Scatter Operation:

Varying Block Size :

Matrix Size 128x128:

Block Size 16

Number of instructions: 240677
Total cycles taken: 12129641
cache_3
    Number of accesses: 12871
    Number of hits: 7516
    Number of misses: 5355
cache_2
    Number of accesses: 55522
    Number of hits: 41382
    Number of misses: 14140
cache_1
    Number of accesses: 240677
    Number of hits: 176617
    Number of misses: 64060
AMATs:
{'cache_1': 40.23945650492939,
 'cache_2': 147.42483099027305,
 'cache_3': 516.0515888431357,
 'mem': 1000}

cache_3

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6 |
| Way 7 | |

| Set 0 | 0x7f0e02aba808 | 0x7f0dee01be08 | 0x7f0dee01c008 | 0x7f0e02aba600 | 0x7f0dee01b600 |
| 0x7f0dedb1fe00 | 0x7f0dee01bc00 | 0x7f0ded582600 |

| Set 1 | 0x7f0ded582610 | 0x7f0dedf00a18 | 0x7f0e02ab8e18 | 0x7f0dee01b618 | 0x7f0e02ab9e18 |
| 0x7f0e02aba61c | 0x604210 | 0x7f0dee01bc10 |

| Set 2 | 0x7f0dee01b42e | 0x7f0ded582628 | 0x7f0e02ab9028 | 0x7f0dee01b628 | 0x7f0e02ab9e20
| 0x7f0dee01b220 | 0x7f0ded79e020 | 0x7f0ded581a28 |

| Set 3 | 0x7f0ded581c30 | 0x7f0e02ab9a38 | 0x7ffe71126430 | 0x7ffe71125a38 | 0x7f0dedf01430 |
0x603e38 | 0x7f0dee01b230 | 0x7f0e02ab9e3c |

| Set 4 | 0x7ffe71126448 | 0x7f0dedf03440 | 0x7f0dedf02840 | 0x7f0e02aba248 | 0x7f0dedf00040 |
0x7f0dedeffa48 | 0x7f0ded79dc40 | 0x7f0ded583848 |

| . | | | | | | | | |

| . | | | | | | | | |

| . | | | | | | | | |

| Set 31 | 0x7f0e02aba7f8 | 0x7f0dee01bff8 | 0x7ffe711263f8 | 0x7f0e02aba5f8 | 0x7f0dedef67f8 |
0x7f0dedb1fdf0 | 0x7f0dedb1fff0 | 0x7f0ded79dff8 |

cache_2

| | Way 0 | Way 1 | Way 2 | Way 3 | |

| Set 0 | 0x7f0dee01be0c | 0x7f0ded582700 | 0x7f0ded582d0c | 0x7f0ded582600 |

| Set 1 | 0x7ffe71126518 | 0x7f0dee01b91c | 0x7f0e02ab8e18 | 0x7f0dee01bc10 |

| Set 2 | 0x7f0ded582d28 | 0x7ffe71126528 | 0x7f0ded582620 | 0x7f0ded581a28 |

| Set 3 | 0x7f0dedeff330 | 0x7f0ded582d30 | 0x7f0dedb20134 | 0x7ffe71126530 |

```
| Set 4  | 0x7ffe71126540 | 0x7f0ded586740 | 0x7f0ded583848 | 0x7f0ded582748 |

| .  |        |        |        |        |

| .  |        |        |        |        |

| .  |        |        |        |        |

| Set 15 | 0x7f0dee01c2fc | 0x7f0dee01c0f0 | 0x7ffe711264f0 | 0x7f0e02ab9af8 |


cache_1
|       | Way 0         | Way 1        |

| Set 0  | 0x7f0ded581a80 | 0x7f0ded582600 |

| Set 1  | 0x7ffe71126518 | 0x7ffe71126498 |

| Set 2  | 0x7f0ded581a28 | 0x7ffe71126528 |

| Set 3  | 0x7f0ded583830 | 0x7ffe71126530 |

| Set 4  | 0x7f0ded583844 | 0x7ffe71126540 |

| Set 5  | 0x7f0ded586750 | 0x7ffe71126550 |

| Set 6  | 0x7ffe711264e4 | 0x7f0ded580e68 |

| Set 7  | 0x7ffe71126478 | 0x7ffe711264f8 |
```

real   2m6.676s
user   0m21.227s
sys   0m2.459s
/home/grads/vmn5118/CachePerformanceOnMatMul

Block size 32

Number of instructions: 240677
Total cycles taken: 11459193
cache_3
        Number of accesses: 12506
        Number of hits: 7060
        Number of misses: 5446

cache_2
        Number of accesses: 27354
        Number of hits: 13529
        Number of misses: 13825
cache_1
        Number of accesses: 240677
        Number of hits: 208047
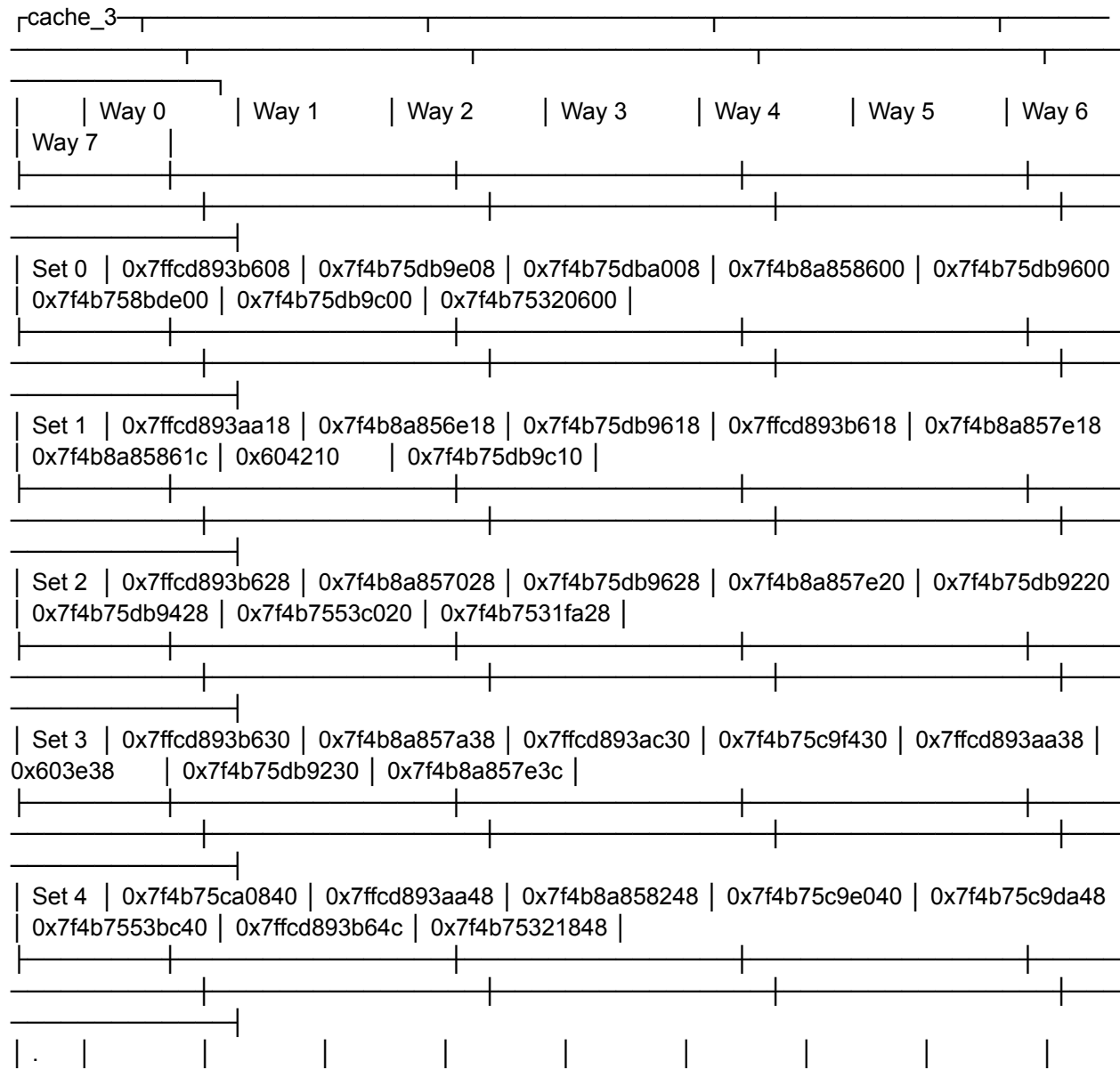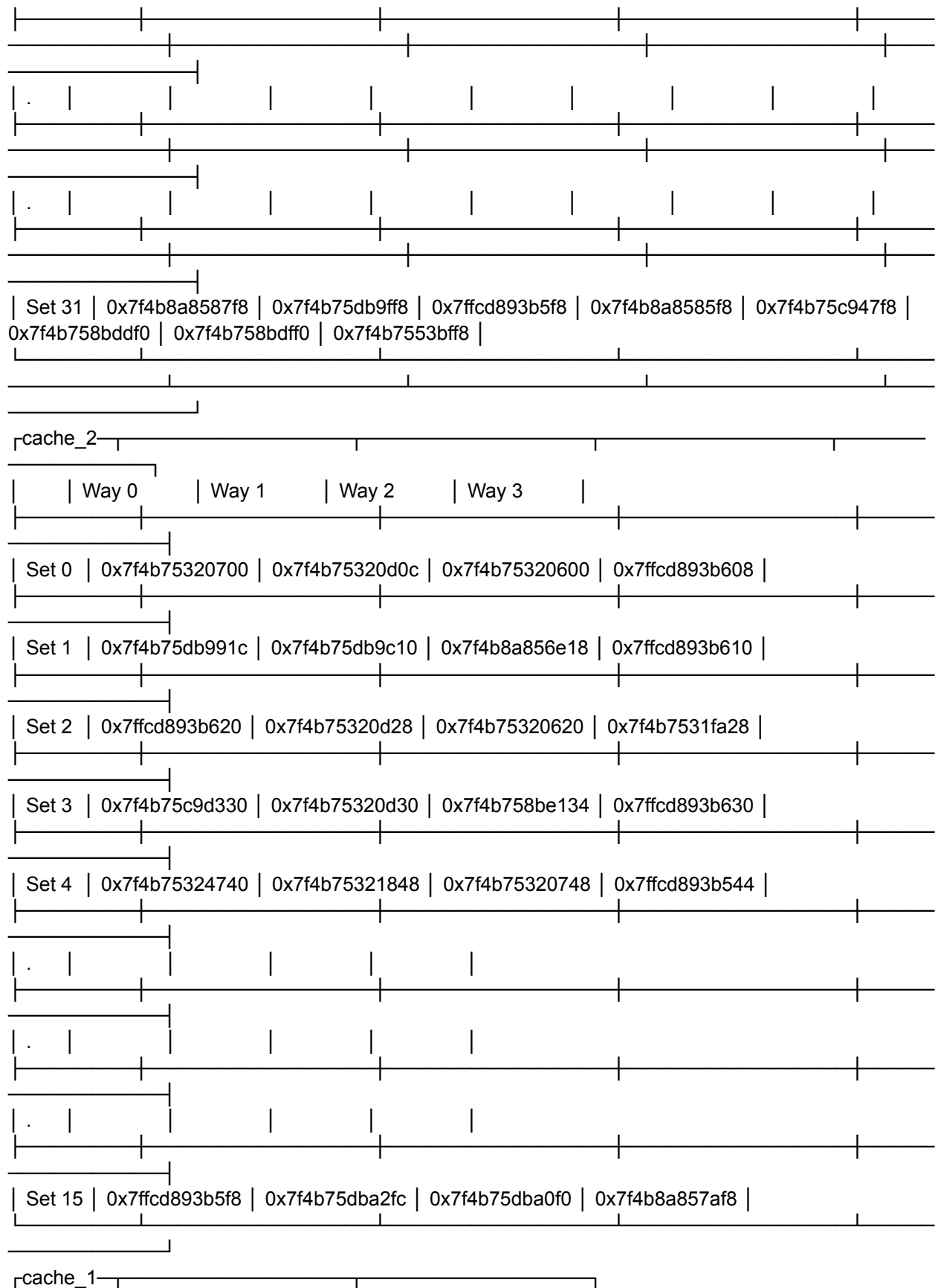   Number of misses: 32630
AMATs:
{'cache_1': 39.8604819417267,
 'cache_2': 286.6326758286533,
 'cache_3': 535.4709739325124,
 'mem': 1000}

cache_3

| | | Way 0 | | Way 1 | | Way 2 | | Way 3 | | Way 4 | | Way 5 | | Way 6 |
| Way 7 | |

| Set 0 | 0x7ffcd893b608 | 0x7f4b75db9e08 | 0x7f4b75dba008 | 0x7f4b8a858600 | 0x7f4b75db9600 | 0x7f4b758bde00 | 0x7f4b75db9c00 | 0x7f4b75320600 |

| Set 1 | 0x7ffcd893aa18 | 0x7f4b8a856e18 | 0x7f4b75db9618 | 0x7ffcd893b618 | 0x7f4b8a857e18 | 0x7f4b8a85861c | 0x604210 | 0x7f4b75db9c10 |

| Set 2 | 0x7ffcd893b628 | 0x7f4b8a857028 | 0x7f4b75db9628 | 0x7f4b8a857e20 | 0x7f4b75db9220 | 0x7f4b75db9428 | 0x7f4b7553c020 | 0x7f4b7531fa28 |

| Set 3 | 0x7ffcd893b630 | 0x7f4b8a857a38 | 0x7ffcd893ac30 | 0x7f4b75c9f430 | 0x7ffcd893aa38 | 0x603e38 | 0x7f4b75db9230 | 0x7f4b8a857e3c |

| Set 4 | 0x7f4b75ca0840 | 0x7ffcd893aa48 | 0x7f4b8a858248 | 0x7f4b75c9e040 | 0x7f4b75c9da48 | 0x7f4b7553bc40 | 0x7ffcd893b64c | 0x7f4b75321848 |

| . | | | | | | | |

| Set 31 | 0x7f4b8a8587f8 | 0x7f4b75db9ff8 | 0x7ffcd893b5f8 | 0x7f4b8a8585f8 | 0x7f4b75c947f8 | 0x7f4b758bddf0 | 0x7f4b758bdff0 | 0x7f4b7553bff8 |

cache_2

	Way 0	Way 1	Way 2	Way 3	
Set 0	0x7f4b75320700	0x7f4b75320d0c	0x7f4b75320600	0x7ffcd893b608
Set 1	0x7f4b75db991c	0x7f4b75db9c10	0x7f4b8a856e18	0x7ffcd893b610
Set 2	0x7ffcd893b620	0x7f4b75320d28	0x7f4b75320620	0x7f4b7531fa28
Set 3	0x7f4b75c9d330	0x7f4b75320d30	0x7f4b758be134	0x7ffcd893b630
Set 4	0x7f4b75324740	0x7f4b75321848	0x7f4b75320748	0x7ffcd893b544

| Set 15 | 0x7ffcd893b5f8 | 0x7f4b75dba2fc | 0x7f4b75dba0f0 | 0x7f4b8a857af8 |

cache_1

	Way 0	Way 1	
Set 0	0x7f4b75320600	0x7ffcd893b608	
Set 1	0x7f4b8a856e18	0x7ffcd893b610	
Set 2	0x7f4b7531fa28	0x7ffcd893b620	
Set 3	0x7ffcd893b630	0x7f4b75321830	
Set 4	0x7f4b75321848	0x7f4b75320748	
.			
.			
.			
Set 15	0x7f4b8a857af8	0x7ffcd893b5f4	

```
real    6m29.509s
user    0m12.900s
sys     0m1.262s
```

