Name: Sahas Marwah
Roll Number: 2020237
Computer Architecture Assignment 1

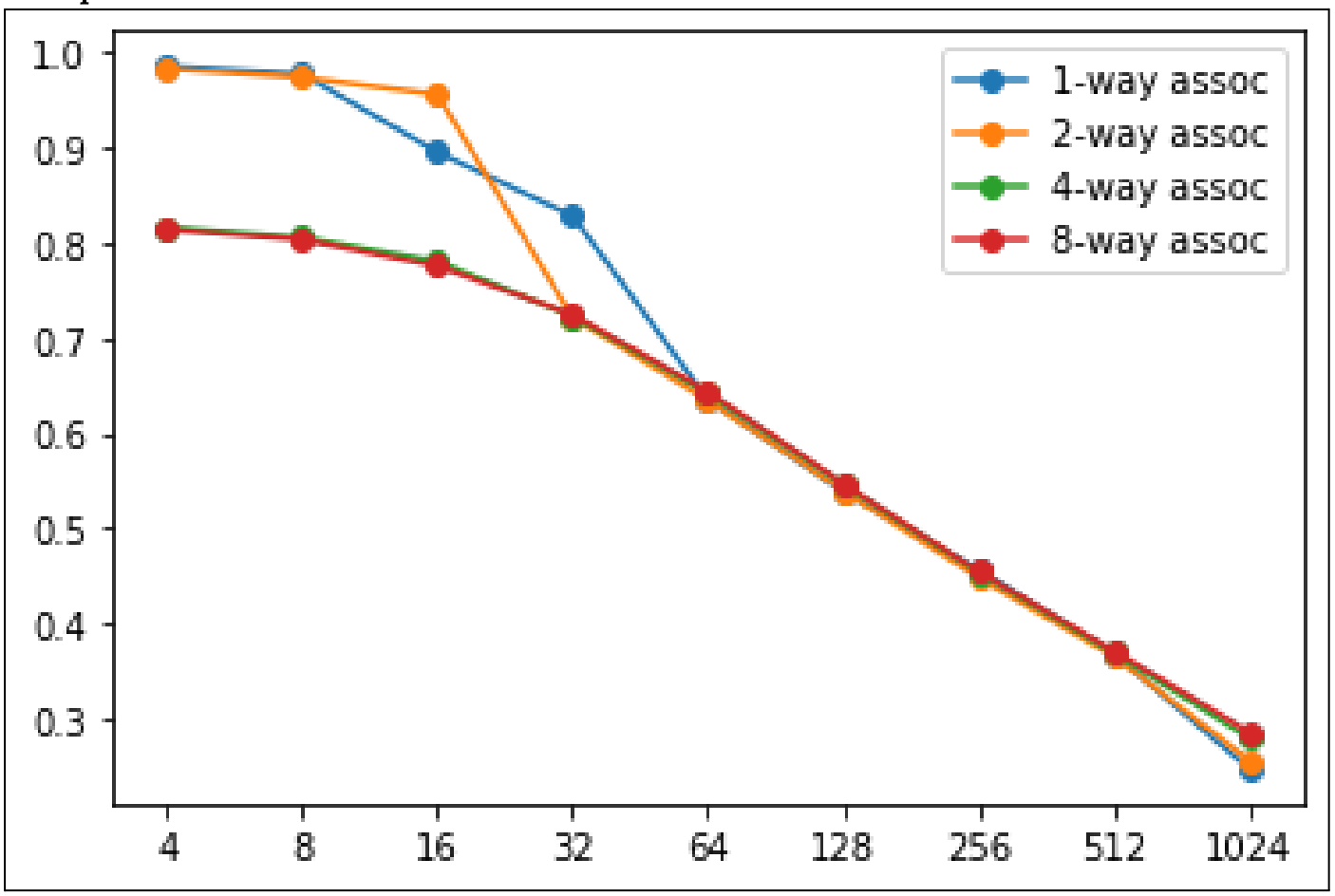
1. **Observations on L2 cache miss rate statistics:**
   In our assignment, we are changing L2 cache size and associativity. This leads to changes in hit and miss rates.

   So intuitively and experimentally, we can infer that **by increasing the cache size miss rate decreases**. This is due to the fact that more data can be cached due to the larger size.

   We know that higher associativity means more complex hardware
   We also observed **that the miss rate was reduced by increasing the associativity in the L2 cache parameter**.

2. **A. Configuration script:**
   Attached in the zip file: **cache_and_main.py**
   (explanation of code written in comments)

B. Graph:



Configurations used:

Size_Associativity:

4kB_1	8kB_1	16kB_1	32kB_1	64kB_1	128kB_1	256kB_1	512kB_1	1024kB_1
4kB_2	8kB_2	16kB_2	32kB_2	64kB_2	128kB_2	256kB_2	512kB_2	1024kB_2
4kB_4	8kB_4	16kB_4	32kB_4	64kB_4	128kB_4	256kB_4	512kB_4	1024kB_4
4kB_8	8kB_8	16kB_8	32kB_8	64kB_8	128kB_8	256kB_8	512kB_8	1024kB_8

Values:

```
X = [4, 8, 16, 32, 64, 128, 256, 512, 1024]
Y_1 = [0.984961, 0.977155, 0.894834, 0.828099, 0.635401, 0.538618, 0.456808, 0.368668, 0.248481]
Y_2 = [0.982304, 0.973260, 0.955630, 0.721525, 0.634303, 0.539766, 0.448473, 0.366017, 0.257389]
Y_4 = [0.815644, 0.805447, 0.780133, 0.722954, 0.641631, 0.546105, 0.453966, 0.369617, 0.280239]
Y_8 = [0.813614, 0.803059, 0.775371, 0.724465, 0.643745, 0.547417, 0.455057, 0.371925, 0.286720]
```

Observations from my graph:

My graph is a bit different from the one given in the book. In my graph, for different associativity line graphs, they all converge from 64kb - 512kb L2 cache size and then diverge a little bit in the end.

This may be because of the different input file.

But the general trend is almost the same.

C. Explanation for graph and statistics:
We observed that the miss rate is inversely proportional to cache size as well as the associativity.

The **larger a cache is, the less chance there will be of a conflict**, hence fewer misses.

In the case of associativity, **higher associativity means each set has more blocks, so there's less chance of a conflict** between two addresses. Hence, fewer misses.

We see this trend from the graph too.