Git repository: GFA23SCM60S/CS402_HW1 (github.com)
Q1)

For both histograms, the X-axis represents the frequency of address and the Y-axis represents the Address in decimal format. The graph has been plotted using Python and matplotlib library.
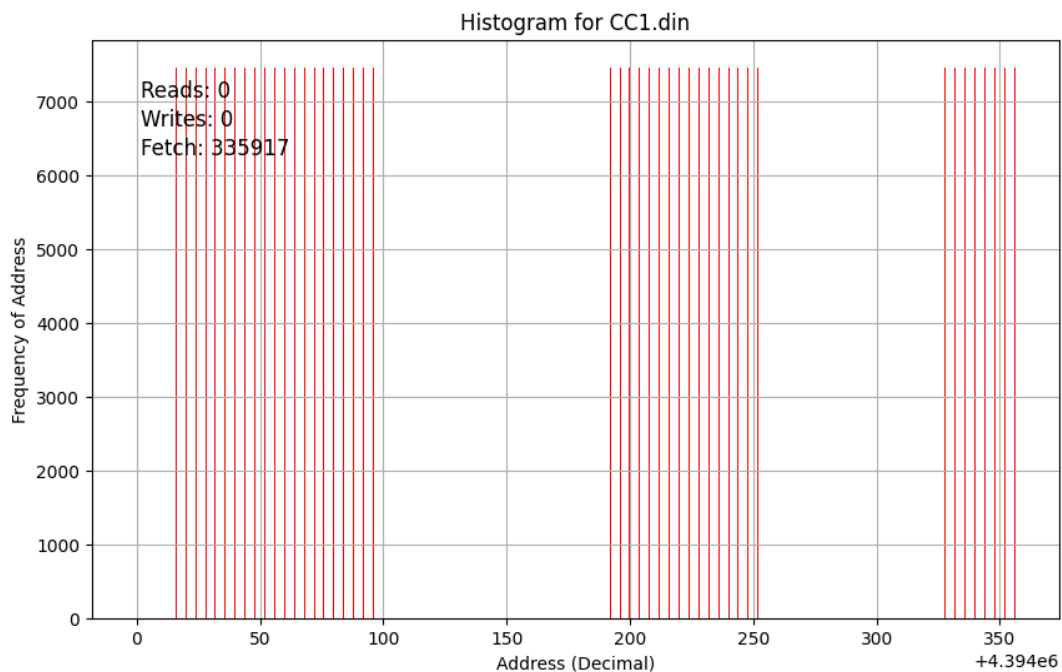
Histogram for cc1.din
Range selected: 4394000, 4397000
Read:0
Write:0
Fetch:335917

It is observed that the number of fetches is more than 333,000 while the read and write counts are 0. We can infer from this that the selected range of cc1.din is primarily used to fetch data.
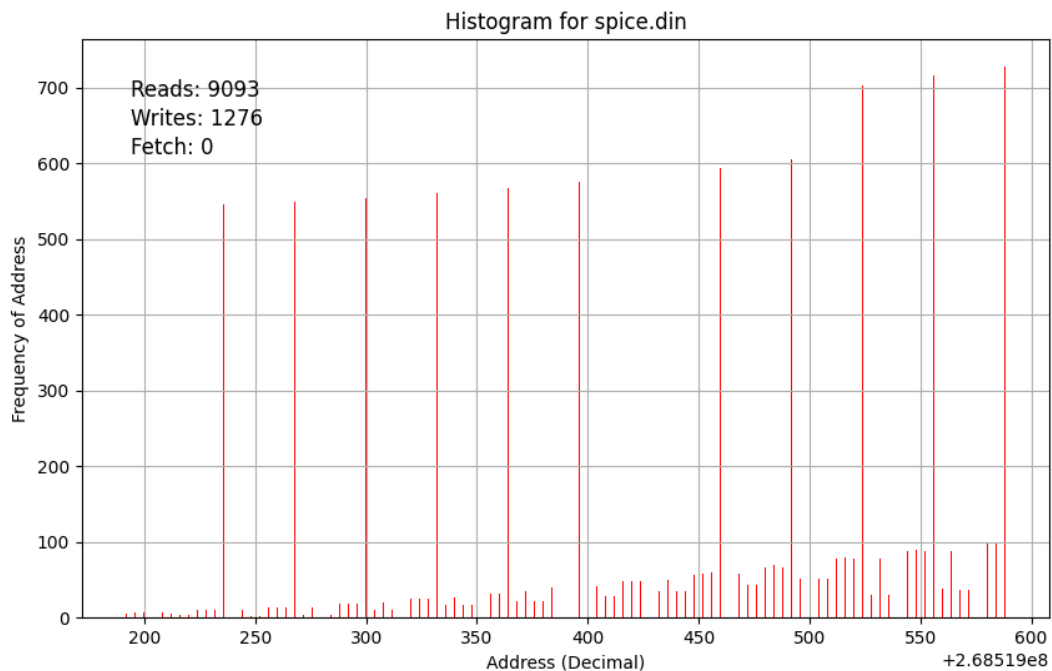
Histogram for spice.din
Range Selected: 268519190, 268519590
Read: 9093
Write: 1276
Fetch: 0

It is observed that the number of reads is 9093 and writes are 1276 while the fetch count is 0. We can infer from this that the selected range of spice.din is primarily used to fetch data. We can infer that for the selected range, there is more activity for reading and writing to memory. The computer might be running an application that is modifying data constantly. The number of reads is much higher than writes. This can be indicative that the application is reading more data.