Block Size 64

Number of instructions: 240677
Total cycles taken: 10740613
cache_3
    Number of accesses: 9074
    Number of hits: 3649
    Number of misses: 5425
cache_2
    Number of accesses: 16171
    Number of hits: 5858
    Number of misses: 10313
cache_1
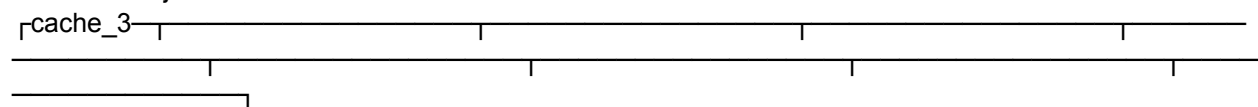   Number of accesses: 240677
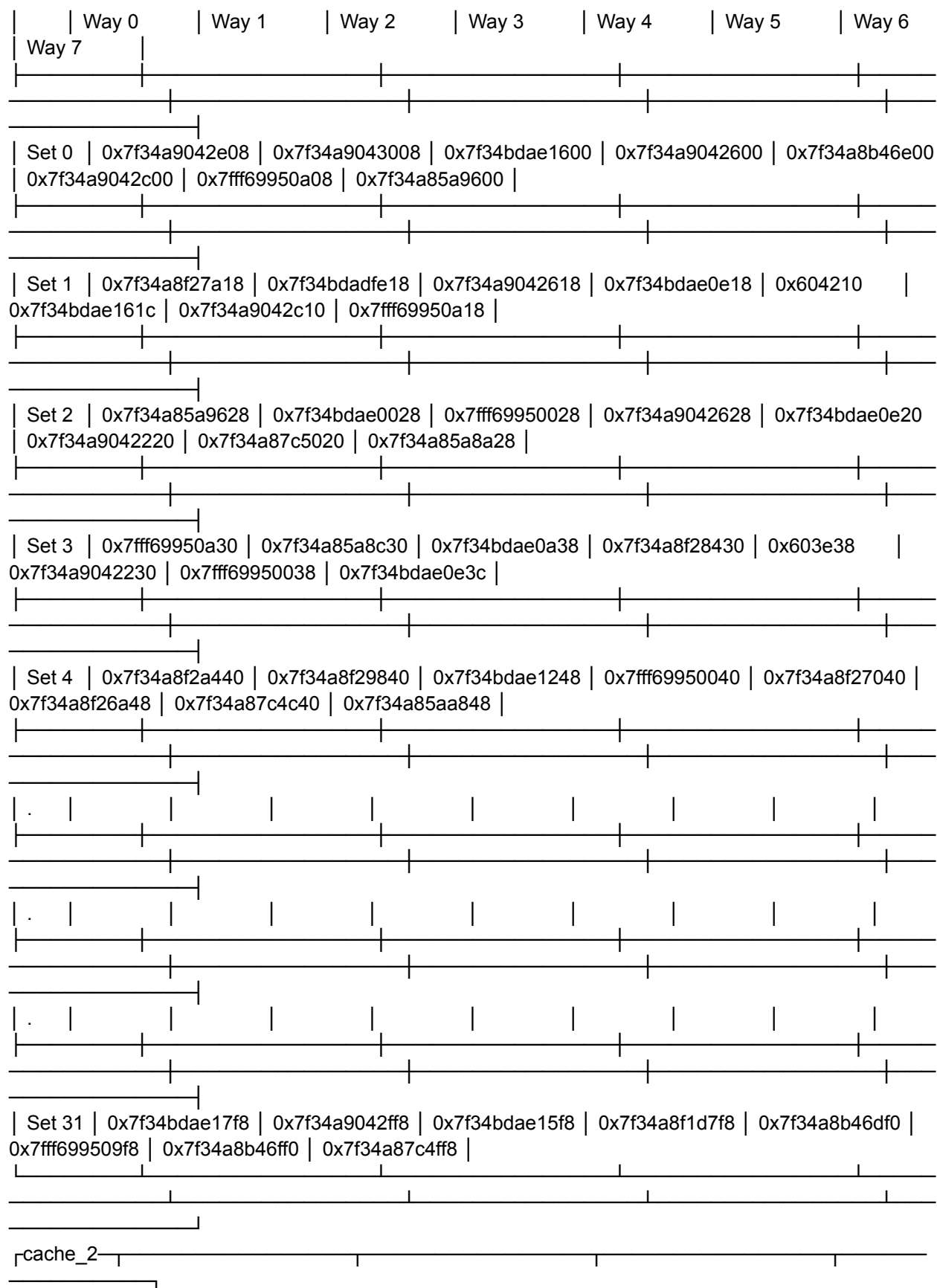   Number of hits: 221324
    Number of misses: 19353
AMATs:
{'cache_1': 38.07407508908841,
 'cache_2': 461.05912107768984,
 'cache_3': 697.862023363456,
 'mem': 1000}

	Way 0	Way 1	Way 2	Way 3	Way 4	Way 5	Way 6	Way 7
Set 0	0x7f34a9042e08	0x7f34a9043008	0x7f34bdae1600	0x7f34a9042600	0x7f34a8b46e00	0x7f34a9042c00	0x7fff69950a08	0x7f34a85a9600
Set 1	0x7f34a8f27a18	0x7f34bdadfe18	0x7f34a9042618	0x7f34bdae0e18	0x604210	0x7f34bdae161c	0x7f34a9042c10	0x7fff69950a18
Set 2	0x7f34a85a9628	0x7f34bdae0028	0x7fff69950028	0x7f34a9042628	0x7f34bdae0e20	0x7f34a9042220	0x7f34a87c5020	0x7f34a85a8a28
Set 3	0x7fff69950a30	0x7f34a85a8c30	0x7f34bdae0a38	0x7f34a8f28430	0x603e38	0x7f34a9042230	0x7fff69950038	0x7f34bdae0e3c
Set 4	0x7f34a8f2a440	0x7f34a8f29840	0x7f34bdae1248	0x7fff69950040	0x7f34a8f27040	0x7f34a8f26a48	0x7f34a87c4c40	0x7f34a85aa848
.								
.								
.								
Set 31	0x7f34bdae17f8	0x7f34a9042ff8	0x7f34bdae15f8	0x7f34a8f1d7f8	0x7f34a8b46df0	0x7fff699509f8	0x7f34a8b46ff0	0x7f34a87c4ff8

cache_2

	Way 0	Way 1	Way 2	Way 3
Set 0	0x7f34a85a9700	0x7fff69950b08	0x7f34a85a9d0c	0x7f34a85a9600
Set 1	0x7f34a9042710	0x7f34a9042c10	0x604210	0x7fff69950b10
Set 2	0x7f34a87c5020	0x7f34a9042428	0x7f34a85a9620	0x7f34a85a8a28
Set 3	0x7f34a9042230	0x7f34a8f26330	0x7f34a85a9d30	0x7f34a8b47134
Set 4	0x7f34a85ad740	0x7f34a85aa848	0x7f34a85a9748	0x7fff69950b48
.				
.				
.				
Set 15	0x7f34a87c4ff8	0x7f34a90432fc	0x7f34a90430f0	0x7f34bdae0af8

cache_1

	Way 0	Way 1
Set 0	0x7f34a9042e0c	0x7f34a85a9600
Set 1	0x7f34bdadfe18	0x7f34a9042c10
Set 2	0x7f34a85a9620	0x7f34a85a8a28
Set 3	0x7f34a9042230	0x7f34a85aa830
Set 4	0x7f34a87c4c40	0x7f34a85aa848
.		
.		
.		

```
| Set 31 | 0x7f34a8b46ff0 | 0x7f34a87c4ff8 |
```

```
real    2m11.570s
user    0m12.334s
sys     0m1.270s
```

Matrix Size 150x150:

Block size 16:
Number of instructions: 262352
Total cycles taken: 14909288
cache_3
      Number of accesses: 16217
      Number of hits: 9162
      Number of misses: 7055
cache_2
      Number of accesses: 55964
      Number of hits: 38005
      Number of misses: 17959
cache_1
      Number of accesses: 262352
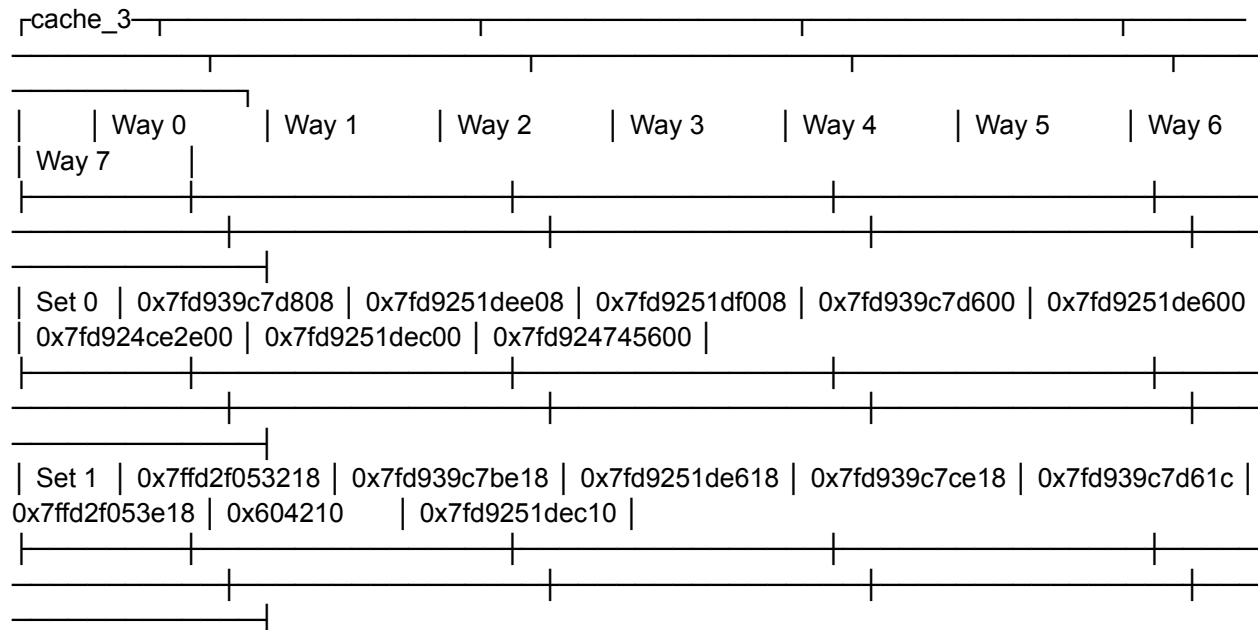   Number of hits: 199271
      Number of misses: 63081
AMATs:
{'cache_1': 46.130144978142695,
 'cache_2': 187.6949286679934,
 'cache_3': 535.0373065301844,
 'mem': 1000}
```

```
┌cache_3─┬──────────────────────┬──────────────────┬──────────────────┬────────────┐
├───────────────────────────────────────────────────────────────────────────────────┤
│  ┌─────────┐                                                                        │
│  │ Way 0   │ Way 1    │ Way 2    │ Way 3    │ Way 4    │ Way 5    │ Way 6           │
│ Way 7     │                                                                         │
├───────────────────────────────────────────────────────────────────────────────────┤
│  ┌─────────┐                                                                        │
│ Set 0 │ 0x7fd939c7d808 │ 0x7fd9251dee08 │ 0x7fd9251df008 │ 0x7fd939c7d600 │ 0x7fd9251de600 │
│ 0x7fd924ce2e00 │ 0x7fd9251dec00 │ 0x7fd924745600 │
├───────────────────────────────────────────────────────────────────────────────────┤
│  ┌─────────┐                                                                        │
│ Set 1 │ 0x7ffd2f053218 │ 0x7fd939c7be18 │ 0x7fd9251de618 │ 0x7fd939c7ce18 │ 0x7fd939c7d61c │
│ 0x7ffd2f053e18 │ 0x604210     │ 0x7fd9251dec10 │
├───────────────────────────────────────────────────────────────────────────────────┤
│  ┌─────────┐                                                                        │
```

| Set 2 | 0x7ffd2f053e20 | 0x7fd9251de628 | 0x7fd939c7ce20 | 0x7fd9251de220 | 0x7fd9251de428 | 0x7fd924961020 | 0x7fd924745620 | 0x7fd924744a28 |

| Set 3 | 0x7fd939c7ca38 | 0x7ffd2f053e38 | 0x7ffd2f053438 | 0x7fd9250c4430 | 0x7ffd2f053238 | 0x603e38 | 0x7fd939c7ce3c | 0x7fd9251de230 |

| Set 4 | 0x7ffd2f053e40 | 0x7ffd2f053440 | 0x7ffd2f053248 | 0x7fd939c7d248 | 0x7fd9250c3040 | 0x7fd9250c2a48 | 0x7fd924960c40 | 0x7fd924746848 |

| . | | | | | | | | |

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| . | | | | | | | | |

| Set 31 | 0x7fd939c7d7f8 | 0x7fd9251deff8 | 0x7fd939c7d5f8 | 0x7fd9250b97f8 | 0x7ffd2f053df8 | 0x7fd924ce2df0 | 0x7fd924ce2ff0 | 0x7fd924960ff8 |

┌cache_2─

| | Way 0 | Way 1 | Way 2 | Way 3 | |

| Set 0 | 0x7ffd2f053e08 | 0x7fd924745d0c | 0x7fd924745700 | 0x7fd924745600 |

| Set 1 | 0x7ffd2f053e10 | 0x7fd9251de91c | 0x7fd939c7be18 | 0x7fd9251dec10 |

| Set 2 | 0x7fd924745d28 | 0x7ffd2f053e28 | 0x7fd924745620 | 0x7fd924744a28 |

| Set 3 | 0x7fd9250c2330 | 0x7fd924745d30 | 0x7fd924ce3134 | 0x7ffd2f053e38 |

```
| Set 4  | 0x7fd924749740 | 0x7fd924746848 | 0x7ffd2f053e48 | 0x7fd924745748 |

| .  |                |                |                |

| .  |                |                |                |

| .  |                |                |                |

| Set 15 | 0x7ffd2f053df8 | 0x7fd9251df2fc | 0x7fd9251df0f0 | 0x7fd939c7caf8 |
```

```
cache_1
|     | Way 0        | Way 1        |

| Set 0 | 0x7fd924744a80 | 0x7ffd2f053e88 |

| Set 1 | 0x7ffd2f053e98 | 0x7ffd2f053e18 |

| Set 2 | 0x7fd924744a28 | 0x7ffd2f053ea0 |

| Set 3 | 0x7fd924746830 | 0x7ffd2f053eb0 |

| Set 4 | 0x7fd924746844 | 0x7ffd2f053ec0 |

| Set 5 | 0x7fd924749750 | 0x7ffd2f053e54 |

| Set 6 | 0x7fd924361f68 | 0x7fd924743e68 |

| Set 7 | 0x7fd939c7caf8 | 0x7fd924745d70 |
```

real   2m43.532s
user   0m14.599s
sys   0m1.458s

Block size 32

umber of instructions: 262352
Total cycles taken: 14496496
cache_3
     Number of accesses: 15459
     Number of hits: 8467
     Number of misses: 6992
cache_2

Number of accesses: 34008
Number of hits: 16734
Number of misses: 17274
cache_1
Number of accesses: 262352
Number of hits: 223707
Number of misses: 38645
AMATs:
{'cache_1': 44.67969836102323,
 'cache_2': 296.5314070231897,
 'cache_3': 552.2931625590271,
 'mem': 1000}

cache_3

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6
| Way 7 |

| Set 0 | 0x7ffd70e06008 | 0x7fd602528e08 | 0x7fd602529008 | 0x7fd616fc7600 | 0x7fd602528600 | 0x7fd60202ce00 | 0x7fd602528c00 | 0x7fd601a8f600 |

| Set 1 | 0x7ffd70e06018 | 0x7fd60240da18 | 0x7fd616fc5e18 | 0x7fd602528618 | 0x7fd616fc6e18 | 0x7fd616fc761c | 0x604210 | 0x7fd602528c10 |

| Set 2 | 0x7ffd70e06020 | 0x7fd602528628 | 0x7fd616fc6e20 | 0x7fd602528220 | 0x7fd602528428 | 0x7fd601cab020 | 0x7fd601a8f620 | 0x7fd601a8ea28 |

| Set 3 | 0x7ffd70e06030 | 0x7fd616fc6a38 | 0x7ffd70e05630 | 0x7fd60240e430 | 0x7ffd70e05438 | 0x603e38 | 0x7fd602528230 | 0x7fd616fc6e3c |

| Set 4 | 0x7ffd70e05640 | 0x7fd60240f840 | 0x7ffd70e05448 | 0x7fd616fc7248 | 0x7fd60240d040 | 0x7fd60240ca48 | 0x7fd601caac40 | 0x7fd601a90848 |

| . | | | | | | | | |

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| . | | | | | | | | |

| Set 31 | 0x7fd616fc77f8 | 0x7fd602528ff8 | 0x7ffd70e05ff8 | 0x7fd616fc75f8 | 0x7fd6024037f8 | 0x7fd60202cdf0 | 0x7fd60202cff0 | 0x7fd601caaff8 |

cache_2

| | Way 0 | Way 1 | Way 2 | Way 3 | |

| Set 0 | 0x7fd601a8f700 | 0x7fd601a8fd0c | 0x7fd601a8f600 | 0x7ffd70e06000 |

| Set 1 | 0x7fd60252891c | 0x7fd602528c10 | 0x7fd616fc5e18 | 0x7ffd70e06010 |

| Set 2 | 0x7ffd70e06020 | 0x7fd601a8fd28 | 0x7fd601a8f620 | 0x7fd601a8ea28 |

| Set 3 | 0x7fd601a8fd30 | 0x7fd60202d134 | 0x7ffd70e0603c | 0x7ffd70e05f38 |

| Set 4 | 0x7fd601a90848 | 0x7fd601a8f748 | 0x7ffd70e05f48 | 0x7fd601a93740 |

| . | | | | |

| . | | | | |

| . | | | | |

| Set 15 | 0x7fd6025292fc | 0x7fd6025290f0 | 0x7fd616fc6af8 | 0x7ffd70e05ff8 |

cache_1

| | Way 0 | Way 1 | |

| Set 0 | 0x7fd601a8f600 | 0x7ffd70e06000 |

