1 is initializing Array[2] to 0
Thread 1 is initializing Array[10] to 0
Thread 1 is initializing Array[18] to 0
Thread 3 is initializing Array[20] to 0
Thread 3 is initializing Array[28] to 0
Thread 0 is initializing Array[17] to 0
Thread 0 is initializing Array[25] to 0
Thread 7 is initializing Array[24] to 0
Thread 6 is initializing Array[23] to 0
Thread 7 is initializing Array[32] to 0
Thread 6 is initializing Array[31] to 0
Thread 1 is initializing Array[26] to 0
Thread 5 is initializing Array[6] to 0
Thread 5 is initializing Array[14] to 0
Thread 5 is initializing Array[22] to 0
Thread 5 is initializing Array[30] to 0
Thread 4 is initializing Array[21] to 0
Thread 4 is initializing Array[29] to 0
Carson@Carsons-MacBook-Pro HW 4 %
```

Exercise 2. [2 points] In addition to what Problem 1 asks, create another parallel construct that adds `i` to `array[i]`.

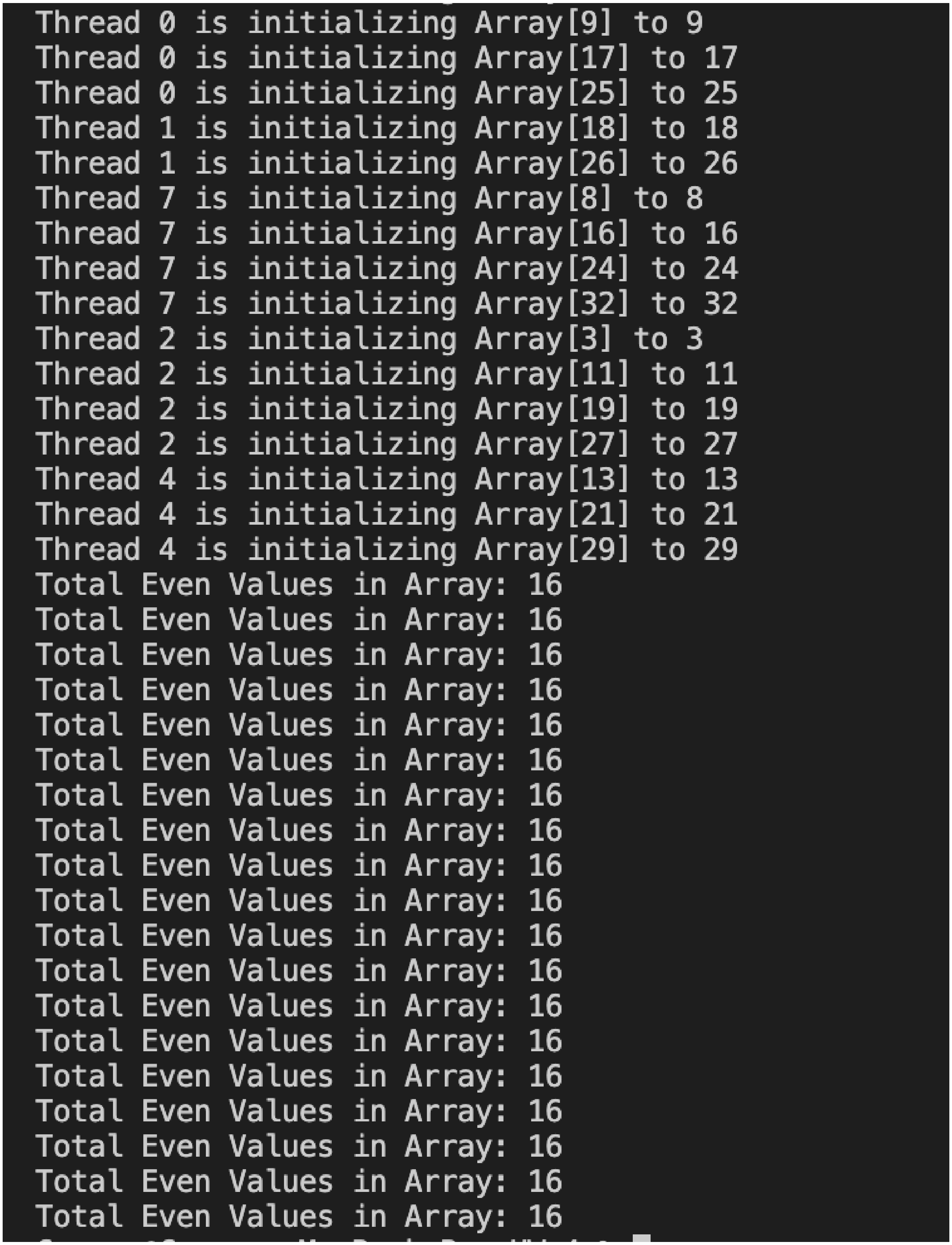


