HPML Lab1 Answer Sheet

C1.

```
    - 1000000 1000
C1 Full Repitition           <N>:1000000,<T>:1.151372 sec,B:10.422349 Gb/sec,F:1.737058 GFLOP/sec
C1 Ave Second Half Repitition <N>:500000,<T>:0.001151 sec,B:10.424563 Gb/sec,F:1.737427 GFLOP/sec
    - 300000000 20
C1 Full Repitition          <N>:300000000,<T>:7.324784 sec,B:9.829641 Gb/sec,F:1.638274 GFLOP/sec
C1 Ave Second Half Repitition <N>:150000000,<T>:0.367438 sec,B:9.804978 Gb/sec,F:1.634163 GFLOP/sec
```

C2.

```
    - 1000000 1000
C2 Full Repitition           <N>:1000000,<T>:0.346318 sec,B:25.987712 Gb/sec,F:5.775047 GFLOP/sec
C2 Ave Second Half Repitition <N>:500000,<T>:0.000346 sec,B:23.121954 Gb/sec,F:5.780488 GFLOP/sec
    - 300000000 20
C2 Full Repitition         <N>:300000000,<T>:4.041862 sec,B:13.360178 Gb/sec,F:2.968928 GFLOP/sec
C2 Ave Second Half Repitition<N>:150000000,<T>:0.202373 sec,B:11.876681 Gb/sec,F:2.969170
GFLOP/sec
```

C3.

```
    - 1000000 1000
C3 Full Repitition           <N>:1000000,<T>:0.318261 sec,B:37.704904 Gb/sec,F:6.284151 GFLOP/sec
C3 Ave Second Half Repitition <N>:500000,<T>:0.000316 sec,B:37.986508 Gb/sec,F:6.331085 GFLOP/sec
    - 300000000 20
C3 Full Repitition         <N>:300000000,<T>:3.460331 sec,B:20.807256 Gb/sec,F:3.467876 GFLOP/sec
C3  Ave  Second  Half  Repitition  <N>:150000000,<T>:0.171748  sec,B:20.989313  Gb/sec,F:3.498219
GFLOP/sec
```

C4.

```
    - 1000000 1000
C4 <N>: 1000000  ,<T>:  473.3247249890119 sec, <B>:  0.025352573754262628 Gb/s,F:
0.004225428959043771 GFLOP/s
C4 <N>: 1000000 , <T>:  0.4623372938418761 sec, <B>:  0.025955358610119373 Gb/s, <F>:
0.004325893101686558 GFLOP/s
    - 300000000 20
C4 <N>: 300000000  ,<T>:  2970.0624963310547 sec, <B>:  0.024241914131080494 Gb/s,F:
0.004040319021846749 GFLOP/s
C4  <N>:  300000000  ,  <T>:    146.93636284670794  sec,  <B>:    0.024505144360525102  Gb/s,  <F>:
0.004084190726754184 GFLOP/s
```

C5.

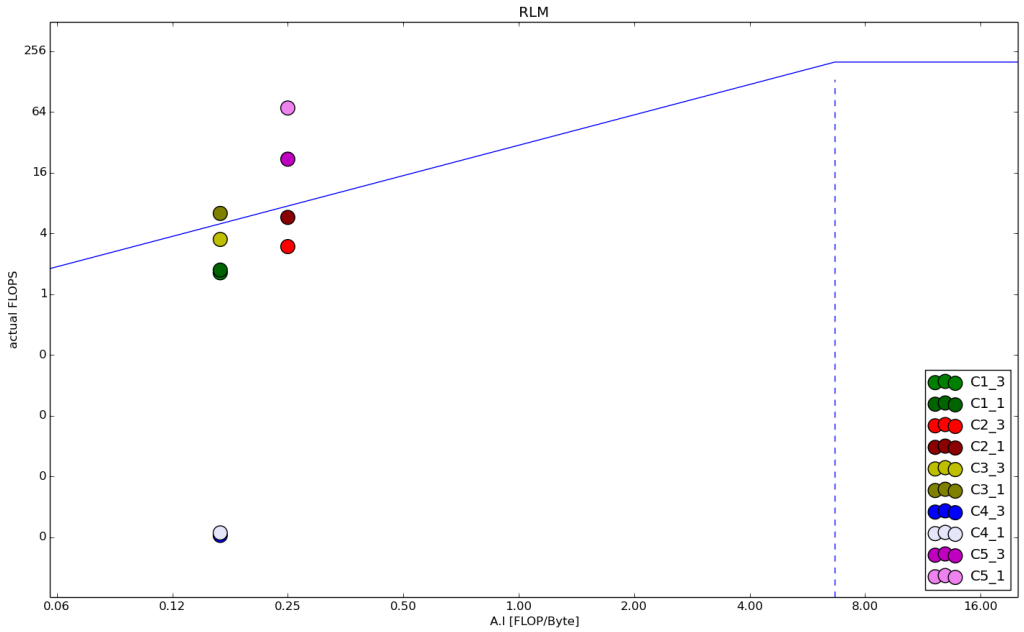
```
    - 1000000 1000
C5 <N>: 1000000  ,<T>:  0.04578380100429058 sec, <B>:  174.73437819743904 Gb/s,F:
43.68357270757341 GFLOP/s
C5 <N>: 1000000 , <T>:  2.8973578475415707e-05 sec, <B>:  280.57524324849845 Gb/s, <F>:
70.1437757402368 GFLOP/s
    - 300000000 20
C5 <N>: 300000000  ,<T>:  0.5548066557385027 sec, <B>:  86.516626258038 Gb/s,F:
21.629156528460907 GFLOP/s
C5  <N>:  300000000  ,  <T>:    0.02751286528073251  sec,  <B>:    87.2952005096135  Gb/s,  <F>:
21.823800091030375 GFLOP/s
```

Q1.

For C program, the result is approximately the same as using the whole data to calculate the mean, for python program, in C4, the mean value calculated by the second half data is also the same as

those calculated by whole data, while in C5, the mean value is higher when using only the second half of measurements, both in small and large cases.

Q2.



Q3.

As we can see from the figure above, C1_300000000 is the baseline, C1_1000000 has similar FLOPs because the point is overlapped with baseline case.

- both C2_300000000 and C2_1000000 have higher FLOPS and A.I. than baseline case.
- C3_1000000 and C3_300000000 have similar A.I but higher FLOPS than baseline case, this is because of the vectorization, which we mentioned in the lecture.

Q4.

For C4 case and C5 case, we can see that both two measurements are lower than both one in C5, this is because dot product have higher A.I than the analytically calculation,

In C4 case, A.I._C4 = 2/(3*4),
In C5 case, A.I._C5 = 2n/(2n+1)*4,

which we can get higher A.I in C5. Moreover, C5 case runs in much shorter time than C4 case as well, which explains that result in C5 has higher FLOPS than those in C4.