```
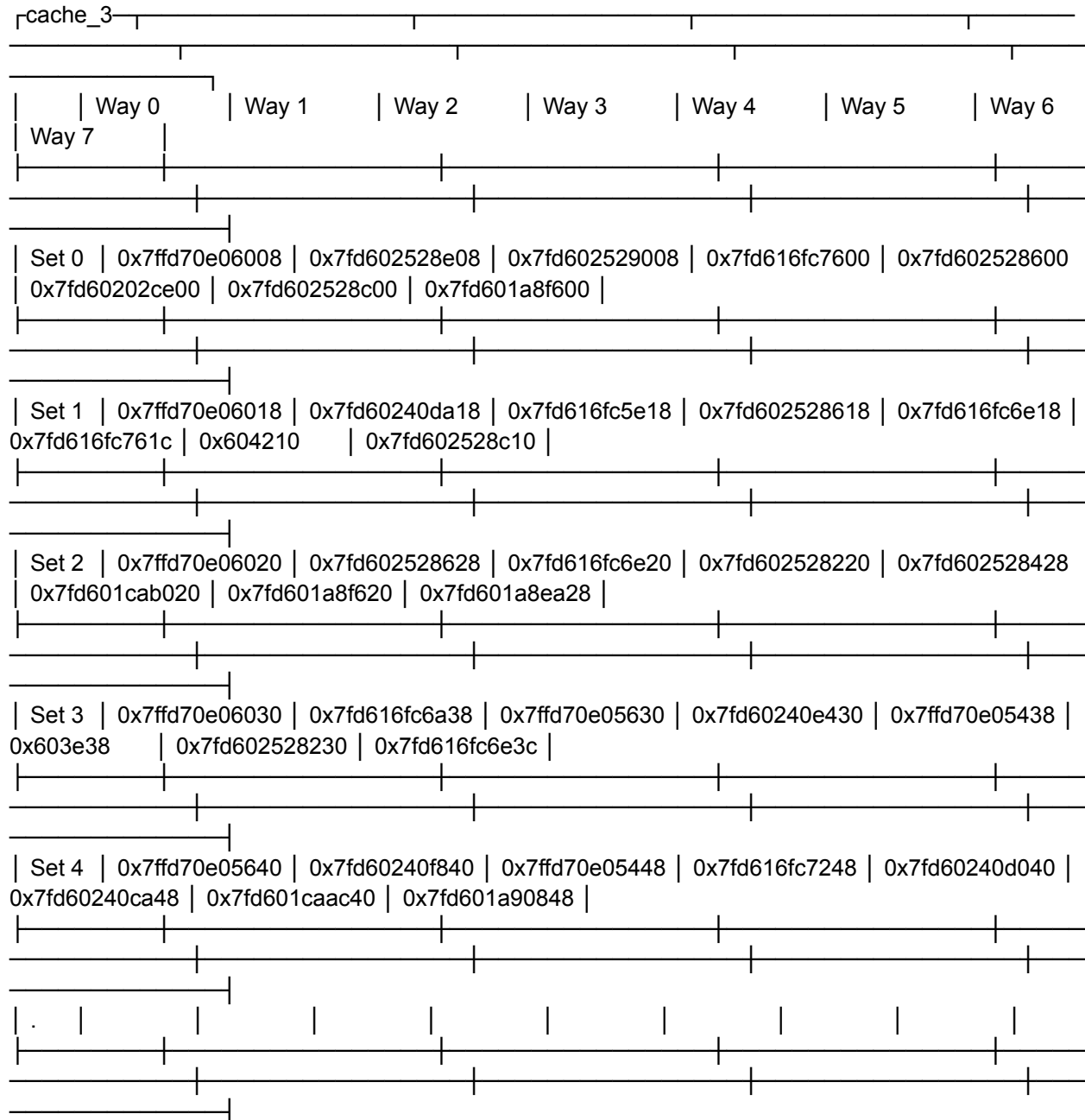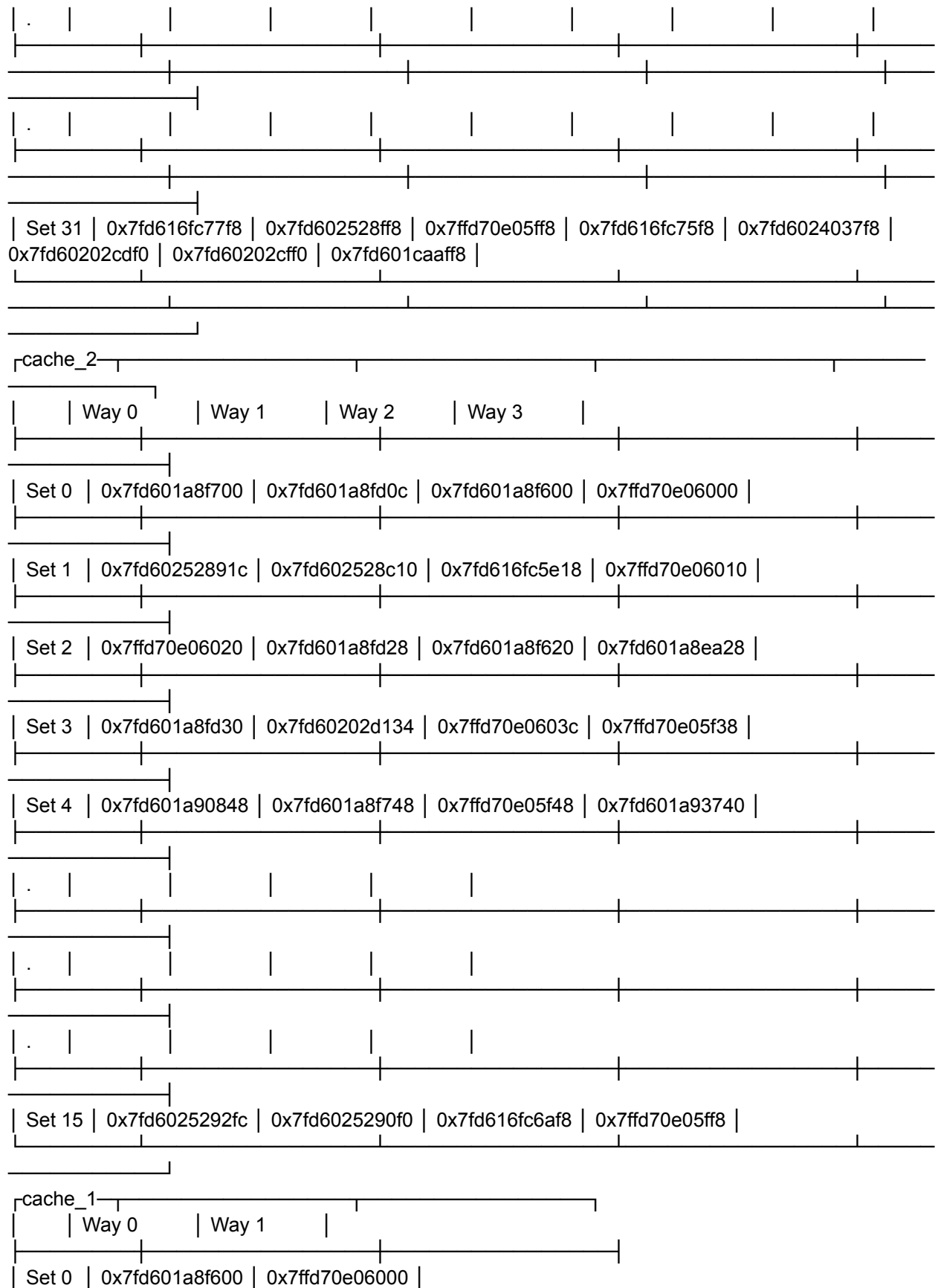|        |                   |                   |
| Set 1  | 0x7fd616fc5e18    | 0x7ffd70e06010    |
|        |                   |                   |
| Set 2  | 0x7fd601a8ea28    | 0x7ffd70e06020    |
|        |                   |                   |
| Set 3  | 0x7ffd70e05f34    | 0x7fd601a90830    |
|        |                   |                   |
| Set 4  | 0x7fd601a90848    | 0x7fd601a8f748    |
|        |                   |                   |
| .      |                   |                   |
|        |                   |                   |
| .      |                   |                   |
|        |                   |                   |
| .      |                   |                   |
|        |                   |                   |
| Set 15 | 0x7fd616fc6af8    | 0x7ffd70e05ff8    |
|        |                   |                   |
```

real   3m2.989s
user   0m13.988s
sys   0m1.422s

Block size 64

Number of instructions: 262352
Total cycles taken: 13651720
cache_3
        Number of accesses: 11623
        Number of hits: 4789
        Number of misses: 6834
cache_2
        Number of accesses: 20328
        Number of hits: 7049
        Number of misses: 13279
cache_1
        Number of accesses: 262352
        Number of hits: 238301
        Number of misses: 24051
AMATs:
{'cache_1': 43.66613844984418,
 'cache_2': 465.408787767391,
 'cache_3': 687.9721242364277,
 'mem': 1000}

```
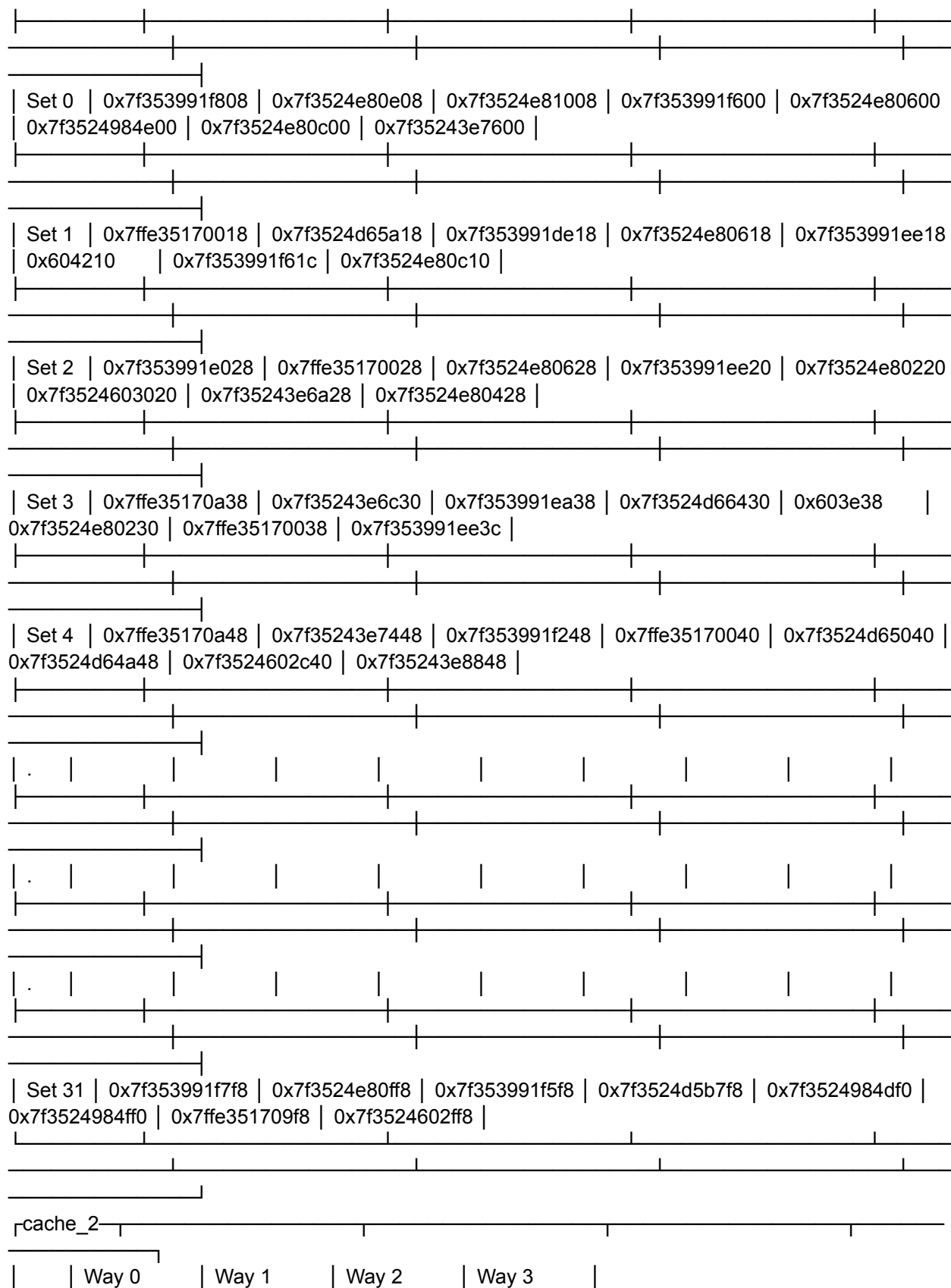┌cache_3─┬──────────────────────────────────────────────────────
|        |            |            |            |            |
├────────┴───┐        |            |            |            |
|        | Way 0  | Way 1  | Way 2  | Way 3  | Way 4  | Way 5  | Way 6
| Way 7      |
```

| Set 0 | 0x7f353991f808 | 0x7f3524e80e08 | 0x7f3524e81008 | 0x7f353991f600 | 0x7f3524e80600
0x7f3524984e00 | 0x7f3524e80c00 | 0x7f35243e7600 |

| Set 1 | 0x7ffe35170018 | 0x7f3524d65a18 | 0x7f353991de18 | 0x7f3524e80618 | 0x7f353991ee18
0x604210 | 0x7f353991f61c | 0x7f3524e80c10 |

| Set 2 | 0x7f353991e028 | 0x7ffe35170028 | 0x7f3524e80628 | 0x7f353991ee20 | 0x7f3524e80220
0x7f3524603020 | 0x7f35243e6a28 | 0x7f3524e80428 |

| Set 3 | 0x7ffe35170a38 | 0x7f35243e6c30 | 0x7f353991ea38 | 0x7f3524d66430 | 0x603e38 |
0x7f3524e80230 | 0x7ffe35170038 | 0x7f353991ee3c |

| Set 4 | 0x7ffe35170a48 | 0x7f35243e7448 | 0x7f353991f248 | 0x7ffe35170040 | 0x7f3524d65040 |
0x7f3524d64a48 | 0x7f3524602c40 | 0x7f35243e8848 |

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| Set 31 | 0x7f353991f7f8 | 0x7f3524e80ff8 | 0x7f353991f5f8 | 0x7f3524d5b7f8 | 0x7f3524984df0 |
0x7f3524984ff0 | 0x7ffe351709f8 | 0x7f3524602ff8 |

cache_2

| | Way 0 | Way 1 | Way 2 | Way 3 | |

Set 0	0x7f3524e80c00	0x7f35243e7700	0x7ffe35170b08	0x7f35243e7600
Set 1	0x7ffe35170b18	0x7f3524e8091c	0x7f3524e80c10	0x604210
Set 2	0x7ffe35170b28	0x7f35243e7620	0x7f3524603020	0x7f35243e6a28
Set 3	0x7f3524d64330	0x7ffe35170b38	0x7f35243e7d30	0x7f3524985134
Set 4	0x7f35243eb740	0x7f35243e8848	0x7f35243e7748	0x7ffe35170b40
.				
.				
.				
Set 15	0x7f3524e812fc	0x7f3524e810f0	0x7ffe35170af0	0x7f353991eaf8

cache_1

	Way 0	Way 1	
Set 0	0x7f3524e80e0c	0x7f35243e7600
Set 1	0x7f353991de18	0x7f3524e80c10
Set 2	0x7f35243e7620	0x7f35243e6a28
Set 3	0x7f3524e80230	0x7f35243e8830
Set 4	0x7f3524602c40	0x7f35243e8848
.		
.		
.		
Set 31	0x7f3524984ff0	0x7f3524602ff8