```
Carson@Carsons-MacBook-Pro HW 4 % gcc-11  -fopenmp main2.c
Carson@Carsons-MacBook-Pro HW 4 % ./a.out
Thread 1 is initializing Array[1] to 1
Thread 1 is initializing Array[9] to 9
Thread 1 is initializing Array[17] to 17
Thread 1 is initializing Array[25] to 25
Thread 5 is initializing Array[5] to 5
Thread 5 is initializing Array[13] to 13
Thread 5 is initializing Array[21] to 21
Thread 6 is initializing Array[6] to 6
Thread 4 is initializing Array[4] to 4
Thread 4 is initializing Array[12] to 12
Thread 4 is initializing Array[20] to 20
Thread 4 is initializing Array[28] to 28
Thread 3 is initializing Array[3] to 3
Thread 3 is initializing Array[11] to 11
Thread 0 is initializing Array[0] to 0
Thread 6 is initializing Array[14] to 14
Thread 6 is initializing Array[22] to 22
Thread 6 is initializing Array[30] to 30
Thread 3 is initializing Array[19] to 19
Thread 3 is initializing Array[27] to 27
Thread 7 is initializing Array[7] to 7
Thread 7 is initializing Array[15] to 15
Thread 7 is initializing Array[23] to 23
Thread 7 is initializing Array[31] to 31
Thread 2 is initializing Array[2] to 2
Thread 2 is initializing Array[10] to 10
Thread 2 is initializing Array[18] to 18
Thread 0 is initializing Array[8] to 8
Thread 0 is initializing Array[16] to 16
Thread 0 is initializing Array[24] to 24
Thread 0 is initializing Array[32] to 32
Thread 5 is initializing Array[29] to 29
Thread 2 is initializing Array[26] to 26
Carson@Carsons-MacBook-Pro HW 4 % 
```

Exercise 3. [4 points] In addition to what Problem 1 and Problem 2 ask, create another parallel construct that calculates the number of even values in `array` as follows: it distributes the iterations to each thread using cyclic distribution, each thread computes the number of even values from its iterations and master thread collects and adds the number of even values. Master thread then displays the result.



```
Carson@Carsons-MacBook-Pro HW 4 % gcc-11  -fopenmp main3.c
Carson@Carsons-MacBook-Pro HW 4 % ./a.out
Thread 4 is initializing Array[5] to 0
Thread 4 is initializing Array[13] to 0
Thread 2 is initializing Array[3] to 0
Thread 6 is initializing Array[7] to 0
Thread 2 is initializing Array[11] to 0
Thread 6 is initializing Array[15] to 0
Thread 2 is initializing Array[19] to 0
Thread 6 is initializing Array[23] to 0
Thread 0 is initializing Array[1] to 0
Thread 6 is initializing Array[31] to 0
Thread 4 is initializing Array[21] to 0
Thread 3 is initializing Array[4] to 0
Thread 4 is initializing Array[29] to 0
Thread 2 is initializing Array[27] to 0
Thread 1 is initializing Array[2] to 0
Thread 1 is initializing Array[10] to 0
Thread 1 is initializing Array[18] to 0
Thread 1 is initializing Array[26] to 0
Thread 7 is initializing Array[8] to 0
Thread 7 is initializing Array[16] to 0
Thread 7 is initializing Array[24] to 0
Thread 7 is initializing Array[32] to 0
Thread 5 is initializing Array[6] to 0
Thread 5 is initializing Array[14] to 0
Thread 5 is initializing Array[22] to 0
Thread 5 is initializing Array[30] to 0
Thread 0 is initializing Array[9] to 0
Thread 0 is initializing Array[17] to 0
Thread 0 is initializing Array[25] to 0
Thread 3 is initializing Array[12] to 0
Thread 3 is initializing Array[20] to 0
Thread 3 is initializing Array[28] to 0
Thread 6 is initializing Array[7] to 7
Thread 6 is initializing Array[15] to 15
Thread 6 is initializing Array[23] to 23
Thread 6 is initializing Array[31] to 31
Thread 3 is initializing Array[4] to 4
Thread 1 is initializing Array[2] to 2
Thread 1 is initializing Array[10] to 10
Thread 3 is initializing Array[12] to 12
Thread 3 is initializing Array[20] to 20
Thread 3 is initializing Array[28] to 28
Thread 4 is initializing Array[5] to 5
Thread 5 is initializing Array[6] to 6
Thread 5 is initializing Array[14] to 14
Thread 5 is initializing Array[22] to 22
Thread 5 is initializing Array[30] to 30
Thread 0 is initializing Array[1] to 1
Thread 0 is initializing Array[9] to 9
```



```
Thread 0 is initializing Array[9] to 9
Thread 0 is initializing Array[17] to 17
Thread 0 is initializing Array[25] to 25
Thread 1 is initializing Array[18] to 18
Thread 1 is initializing Array[26] to 26
Thread 7 is initializing Array[8] to 8
Thread 7 is initializing Array[16] to 16
Thread 7 is initializing Array[24] to 24
Thread 7 is initializing Array[32] to 32
Thread 2 is initializing Array[3] to 3
Thread 2 is initializing Array[11] to 11
Thread 2 is initializing Array[19] to 19
Thread 2 is initializing Array[27] to 27
Thread 4 is initializing Array[13] to 13
Thread 4 is initializing Array[21] to 21
Thread 4 is initializing Array[29] to 29
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
Total Even Values in Array: 16
```