Q2)
System Configurations:

Details	System-1	System-2
Manufacturer	Apple	Intel
CPU	M2 Pro SoC processor	Xenon(R) Platinum 8259CL CPU
Total Cores	10 (6 performance and 4 efficiency)	24
Clock Speed	2.5 GHz	2.5 GHz with turbo speed of 3.5 GHz
Memory	16 GB	32 GB
OS	macOS Sonoma 14.2	Windows 2019 server, 64 bit OS
GPU	16- core GPU	-
The Complier Used to run the program	Eclipse	Eclipse

Macbook Pro M2 (Column inner Loop)

S.No.	Time measured for Integer Matrix Multiplication	Time measured for double Matrix Multiplication
1	4349617834	24852705583
2	24214542583	24480149708
3	2258970958	25786998708
4	1622156666	25017747542
5	4083531625	25371127000
6	9391346458	25199258958
7	24530693875	25331509750
8	9814704042	25540869917
9	20033058000	25427862334
10	1633402625	26469328333
Average(ns)	10193202466.6	25347755783.3

Average (s)	10.19	25.35

Macbook Pro M2 (Row inner Loop)

S.No.	Time measured for Integer Matrix Multiplication	Time measured for double Matrix Multiplication
1	2258970909	25199258921
2	2258970934	25786998711
3	9814704097	26469328309
4	1633402601	25427862314
5	20033058078	25017747545
6	4349617865	25540869900
7	24214542566	24480149716
8	9391346472	25371127004
9	24530693812	25331509781
10	1622156689	24852705599
Average(ns)	10010746402.3	25347755780
Average (s)	10.01	25.35

IIT Windows VM system (Column inner loop)

S.No.	Time measured for Integer Matrix Multiplication	Time measured for double Matrix Multiplication
1	7366474300	6094153200
2	4511491400	5565198800
3	4097044700	5418030900
4	5478526100	5339585300
5	3877890300	4511146300
6	4621344900	5727237400
7	4230744900	4820056100
8	5566184200	5490569300
9	5545423400	6047820400
10	4898803601	4799394200
Average(ns)	5019392780.1	5381319190
Average (S)	5.02	5.38

IIT Windows VM system (Row inner loop)

S.No.	Time measured for Integer Matrix Multiplication	Time measured for double Matrix Multiplication
1	4621344200	5727237400
2	5478523100	4820056100
3	5566182200	4511146300
4	4898800601	4799394200
5	4230714900	6047820400
6	5545429400	5490569300
7	4511491100	6094153200
8	3877990300	5418030900
9	7366074300	5727237400
10	4097014700	5565198800
Average(ns)	5019356480.1	5420084400
Average (S)	5.02	5.42

Performance Ratio:
1. Integer Matrix Multiplication
    Time2/Time1 = 5.02/10.01 = 0.501
    This shows that system2 is 50% more efficient than system1 in performing Integer Matrix multiplication

2. Double Matrix Multiplication
    Time2/Time1 = 25.34/5.42 = 4.675
    This shows us that system2 is 467.5 % more powerful than system1 in performing double matrix multiplication.

3. Clock Speed
    ClockSpeed2/ClockSpeed1 = 3.5/2.5 = 1.4
    This shows us that System2 is 1.4 times faster than System1.

This is due to more number of cores present for processing quickly. Based on these specifications, the Intel Xeon Platinum 8259CL has more cores, threads, cache, and raw performance than the M2 processor, but it also consumes more power and requires a separate GPU.
We observe that the for Mac system, the average time taken to multiply an integer and double matrices is 10.1 seconds and 25.3 seconds respectively, whereas the time taken for the same matrix multiplication in a Windows system

for integer and double matrices is 5 seconds and 5.3 seconds respectively. We observe that the latter is much faster than the former.

Again, this is due to more number of cores and better memory for the Intel CPU. The price of a computer with Intel (R) Xenon(R) Platinum 8259CL CPU costs around 8,821$ whereas a MacBook Pro M2 costs 2,100$. Hence cost-wise, a MacBook Pro would be better as it performs decently but if the customer wants to perform large calculations in a shorter time, the former would be a better option although it costs more.