```
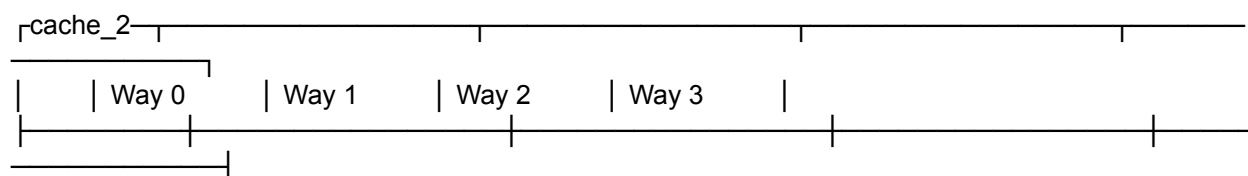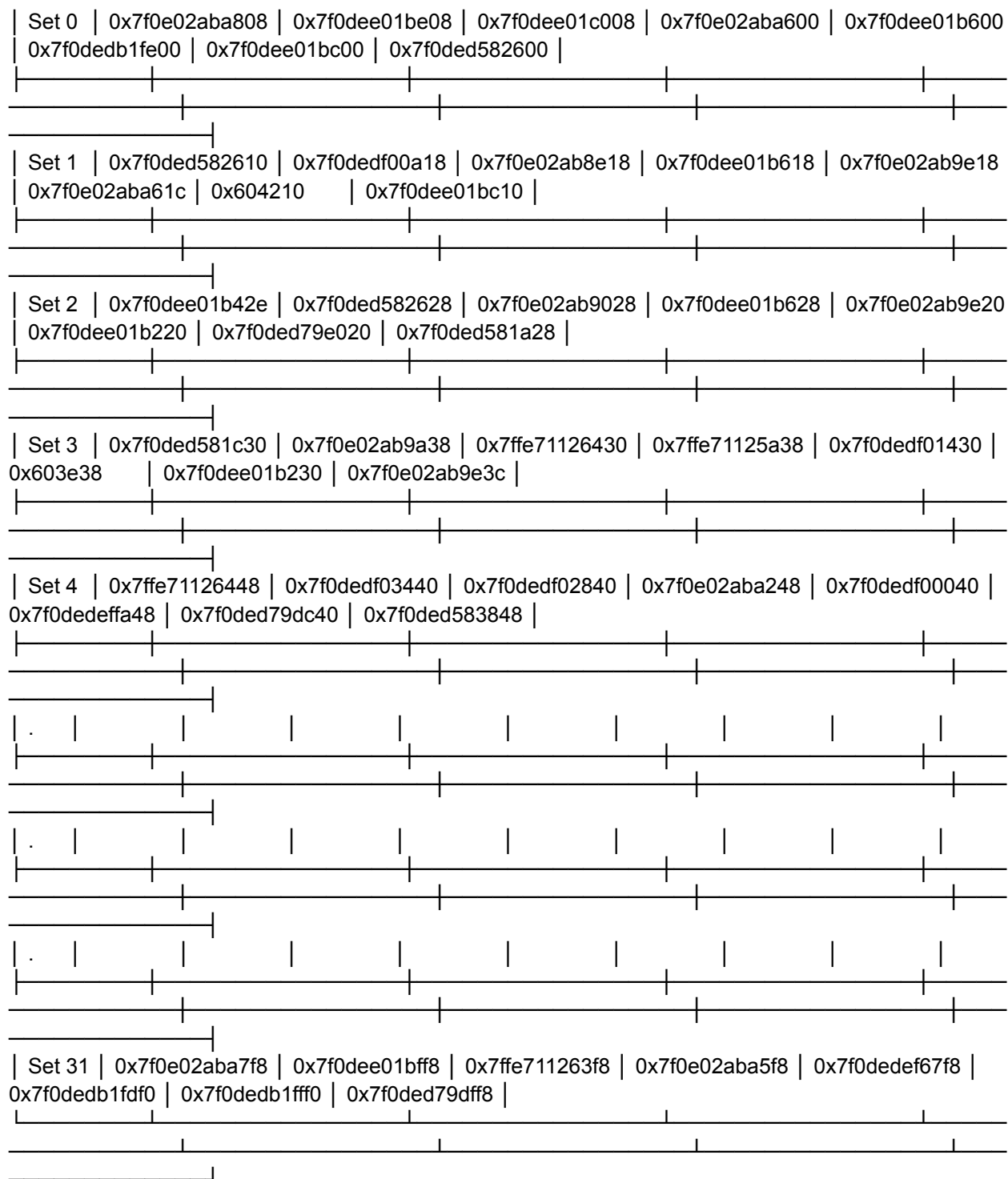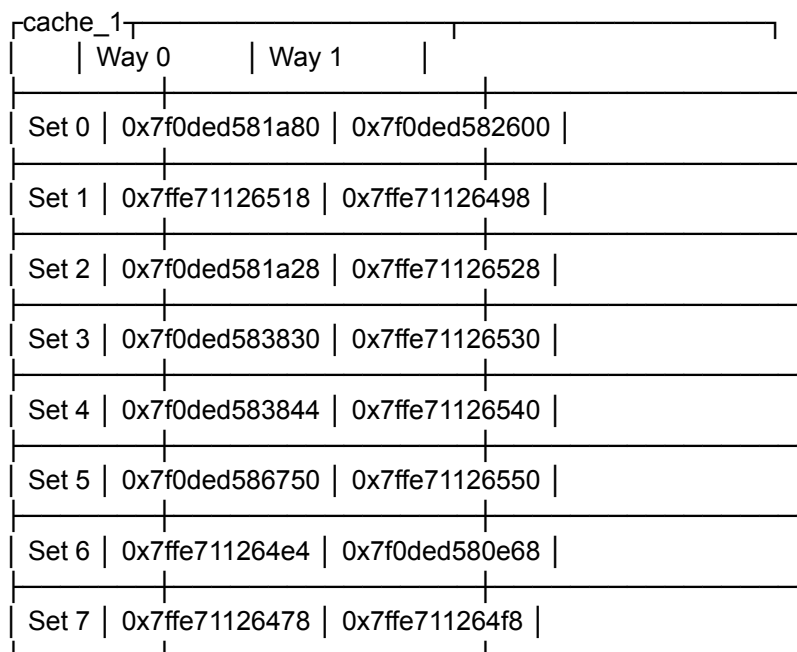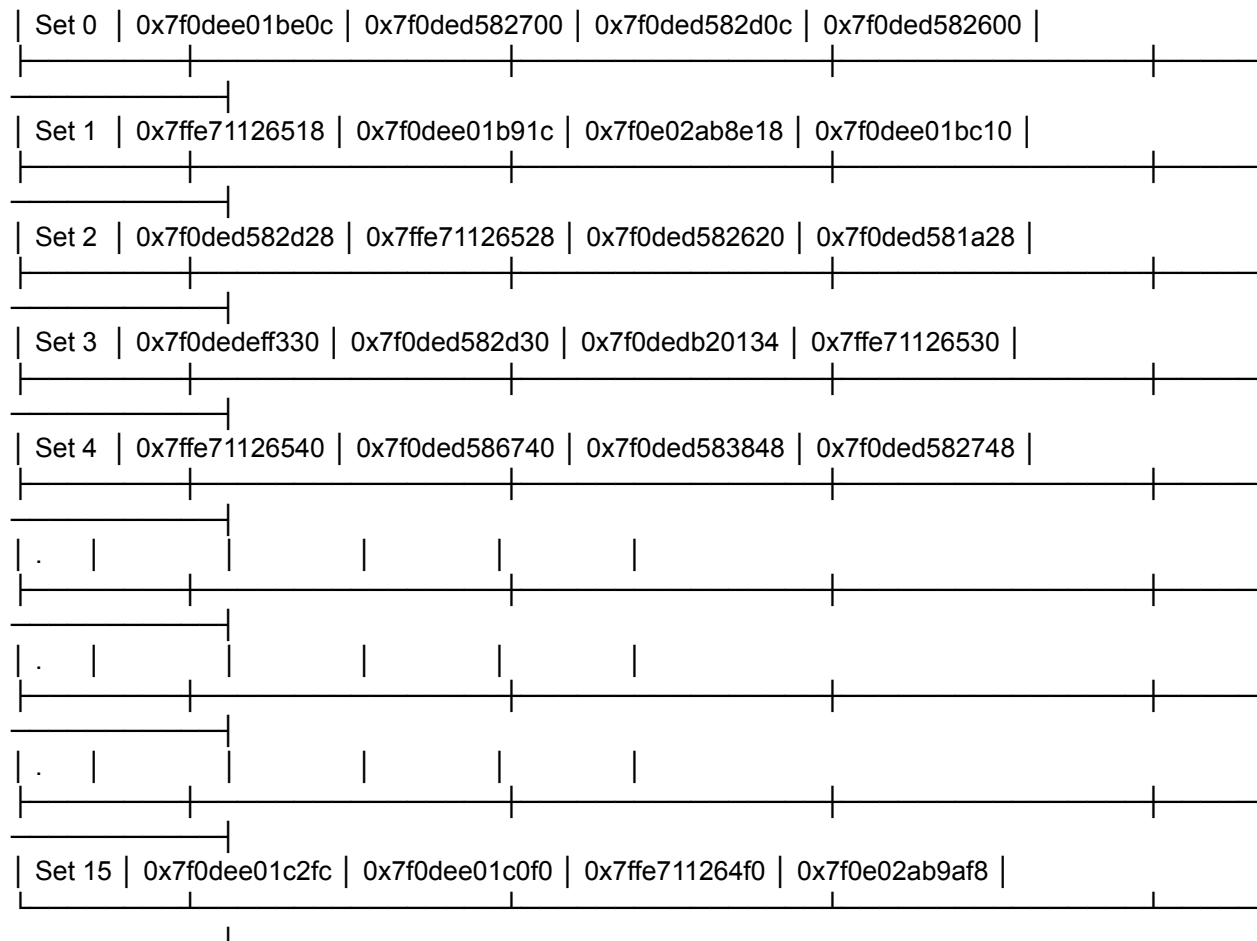real    5m10.111s
user    0m13.685s
sys     0m1.382s
```

Varying Associativity :

Matrix Size 128x128:

Associativity : 2

Number of instructions: 240677

Total cycles taken: 12129641

```
cache_3
     Number of accesses: 12871
     Number of hits: 7516
     Number of misses: 5355
cache_2
     Number of accesses: 55522
     Number of hits: 41382
     Number of misses: 14140
cache_1
     Number of accesses: 240677
     Number of hits: 176617
     Number of misses: 64060
```

```
AMATs:
{'cache_1': 40.23945650492939,
 'cache_2': 147.42483099027305,
 'cache_3': 516.0515888431357,
 'mem': 1000}
```

| Set 0 | 0x7f0e02aba808 | 0x7f0dee01be08 | 0x7f0dee01c008 | 0x7f0e02aba600 | 0x7f0dee01b600 | 0x7f0dedb1fe00 | 0x7f0dee01bc00 | 0x7f0ded582600 |

| Set 1 | 0x7f0ded582610 | 0x7f0dedf00a18 | 0x7f0e02ab8e18 | 0x7f0dee01b618 | 0x7f0e02ab9e18 | 0x7f0e02aba61c | 0x604210 | 0x7f0dee01bc10 |

| Set 2 | 0x7f0dee01b42e | 0x7f0ded582628 | 0x7f0e02ab9028 | 0x7f0dee01b628 | 0x7f0e02ab9e20 | 0x7f0dee01b220 | 0x7f0ded79e020 | 0x7f0ded581a28 |

| Set 3 | 0x7f0ded581c30 | 0x7f0e02ab9a38 | 0x7ffe71126430 | 0x7ffe71125a38 | 0x7f0dedf01430 | 0x603e38 | 0x7f0dee01b230 | 0x7f0e02ab9e3c |

| Set 4 | 0x7ffe71126448 | 0x7f0dedf03440 | 0x7f0dedf02840 | 0x7f0e02aba248 | 0x7f0dedf00040 | 0x7f0dedeffa48 | 0x7f0ded79dc40 | 0x7f0ded583848 |

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| Set 31 | 0x7f0e02aba7f8 | 0x7f0dee01bff8 | 0x7ffe711263f8 | 0x7f0e02aba5f8 | 0x7f0dedef67f8 | 0x7f0dedb1fdf0 | 0x7f0dedb1fff0 | 0x7f0ded79dff8 |

cache_2

| | Way 0 | Way 1 | Way 2 | Way 3 | |

| Set 0 | 0x7f0dee01be0c | 0x7f0ded582700 | 0x7f0ded582d0c | 0x7f0ded582600 |

| Set 1 | 0x7ffe71126518 | 0x7f0dee01b91c | 0x7f0e02ab8e18 | 0x7f0dee01bc10 |

| Set 2 | 0x7f0ded582d28 | 0x7ffe71126528 | 0x7f0ded582620 | 0x7f0ded581a28 |

| Set 3 | 0x7f0dedeff330 | 0x7f0ded582d30 | 0x7f0dedb20134 | 0x7ffe71126530 |

| Set 4 | 0x7ffe71126540 | 0x7f0ded586740 | 0x7f0ded583848 | 0x7f0ded582748 |

| . |

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| . |

| Set 15 | 0x7f0dee01c2fc | 0x7f0dee01c0f0 | 0x7ffe711264f0 | 0x7f0e02ab9af8 |

cache_1

| | Way 0 | Way 1 | |

| Set 0 | 0x7f0ded581a80 | 0x7f0ded582600 |

| Set 1 | 0x7ffe71126518 | 0x7ffe71126498 |

| Set 2 | 0x7f0ded581a28 | 0x7ffe71126528 |

| Set 3 | 0x7f0ded583830 | 0x7ffe71126530 |

| Set 4 | 0x7f0ded583844 | 0x7ffe71126540 |

| Set 5 | 0x7f0ded586750 | 0x7ffe71126550 |

| Set 6 | 0x7ffe711264e4 | 0x7f0ded580e68 |

| Set 7 | 0x7ffe71126478 | 0x7ffe711264f8 |

```
real    2m6.676s
user    0m21.227s
sys     0m2.459s
```

Associativity : 4

Number of instructions: 240677
Total cycles taken: 11928753
cache_3
        Number of accesses: 11412
        Number of hits: 6213
        Number of misses: 5199
cache_2
        Number of accesses: 54094
        Number of hits: 41532
        Number of misses: 12562
cache_1
        Number of accesses: 240677
        Number of hits: 179998
        Number of misses: 60679
AMATs:
{'cache_1': 37.56168936561113,
 'cache_2': 145.0181728678322,
 'cache_3': 555.5730809674028,
 'mem': 1000}

┌cache_3─┬──

│   │ Way 0   │ Way 1   │ Way 2   │ Way 3   │ Way 4   │ Way 5   │ Way 6
│ Way 7   │

│ Set 0 │ 0x7fe70133b808 │ 0x7fe6ec89ce08 │ 0x7fe6ec89d008 │ 0x7fe70133b600 │ 0x7fe6ec89c600
│ 0x7fe6ec3a0e00 │ 0x7fe6ec89cc00 │ 0x7fe6ebe03600 │

│ Set 1 │ 0x7fe6ec781a18 │ 0x7ffcbf9dae10 │ 0x7fe701339e18 │ 0x7fe6ec89c618 │ 0x7fe70133ae18 │
0x7fe70133b61c │ 0x604210   │ 0x7fe6ec89cc10 │

│ Set 2 │ 0x7fe6ec89c42e │ 0x7fe6ec89c628 │ 0x7fe70133ae20 │ 0x7fe6ec89c220 │ 0x7ffcbf9db828 │
0x7fe6ec01f020 │ 0x7fe6ebe03620 │ 0x7fe6ebe02a28 │
```
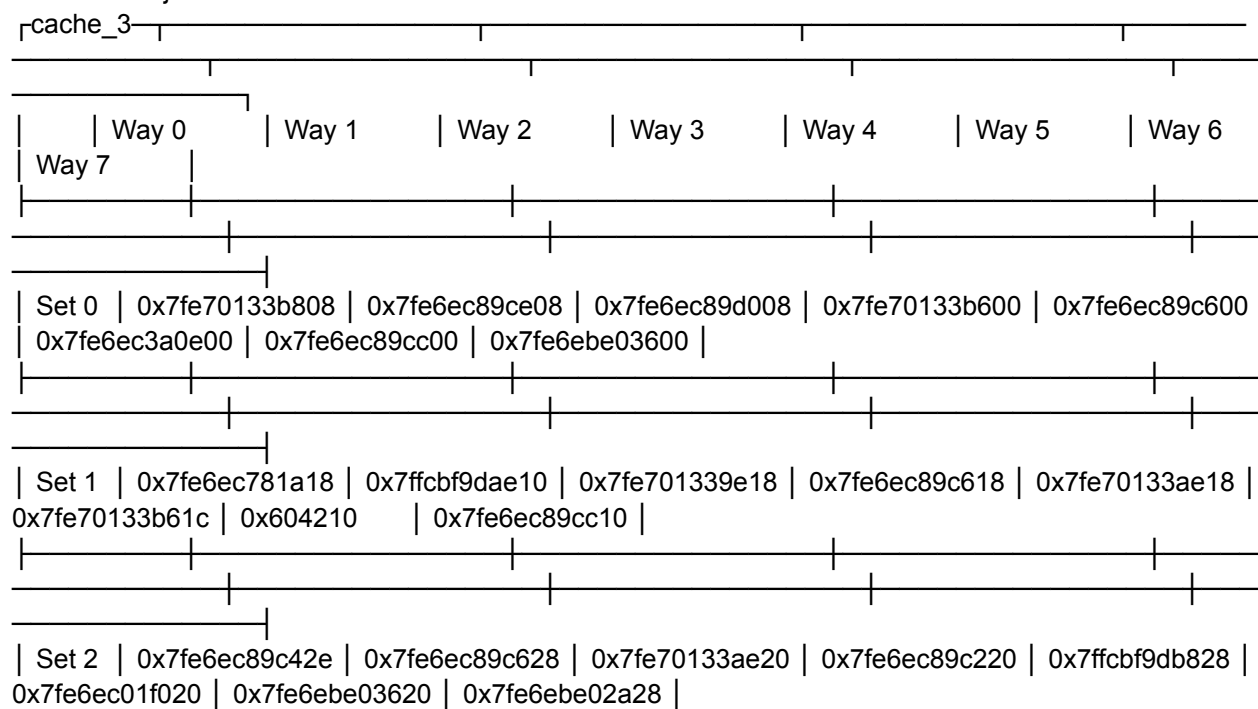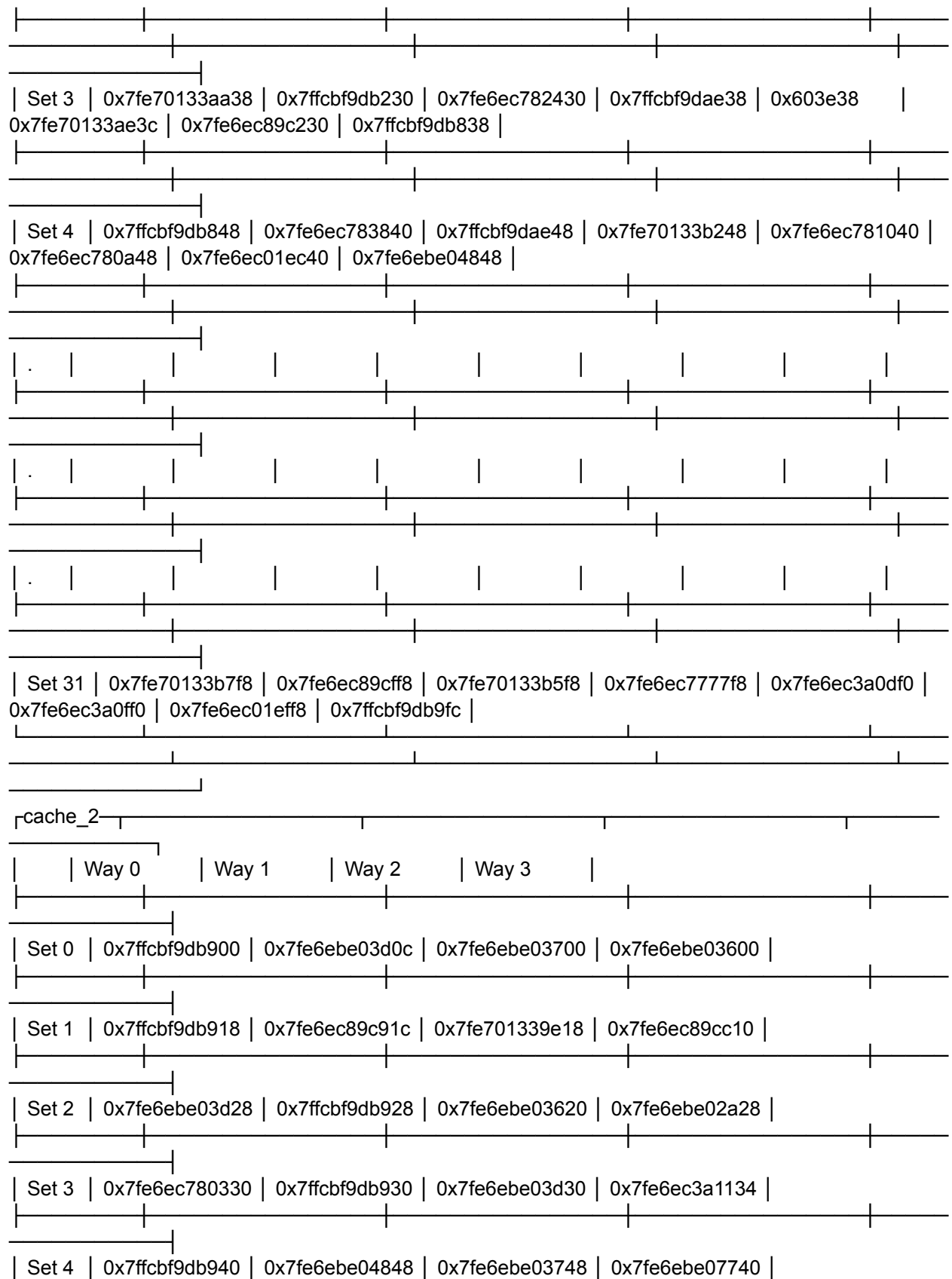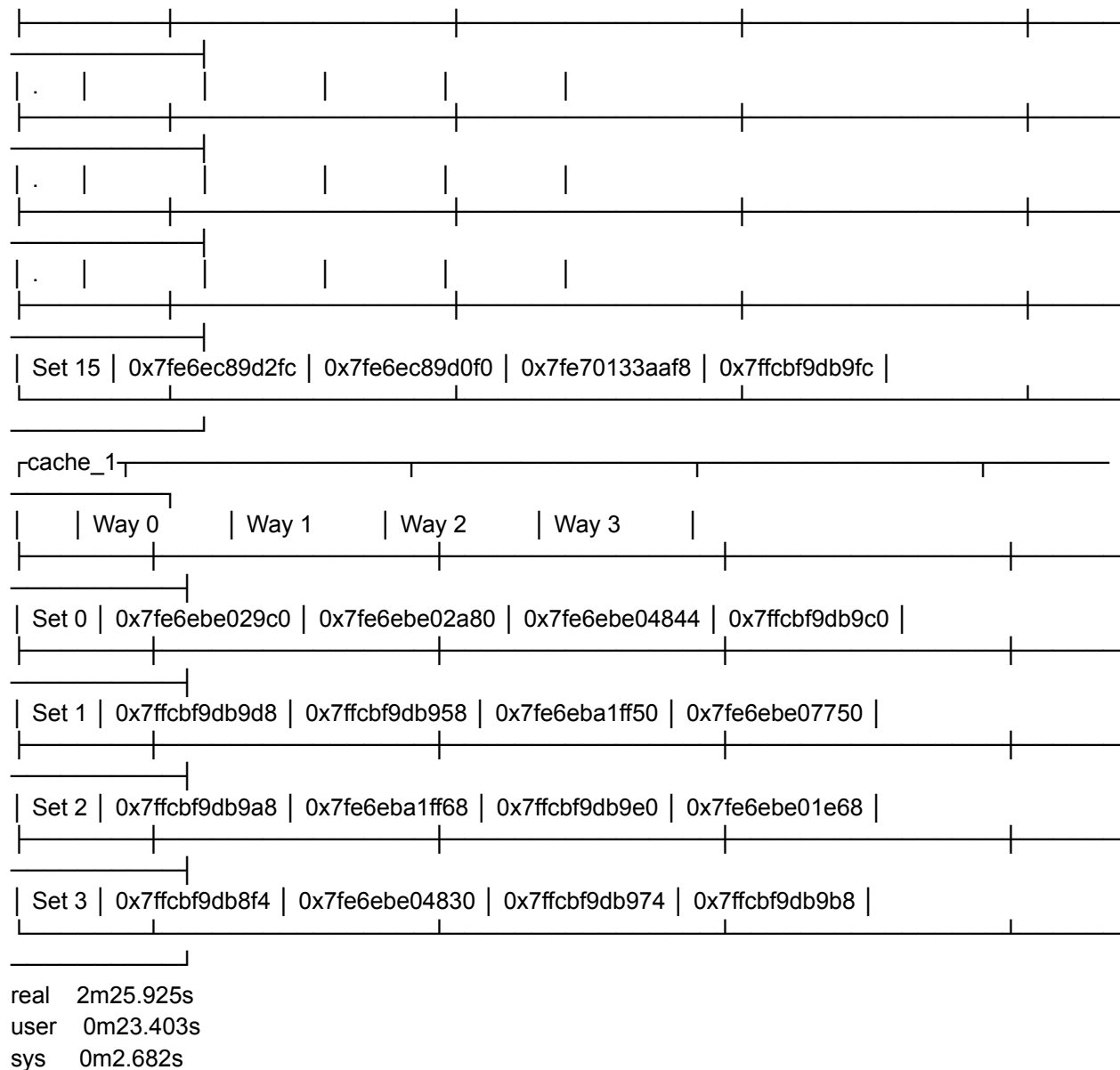
| Set 3 | 0x7fe70133aa38 | 0x7ffcbf9db230 | 0x7fe6ec782430 | 0x7ffcbf9dae38 | 0x603e38 |
0x7fe70133ae3c | 0x7fe6ec89c230 | 0x7ffcbf9db838 |

| Set 4 | 0x7ffcbf9db848 | 0x7fe6ec783840 | 0x7ffcbf9dae48 | 0x7fe70133b248 | 0x7fe6ec781040 |
0x7fe6ec780a48 | 0x7fe6ec01ec40 | 0x7fe6ebe04848 |

| . | | | | | | | | |

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| Set 31 | 0x7fe70133b7f8 | 0x7fe6ec89cff8 | 0x7fe70133b5f8 | 0x7fe6ec7777f8 | 0x7fe6ec3a0df0 |
0x7fe6ec3a0ff0 | 0x7fe6ec01eff8 | 0x7ffcbf9db9fc |

cache_2

| | Way 0 | | Way 1 | | Way 2 | | Way 3 | |

| Set 0 | 0x7ffcbf9db900 | 0x7fe6ebe03d0c | 0x7fe6ebe03700 | 0x7fe6ebe03600 |

| Set 1 | 0x7ffcbf9db918 | 0x7fe6ec89c91c | 0x7fe701339e18 | 0x7fe6ec89cc10 |

| Set 2 | 0x7fe6ebe03d28 | 0x7ffcbf9db928 | 0x7fe6ebe03620 | 0x7fe6ebe02a28 |

| Set 3 | 0x7fe6ec780330 | 0x7ffcbf9db930 | 0x7fe6ebe03d30 | 0x7fe6ec3a1134 |

| Set 4 | 0x7ffcbf9db940 | 0x7fe6ebe04848 | 0x7fe6ebe03748 | 0x7fe6ebe07740 |

```
┌─────────┐
│ ·   │         │         │         │         │
├─────────┤
│ ·   │         │         │         │
├─────────┤
│ ·   │         │         │         │
├─────────┤
│ Set 15 │ 0x7fe6ec89d2fc │ 0x7fe6ec89d0f0 │ 0x7fe70133aaf8 │ 0x7ffcbf9db9fc │
└─────────┘
```

┌cache_1┐
```
│   │ Way 0   │ Way 1   │ Way 2   │ Way 3   │
├─────────┤
│ Set 0 │ 0x7fe6ebe029c0 │ 0x7fe6ebe02a80 │ 0x7fe6ebe04844 │ 0x7ffcbf9db9c0 │
├─────────┤
│ Set 1 │ 0x7ffcbf9db9d8 │ 0x7ffcbf9db958 │ 0x7fe6eba1ff50 │ 0x7fe6ebe07750 │
├─────────┤
│ Set 2 │ 0x7ffcbf9db9a8 │ 0x7fe6eba1ff68 │ 0x7ffcbf9db9e0 │ 0x7fe6ebe01e68 │
├─────────┤
│ Set 3 │ 0x7ffcbf9db8f4 │ 0x7fe6ebe04830 │ 0x7ffcbf9db974 │ 0x7ffcbf9db9b8 │
└─────────┘
```

```
real    2m25.925s
user    0m23.403s
sys     0m2.682s
```

Associativity : 8

Number of instructions: 240677
Total cycles taken: 12114705
cache_3
    Number of accesses: 12501
    Number of hits: 7306
    Number of misses: 5195
cache_2
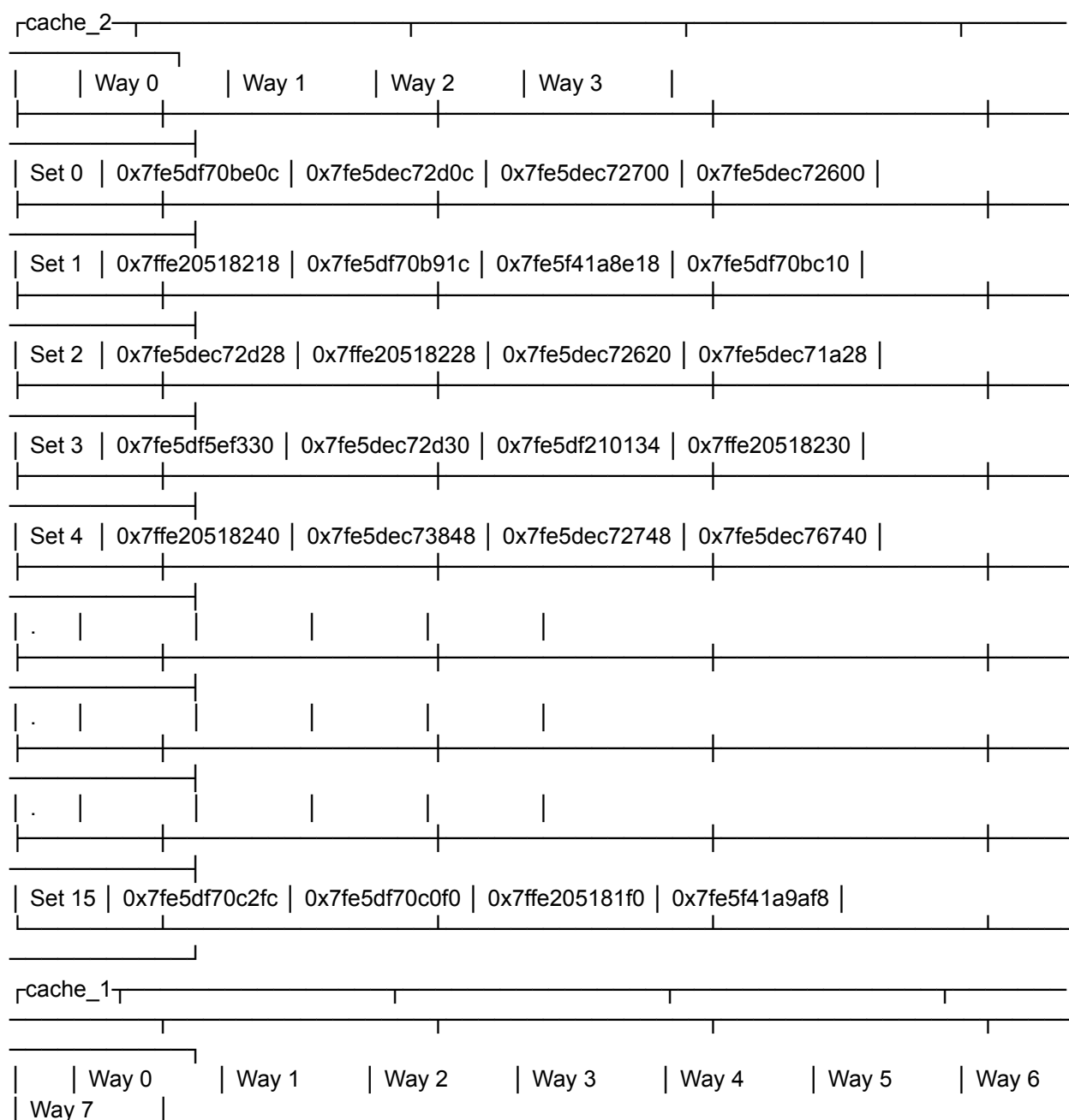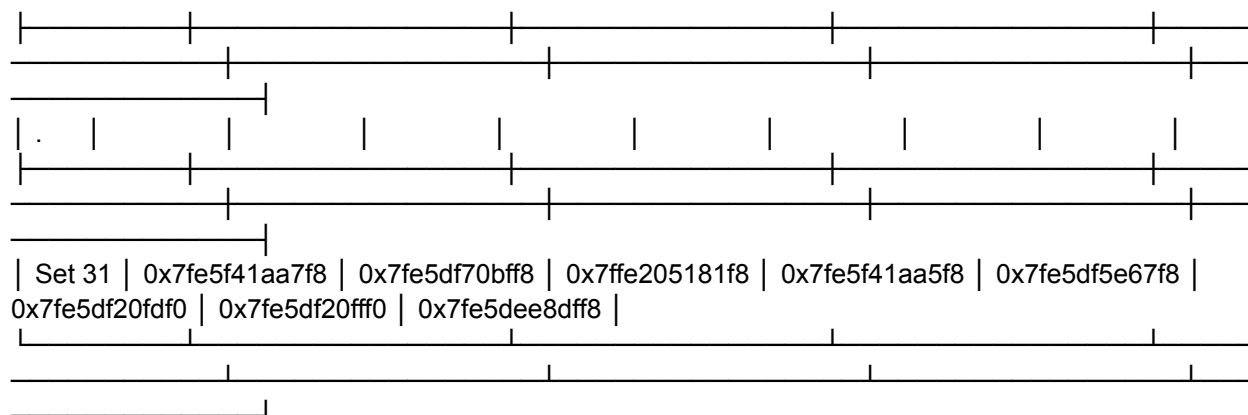   Number of accesses: 55231

Number of hits: 41511
Number of misses: 13720
cache_1
    Number of accesses: 240677
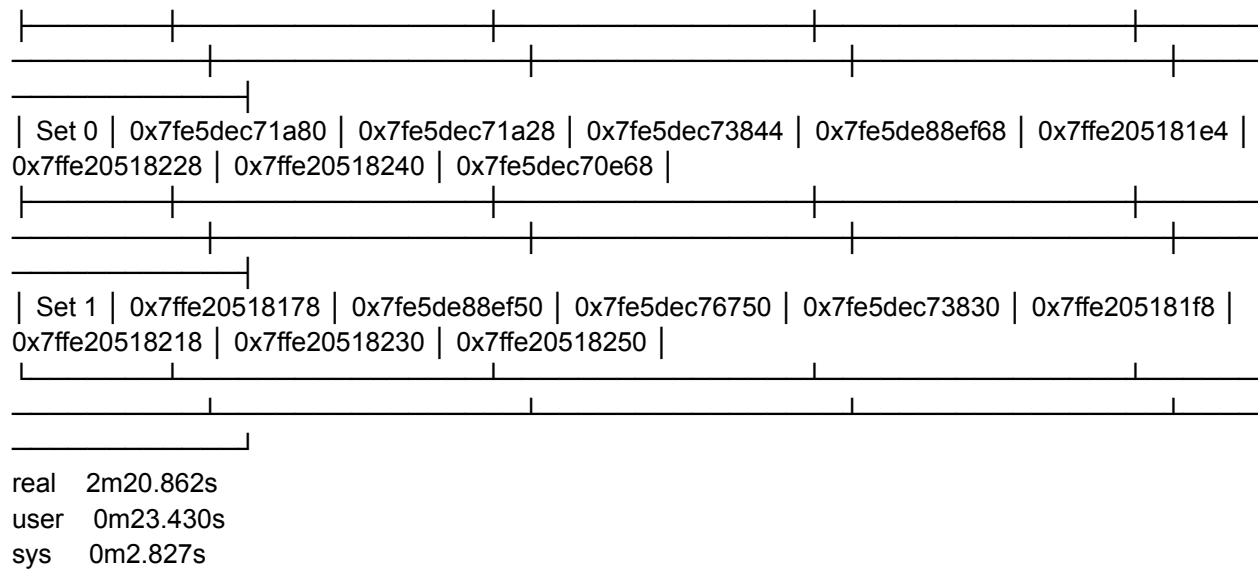   Number of hits: 177116
    Number of misses: 63561
AMATs:
{'cache_1': 39.04848965988544,
 'cache_2': 144.07256565932332,
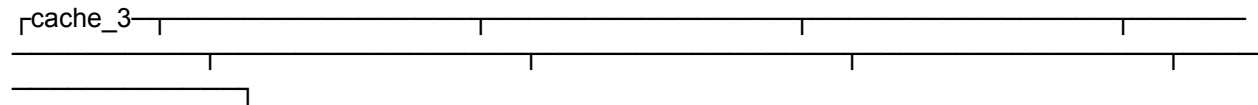 'cache_3': 515.5667546596272,
 'mem': 1000}
┌cache_3

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6
| Way 7 |

| Set 0 | 0x7fe5df70be08 | 0x7fe5df70c008 | 0x7fe5f41aa600 | 0x7ffe20518208 | 0x7fe5df70b600 |
0x7fe5df20fe00 | 0x7fe5df70bc00 | 0x7fe5dec72600 |

| Set 1 | 0x7fe5df5f0a18 | 0x7fe5f41a8e18 | 0x7fe5df70b618 | 0x7ffe20518218 | 0x7fe5f41a9e18 |
0x7fe5f41aa61c | 0x604210 | 0x7fe5df70bc10 |

| Set 2 | 0x7fe5f41a9028 | 0x7fe5df70b628 | 0x7fe5f41a9e20 | 0x7ffe20518228 | 0x7fe5df70b220 |
0x7fe5dee8e020 | 0x7fe5df70b428 | 0x7fe5dec71a28 |

| Set 3 | 0x7fe5f41a9a38 | 0x7ffe20517838 | 0x7fe5df5f1430 | 0x7ffe20517630 | 0x603e38 |
0x7ffe20518238 | 0x7fe5df70b230 | 0x7fe5f41a9e3c |

| Set 4 | 0x7ffe20518248 | 0x7ffe20517648 | 0x7fe5df5f2840 | 0x7fe5f41aa248 | 0x7fe5df5f0040 |
0x7fe5df5efa48 | 0x7fe5dee8dc40 | 0x7fe5dec73848 |

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| . | | | | | | | |

| Set 31 | 0x7fe5f41aa7f8 | 0x7fe5df70bff8 | 0x7ffe205181f8 | 0x7fe5f41aa5f8 | 0x7fe5df5e67f8 |
0x7fe5df20fdf0 | 0x7fe5df20fff0 | 0x7fe5dee8dff8 |

cache_2

| | Way 0 | Way 1 | Way 2 | Way 3 | |

| Set 0 | 0x7fe5df70be0c | 0x7fe5dec72d0c | 0x7fe5dec72700 | 0x7fe5dec72600 |

| Set 1 | 0x7ffe20518218 | 0x7fe5df70b91c | 0x7fe5f41a8e18 | 0x7fe5df70bc10 |

| Set 2 | 0x7fe5dec72d28 | 0x7ffe20518228 | 0x7fe5dec72620 | 0x7fe5dec71a28 |

| Set 3 | 0x7fe5df5ef330 | 0x7fe5dec72d30 | 0x7fe5df210134 | 0x7ffe20518230 |

| Set 4 | 0x7ffe20518240 | 0x7fe5dec73848 | 0x7fe5dec72748 | 0x7fe5dec76740 |

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| Set 15 | 0x7fe5df70c2fc | 0x7fe5df70c0f0 | 0x7ffe205181f0 | 0x7fe5f41a9af8 |

cache_1

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6
| Way 7 | |

| Set 0 | 0x7fe5dec71a80 | 0x7fe5dec71a28 | 0x7fe5dec73844 | 0x7fe5de88ef68 | 0x7ffe205181e4 | 0x7ffe20518228 | 0x7ffe20518240 | 0x7fe5dec70e68 |

| Set 1 | 0x7ffe20518178 | 0x7fe5de88ef50 | 0x7fe5dec76750 | 0x7fe5dec73830 | 0x7ffe205181f8 | 0x7ffe20518218 | 0x7ffe20518230 | 0x7ffe20518250 |

```
real    2m20.862s
user    0m23.430s
sys     0m2.827s
```

Matrix Size 150x150:

Associativity : 2

```
Associativity 2
Number of instructions: 262352
Total cycles taken: 15008504
cache_3
      Number of accesses: 15863
      Number of hits: 9114
      Number of misses: 6749
cache_2
      Number of accesses: 57681
      Number of hits: 40345
      Number of misses: 17336
cache_1
      Number of accesses: 262352
      Number of hits: 197694
      Number of misses: 64658
AMATs:
{'cache_1': 43.86481338284825,
 'cache_2': 173.92541558070158,
 'cache_3': 525.4554623967724,
 'mem': 1000}
```

cache_3

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6 |
| Way 7 |

| Set 0 | 0x7f544a901808 | 0x7f5435e62e08 | 0x7f5435e63008 | 0x7f544a901600 | 0x7f5435e62600 | 0x7f5435966e00 | 0x7f5435e62c00 | 0x7f54353c9600 |

| Set 1 | 0x7f5435d47a18 | 0x7f544a8ffe18 | 0x7f5435e62618 | 0x7f544a900e18 | 0x7f544a90161c | 0x604210 | 0x7ffe83c44418 | 0x7f5435e62c10 |

| Set 2 | 0x7ffe83c44428 | 0x7f5435e6242e | 0x7f544a900028 | 0x7f5435e62628 | 0x7f544a900e20 | 0x7f5435e62220 | 0x7f54355e5020 | 0x7f54353c8a28 |

| Set 3 | 0x7ffe83c44438 | 0x7f544a901230 | 0x7f544a900a38 | 0x7ffe83c43a38 | 0x7f5435d48430 | 0x603e38 | 0x7f544a900e3c | 0x7f5435e62230 |

| Set 4 | 0x7ffe83c44440 | 0x7ffe83c43a48 | 0x7f5435d49840 | 0x7f544a901248 | 0x7f5435d47040 | 0x7f5435d46a48 | 0x7f54355e4c40 | 0x7f54353ca848 |

| . | | | | | | | |

| . | | | | | | | |

| . | | | | | | | |

| Set 31 | 0x7f544a9017f8 | 0x7f5435e62ff8 | 0x7f544a9015f8 | 0x7f5435d3d7f8 | 0x7ffe83c443ff | 0x7f5435966df0 | 0x7f5435966ff0 | 0x7f54355e4ff8 |

cache_2

	Way 0	Way 1	Way 2	Way 3
Set 0	0x7ffe83c44400	0x7f54353c9700	0x7f54353c9d0c	0x7f54353c9600
Set 1	0x7ffe83c44418	0x7f5435e6291c	0x7f544a8ffe18	0x7f5435e62c10
Set 2	0x7f54353c9d28	0x7ffe83c44428	0x7f54353c9620	0x7f54353c8a28
Set 3	0x7ffe83c44438	0x7f5435d46330	0x7f54353c9d30	0x7f5435967134
Set 4	0x7ffe83c44448	0x7f54353cd740	0x7f54353ca848	0x7f54353c9748
.				
.				
.				
Set 15	0x7f5435e632fc	0x7f5435e630f0	0x7f544a900af8	0x7ffe83c444fc

cache_1

	Way 0	Way 1
Set 0	0x7f54353c9600	0x7f54353c8a80
Set 1	0x7ffe83c44498	0x7f54353c9d90
Set 2	0x7f54353c8a28	0x7ffe83c444a8
Set 3	0x7f54353ca830	0x7ffe83c444b8
Set 4	0x7f54353ca844	0x7ffe83c444c0
Set 5	0x7f54353cd750	0x7ffe83c444d0
Set 6	0x7ffe83c444e0	0x7f54353c7e68
Set 7	0x7ffe83c443f4	0x7ffe83c44474

```
real    3m30.723s
user    0m26.742s
sys     0m3.196s
```

Associativity : 4

Number of instructions: 262352
Total cycles taken: 14978804
cache_3
        Number of accesses: 16031
        Number of hits: 9163
        Number of misses: 6868
cache_2
        Number of accesses: 56691
        Number of hits: 38912
        Number of misses: 17779
cache_1
        Number of accesses: 262352
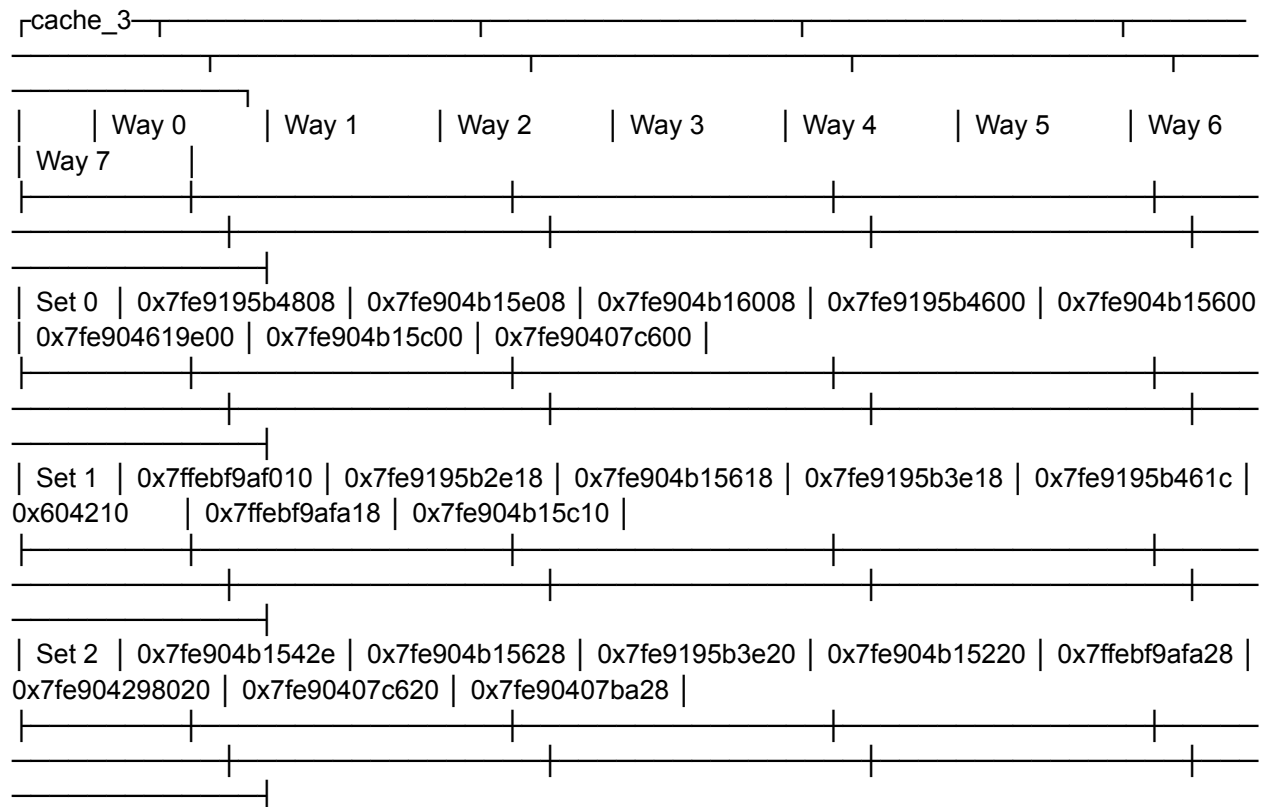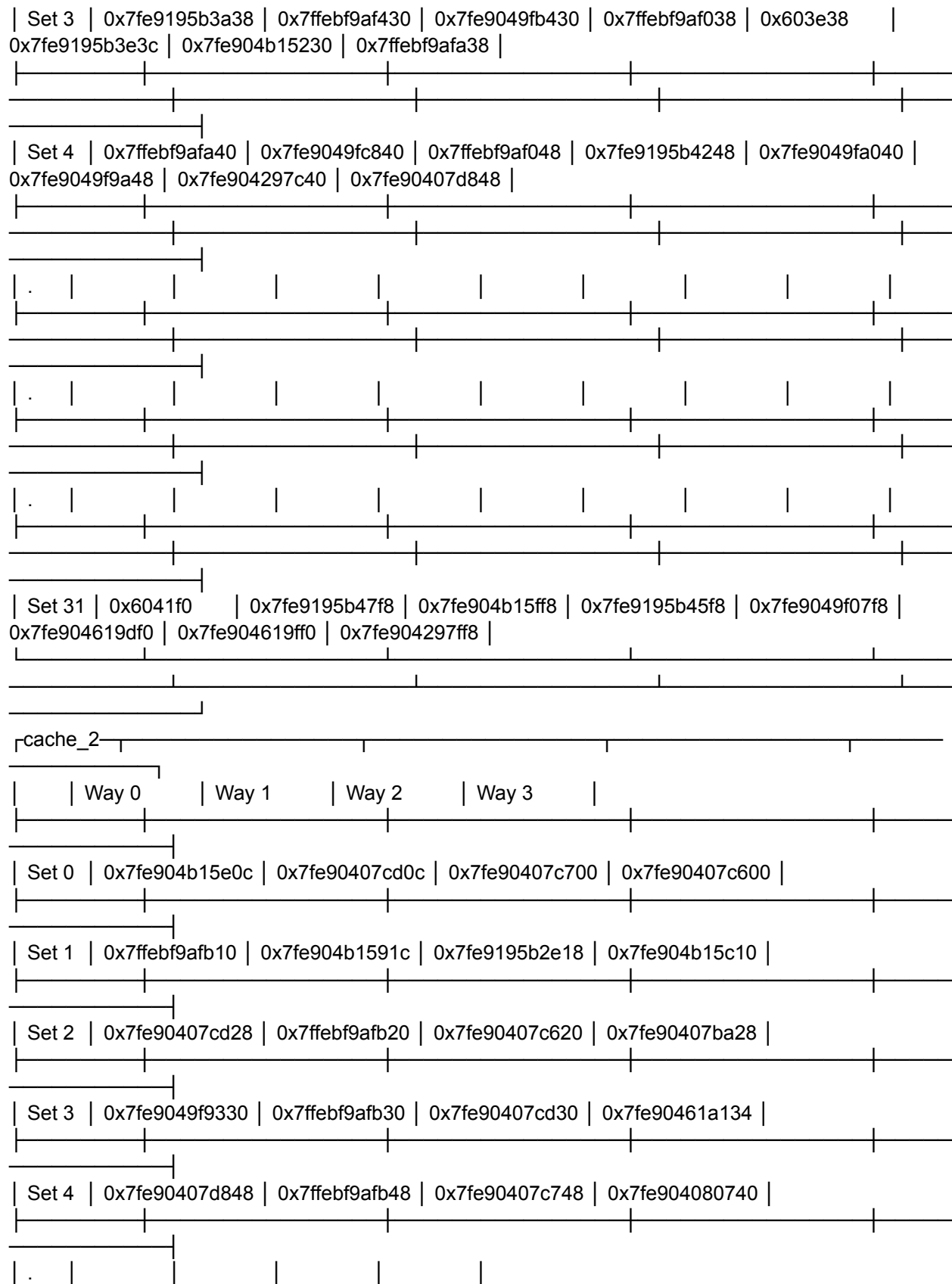   Number of hits: 196318
        Number of misses: 66034
AMATs:
{'cache_1': 46.738683263756215,
 'cache_2': 181.71903915578292,
 'cache_3': 528.4199363732769,
 'mem': 1000}

┌cache_3─┬───┐

│   │ Way 0   │ Way 1   │ Way 2   │ Way 3   │ Way 4   │ Way 5   │ Way 6
│ Way 7   │

│ Set 0 │ 0x7fe9195b4808 │ 0x7fe904b15e08 │ 0x7fe904b16008 │ 0x7fe9195b4600 │ 0x7fe904b15600
│ 0x7fe904619e00 │ 0x7fe904b15c00 │ 0x7fe90407c600 │

│ Set 1 │ 0x7ffebf9af010 │ 0x7fe9195b2e18 │ 0x7fe904b15618 │ 0x7fe9195b3e18 │ 0x7fe9195b461c │
0x604210   │ 0x7ffebf9afa18 │ 0x7fe904b15c10 │

│ Set 2 │ 0x7fe904b1542e │ 0x7fe904b15628 │ 0x7fe9195b3e20 │ 0x7fe904b15220 │ 0x7ffebf9afa28 │
0x7fe904298020 │ 0x7fe90407c620 │ 0x7fe90407ba28 │
```

| Set 3 | 0x7fe9195b3a38 | 0x7ffebf9af430 | 0x7fe9049fb430 | 0x7ffebf9af038 | 0x603e38 |
0x7fe9195b3e3c | 0x7fe904b15230 | 0x7ffebf9afa38 |

| Set 4 | 0x7ffebf9afa40 | 0x7fe9049fc840 | 0x7ffebf9af048 | 0x7fe9195b4248 | 0x7fe9049fa040 |
0x7fe9049f9a48 | 0x7fe904297c40 | 0x7fe90407d848 |

| . | | | | | | | |

| . | | | | | | | |

| . | | | | | | | |

| Set 31 | 0x6041f0 | 0x7fe9195b47f8 | 0x7fe904b15ff8 | 0x7fe9195b45f8 | 0x7fe9049f07f8 |
0x7fe904619df0 | 0x7fe904619ff0 | 0x7fe904297ff8 |

cache_2

| | Way 0 | Way 1 | Way 2 | Way 3 | |

| Set 0 | 0x7fe904b15e0c | 0x7fe90407cd0c | 0x7fe90407c700 | 0x7fe90407c600 |

| Set 1 | 0x7ffebf9afb10 | 0x7fe904b1591c | 0x7fe9195b2e18 | 0x7fe904b15c10 |

| Set 2 | 0x7fe90407cd28 | 0x7ffebf9afb20 | 0x7fe90407c620 | 0x7fe90407ba28 |

| Set 3 | 0x7fe9049f9330 | 0x7ffebf9afb30 | 0x7fe90407cd30 | 0x7fe90461a134 |

| Set 4 | 0x7fe90407d848 | 0x7ffebf9afb48 | 0x7fe90407c748 | 0x7fe904080740 |

| . | | | | |

```
┌──────────┬───────────┬──────────┬──────────┬──────────┐
│   .   │        │         │        │        │
├──────────┬───────────┬──────────┬──────────┬──────────┤
│   .   │        │         │        │        │
├──────────┬───────────┬──────────┬──────────┬──────────┤
│ Set 15 │ 0x7ffebf9afaf8 │ 0x7fe904b162fc │ 0x7fe904b160f0 │ 0x7fe9195b3af8 │
└──────────┘
```

┌ cache_1 ┐
│   │ Way 0   │ Way 1   │ Way 2   │ Way 3   │
├──────────┬───────────┬──────────┬──────────┬──────────┤
│ Set 0 │ 0x7fe90407b9c0 │ 0x7fe90407ba80 │ 0x7fe90407d844 │ 0x7ffebf9afbc0 │
├──────────┬───────────┬──────────┬──────────┬──────────┤
│ Set 1 │ 0x7fe903c98f50 │ 0x7fe904080750 │ 0x7ffebf9afb98 │ 0x7ffebf9afbd0 │
├──────────┬───────────┬──────────┬──────────┬──────────┤
│ Set 2 │ 0x7fe903c98f68 │ 0x7ffebf9afb64 │ 0x7ffebf9afba8 │ 0x7fe90407ae68 │
├──────────┬───────────┬──────────┬──────────┬──────────┤
│ Set 3 │ 0x7ffebf9afaf8 │ 0x7fe90407d830 │ 0x7ffebf9afb78 │ 0x7ffebf9afbb0 │
└──────────┘

```
real    2m49.764s
user    0m25.717s
sys     0m3.167s
```

Associativity : 8

Number of instructions: 262352
Total cycles taken: 14786272
cache_3
        Number of accesses: 15443
        Number of hits: 8610
        Number of misses: 6833
cache_2
        Number of accesses: 49503
        Number of hits: 32529
        Number of misses: 16974
cache_1
        Number of accesses: 262352
        Number of hits: 207018
        Number of misses: 55334

AMATs:
{'cache_1': 43.60594735550116,
 'cache_2': 202.0051957315654,
 'cache_3': 542.46584212912,
 'mem': 1000}

cache_3

| | Way 0 | | Way 1 | | Way 2 | | Way 3 | | Way 4 | | Way 5 | | Way 6 |
| Way 7 | |

| Set 0 | 0x7fe1bd1ed808 | 0x7fe1a874ee08 | 0x7fe1a874f008 | 0x7fe1bd1ed600 | 0x7fe1a874e600
| 0x7fe1a8252e00 | 0x7fe1a874ec00 | 0x7fe1a7cb5600 |

| Set 1 | 0x7fe1a8633a18 | 0x7fe1bd1ebe18 | 0x7fe1a874e618 | 0x7ffc92f65418 | 0x7fe1bd1ece18
| 0x604210 | 0x7fe1bd1ed61c | 0x7fe1a874ec10 |

| Set 2 | 0x7fe1bd1ec028 | 0x7fe1a874e628 | 0x7fe1bd1ece20 | 0x7ffc92f65428 | 0x7fe1a874e220
| 0x7fe1a7ed1020 | 0x7fe1a874e428 | 0x7fe1a7cb4a28 |

| Set 3 | 0x7fe1bd1eca38 | 0x7ffc92f65438 | 0x7ffc92f64a30 | 0x7ffc92f64838 | 0x7fe1a8634430 |
0x603e38 | 0x7fe1a874e230 | 0x7fe1bd1ece3c |

| Set 4 | 0x7ffc92f65440 | 0x7fe1a8635840 | 0x7ffc92f64848 | 0x7fe1bd1ed248 | 0x7fe1a8633040 |
0x7fe1a8632a48 | 0x7fe1a7ed0c40 | 0x7fe1a7cb6848 |

| . | | | | | | | | |

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| Set 31 | 0x7fe1bd1ed7f8 | 0x7fe1a874eff8 | 0x7ffc92f653f8 | 0x7fe1bd1ed5f8 | 0x7fe1a86297f8 |
0x7fe1a8252df0 | 0x7fe1a8252ff0 | 0x7fe1a7ed0ff8 |

cache_2

| | Way 0 | Way 1 | Way 2 | Way 3 | |

| Set 0 | 0x7ffc92f65408 | 0x7fe1a7cb5d0c | 0x7fe1a7cb5700 | 0x7fe1a7cb5600 |

| Set 1 | 0x7fe1a874e91c | 0x7fe1bd1ebe18 | 0x7fe1a874ec10 | 0x7ffc92f65418 |

| Set 2 | 0x7fe1a7cb5d28 | 0x7ffc92f65420 | 0x7fe1a7cb5620 | 0x7fe1a7cb4a28 |

| Set 3 | 0x7fe1a8632330 | 0x7fe1a7cb5d30 | 0x7fe1a8253134 | 0x7ffc92f65430 |

| Set 4 | 0x7ffc92f65440 | 0x7fe1a7cb9740 | 0x7fe1a7cb6848 | 0x7fe1a7cb5748 |

| . | | | | |

| . | | | | |

| . | | | | |

| Set 15 | 0x7fe1a7ed0ff8 | 0x7fe1a874f2fc | 0x7fe1a874f0f0 | 0x7fe1bd1ecaf8 |

cache_1

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6 |
Way 7 |

```
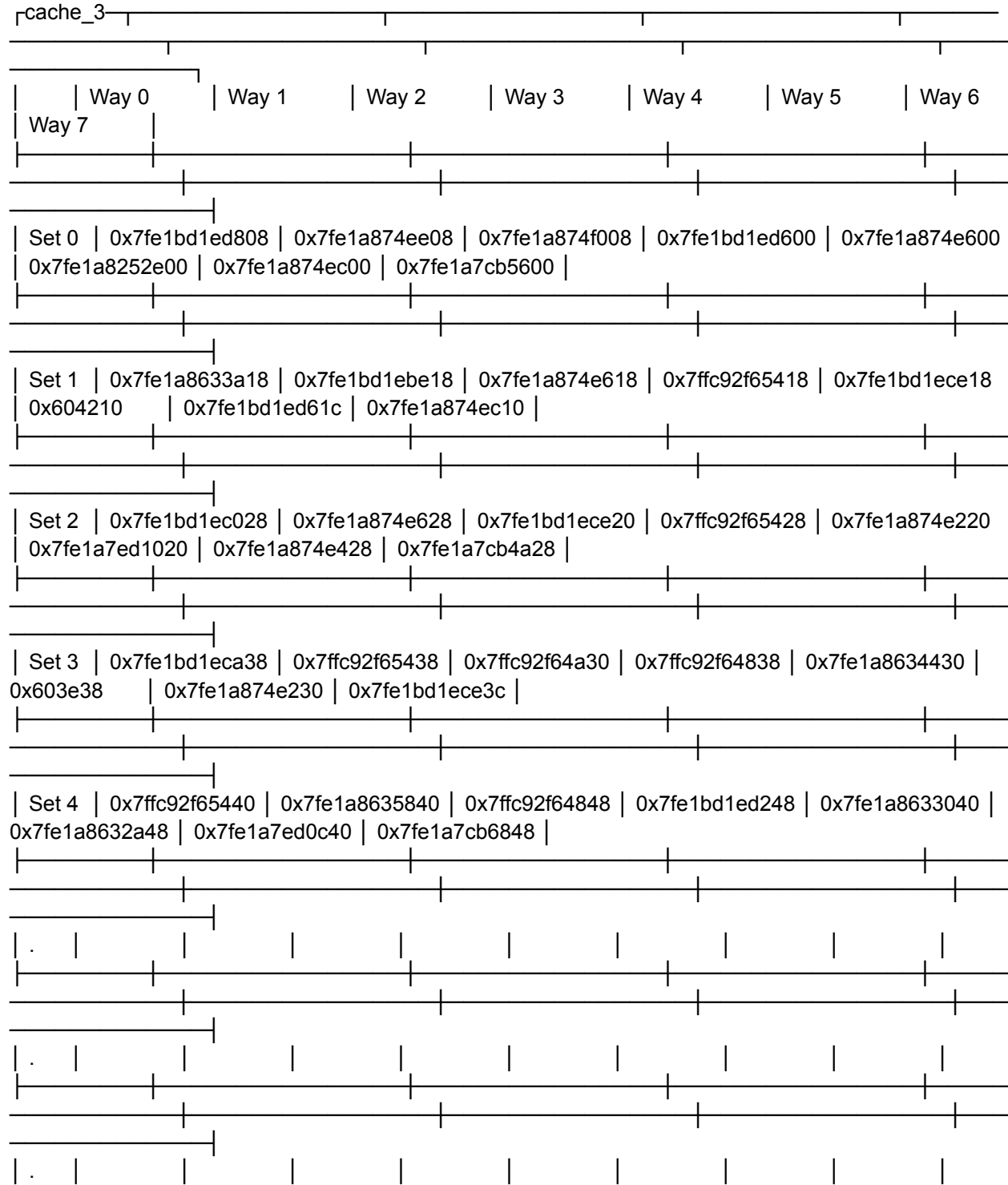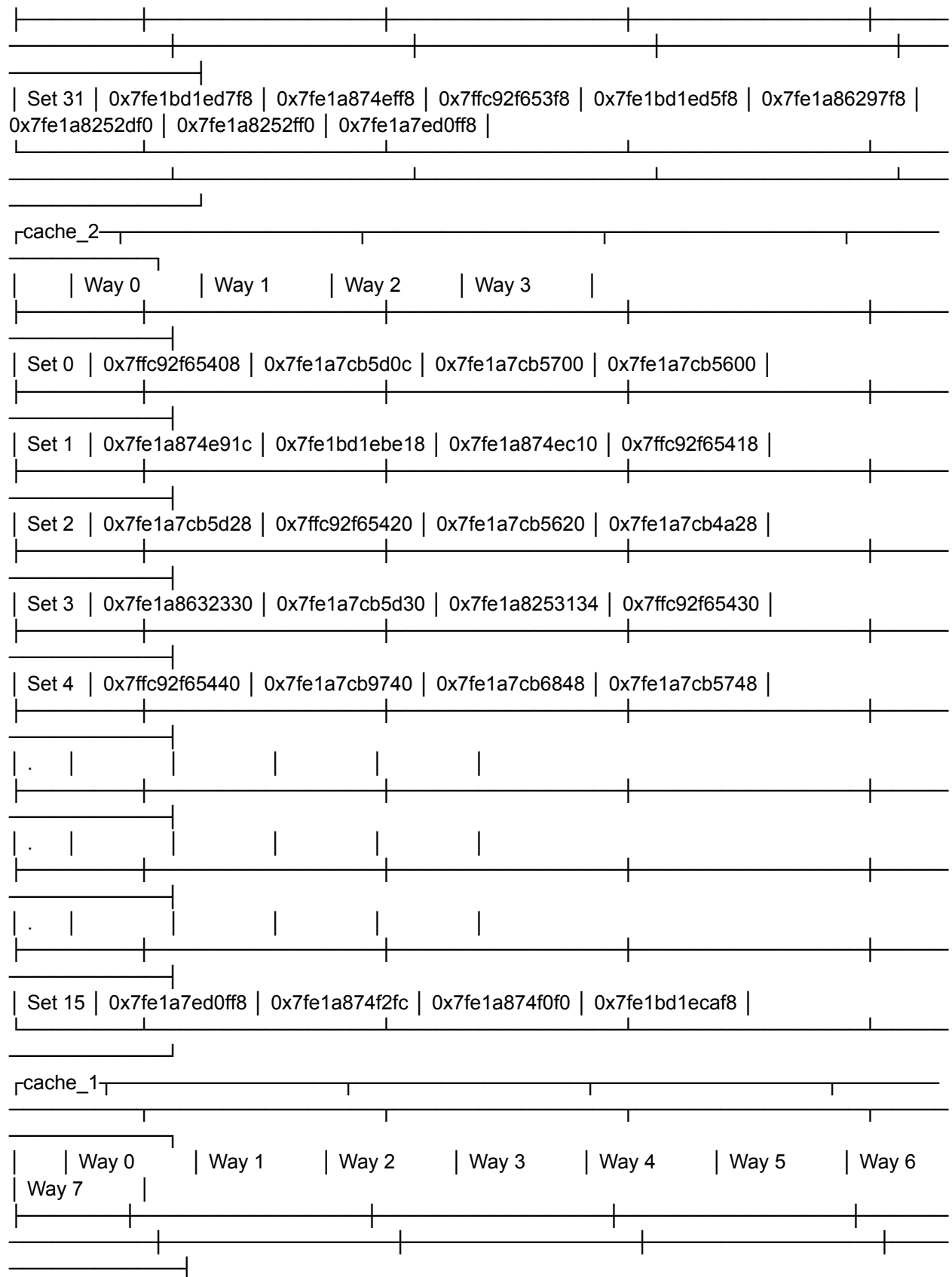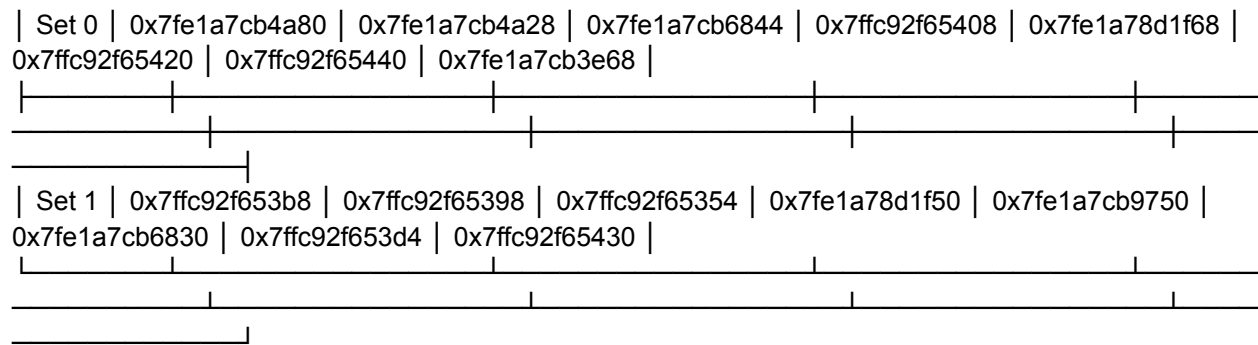│ Set 0 │ 0x7fe1a7cb4a80 │ 0x7fe1a7cb4a28 │ 0x7fe1a7cb6844 │ 0x7ffc92f65408 │ 0x7fe1a78d1f68 │
0x7ffc92f65420 │ 0x7ffc92f65440 │ 0x7fe1a7cb3e68 │
```

```
│ Set 1 │ 0x7ffc92f653b8 │ 0x7ffc92f65398 │ 0x7ffc92f65354 │ 0x7fe1a78d1f50 │ 0x7fe1a7cb9750 │
0x7fe1a7cb6830 │ 0x7ffc92f653d4 │ 0x7ffc92f65430 │
```

```
real    3m45.207s
user    0m27.395s
sys     0m3.056s
```

Varying Number of Cache:

Matrix Size 128x128:

Using 1 Cache :

Number of instructions: 240677
Total cycles taken: 76937677
cache_1
        Number of accesses: 240677
        Number of hits: 176626
        Number of misses: 64051
AMATs:
{'cache_1': 267.1284626283359, 'mem': 1000}

```
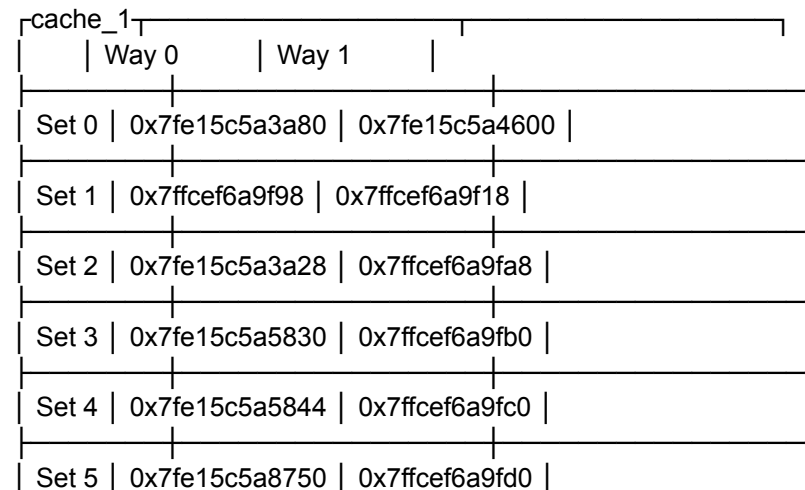┌cache_1┬─────────────────────────────┐
│      │ Way 0      │ Way 1     │     │
├──────┼────────────┼───────────────────┤
│ Set 0 │ 0x7fe15c5a3a80 │ 0x7fe15c5a4600 │
├──────┼────────────┼───────────────────┤
│ Set 1 │ 0x7ffcef6a9f98 │ 0x7ffcef6a9f18 │
├──────┼────────────┼───────────────────┤
│ Set 2 │ 0x7fe15c5a3a28 │ 0x7ffcef6a9fa8 │
├──────┼────────────┼───────────────────┤
│ Set 3 │ 0x7fe15c5a5830 │ 0x7ffcef6a9fb0 │
├──────┼────────────┼───────────────────┤
│ Set 4 │ 0x7fe15c5a5844 │ 0x7ffcef6a9fc0 │
├──────┼────────────┼───────────────────┤
│ Set 5 │ 0x7fe15c5a8750 │ 0x7ffcef6a9fd0 │
```

```
|         |                    |                    |
| Set 6 | 0x7ffcef6a9f64 | 0x7fe15c5a2e68 |
|         |                    |                    |
| Set 7 | 0x7ffcef6a9ef8 | 0x7ffcef6a9f78 |
|         |                    |                    |
```

real   1m50.739s
user   0m18.504s
sys   0m2.226s
/home/grads/vmn5118/CachePerformanceOnMatMul

Using 2 Cache :

Number of instructions: 240677
Total cycles taken: 20140349
cache_2
        Number of accesses: 50091
        Number of hits: 37477
        Number of misses: 12614
cache_1
        Number of accesses: 240677
        Number of hits: 184319
        Number of misses: 56358
AMATs:
{'cache_1': 63.714320425198515, 'cache_2': 267.82168453414783, 'mem': 1000}

```
 ┌cache_2─┐
|    | Way 0   | Way 1   | Way 2   | Way 3   |
|    |         |         |         |         |
| Set 0 | 0x7ffd59889e00 | 0x7fd98cba7700 | 0x7fd98cba7d0c | 0x7fd98cba7600 |
|    |         |         |         |         |
| Set 1 | 0x7ffd59889e18 | 0x7fd98d64091c | 0x7fd9a20dde18 | 0x7fd98d640c10 |
|    |         |         |         |         |
| Set 2 | 0x7fd98cba7d28 | 0x7ffd59889e28 | 0x7fd98cba7620 | 0x7fd98cba6a28 |
|    |         |         |         |         |
| Set 3 | 0x7ffd59889e38 | 0x7fd98d524330 | 0x7fd98cba7d30 | 0x7fd98d145134 |
|    |         |         |         |         |
| Set 4 | 0x7ffd59889e48 | 0x7fd98cbab740 | 0x7fd98cba8848 | 0x7fd98cba7748 |
|    |         |         |         |         |
| .  |         |         |         |         |
|    |         |         |         |         |
| .  |         |         |         |         |
```

```
┌──────────────┬────────────────────┬────────────────────┬────────────────────┬────────────────────┬──────────┐
│              │                    │                    │                    │                    │          │
├──────────────┘                    │                    │                    │                    │          │
│  .   │       │           │        │           │        │                                                     │
├──────────────┐                    │                    │                    │                    │          │
│ Set 15 │ 0x7fd98d6412fc │ 0x7fd98d6410f0 │ 0x7fd9a20deaf8 │ 0x7ffd59889efc │
└──────────────┘
```

```
┌cache_1┬────────────────────────────────────┐
│    │ Way 0     │ Way 1      │               │
├────┼───────────┼────────────┤
│ Set 0 │ 0x7fd98cba7600 │ 0x7fd98cba6a80 │
├───────┼────────────────┼────────────────┤
│ Set 1 │ 0x7ffd59889e98 │ 0x7fd98cba7d90 │
├───────┼────────────────┼────────────────┤
│ Set 2 │ 0x7fd98cba6a28 │ 0x7ffd59889ea8 │
├───────┼────────────────┼────────────────┤
│ Set 3 │ 0x7fd98cba8830 │ 0x7ffd59889eb8 │
├───────┼────────────────┼────────────────┤
│ Set 4 │ 0x7fd98cba8844 │ 0x7ffd59889ec0 │
├───────┼────────────────┼────────────────┤
│ Set 5 │ 0x7fd98cbab750 │ 0x7ffd59889ed0 │
├───────┼────────────────┼────────────────┤
│ Set 6 │ 0x7ffd59889ee0 │ 0x7fd98cba5e68 │
├───────┼────────────────┼────────────────┤
│ Set 7 │ 0x7ffd59889df4 │ 0x7ffd59889e74 │
└───────┴────────────────┴────────────────┘
```

real   2m8.047s
user   0m21.266s
sys   0m2.574s

Using 3 Cache :

Number of instructions: 240677
Total cycles taken: 12129641
cache_3
      Number of accesses: 12871
      Number of hits: 7516
      Number of misses: 5355
cache_2
      Number of accesses: 55522
      Number of hits: 41382
      Number of misses: 14140
cache_1
      Number of accesses: 240677
      Number of hits: 176617
      Number of misses: 64060
AMATs:

{'cache_1': 40.23945650492939,
 'cache_2': 147.42483099027305,
 'cache_3': 516.0515888431357,
 'mem': 1000}

cache_3

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6 |
| Way 7 | |

| Set 0 | 0x7f0e02aba808 | 0x7f0dee01be08 | 0x7f0dee01c008 | 0x7f0e02aba600 | 0x7f0dee01b600 |
| 0x7f0dedb1fe00 | 0x7f0dee01bc00 | 0x7f0ded582600 |

| Set 1 | 0x7f0ded582610 | 0x7f0dedf00a18 | 0x7f0e02ab8e18 | 0x7f0dee01b618 | 0x7f0e02ab9e18 |
| 0x7f0e02aba61c | 0x604210 | 0x7f0dee01bc10 |

| Set 2 | 0x7f0dee01b42e | 0x7f0ded582628 | 0x7f0e02ab9028 | 0x7f0dee01b628 | 0x7f0e02ab9e20 |
| 0x7f0dee01b220 | 0x7f0ded79e020 | 0x7f0ded581a28 |

| Set 3 | 0x7f0ded581c30 | 0x7f0e02ab9a38 | 0x7ffe71126430 | 0x7ffe71125a38 | 0x7f0dedf01430 |
| 0x603e38 | 0x7f0dee01b230 | 0x7f0e02ab9e3c |

| Set 4 | 0x7ffe71126448 | 0x7f0dedf03440 | 0x7f0dedf02840 | 0x7f0e02aba248 | 0x7f0dedf00040 |
| 0x7f0dedeffa48 | 0x7f0ded79dc40 | 0x7f0ded583848 |

| . | | | | | | | |

| . | | | | | | | |

| . | | | | | | | |

| Set 31 | 0x7f0e02aba7f8 | 0x7f0dee01bff8 | 0x7ffe711263f8 | 0x7f0e02aba5f8 | 0x7f0dedef67f8 |
0x7f0dedb1fdf0 | 0x7f0dedb1fff0 | 0x7f0ded79dff8 |

cache_2

| | | Way 0 | | Way 1 | | Way 2 | | Way 3 | |

| Set 0 | 0x7f0dee01be0c | 0x7f0ded582700 | 0x7f0ded582d0c | 0x7f0ded582600 |

| Set 1 | 0x7ffe71126518 | 0x7f0dee01b91c | 0x7f0e02ab8e18 | 0x7f0dee01bc10 |

| Set 2 | 0x7f0ded582d28 | 0x7ffe71126528 | 0x7f0ded582620 | 0x7f0ded581a28 |

| Set 3 | 0x7f0dedeff330 | 0x7f0ded582d30 | 0x7f0dedb20134 | 0x7ffe71126530 |

| Set 4 | 0x7ffe71126540 | 0x7f0ded586740 | 0x7f0ded583848 | 0x7f0ded582748 |

| . | | | | | |

| . | | | | | |

| . | | | | | |

| Set 15 | 0x7f0dee01c2fc | 0x7f0dee01c0f0 | 0x7ffe711264f0 | 0x7f0e02ab9af8 |

cache_1

| | Way 0 | | Way 1 | |

| Set 0 | 0x7f0ded581a80 | 0x7f0ded582600 |

| Set 1 | 0x7ffe71126518 | 0x7ffe71126498 |

| Set 2 | 0x7f0ded581a28 | 0x7ffe71126528 |

| Set 3 | 0x7f0ded583830 | 0x7ffe71126530 |

| Set 4 | 0x7f0ded583844 | 0x7ffe71126540 |

| Set 5 | 0x7f0ded586750 | 0x7ffe71126550 |

| Set 6 | 0x7ffe711264e4 | 0x7f0ded580e68 |

| Set 7 | 0x7ffe71126478 | 0x7ffe711264f8 |

```
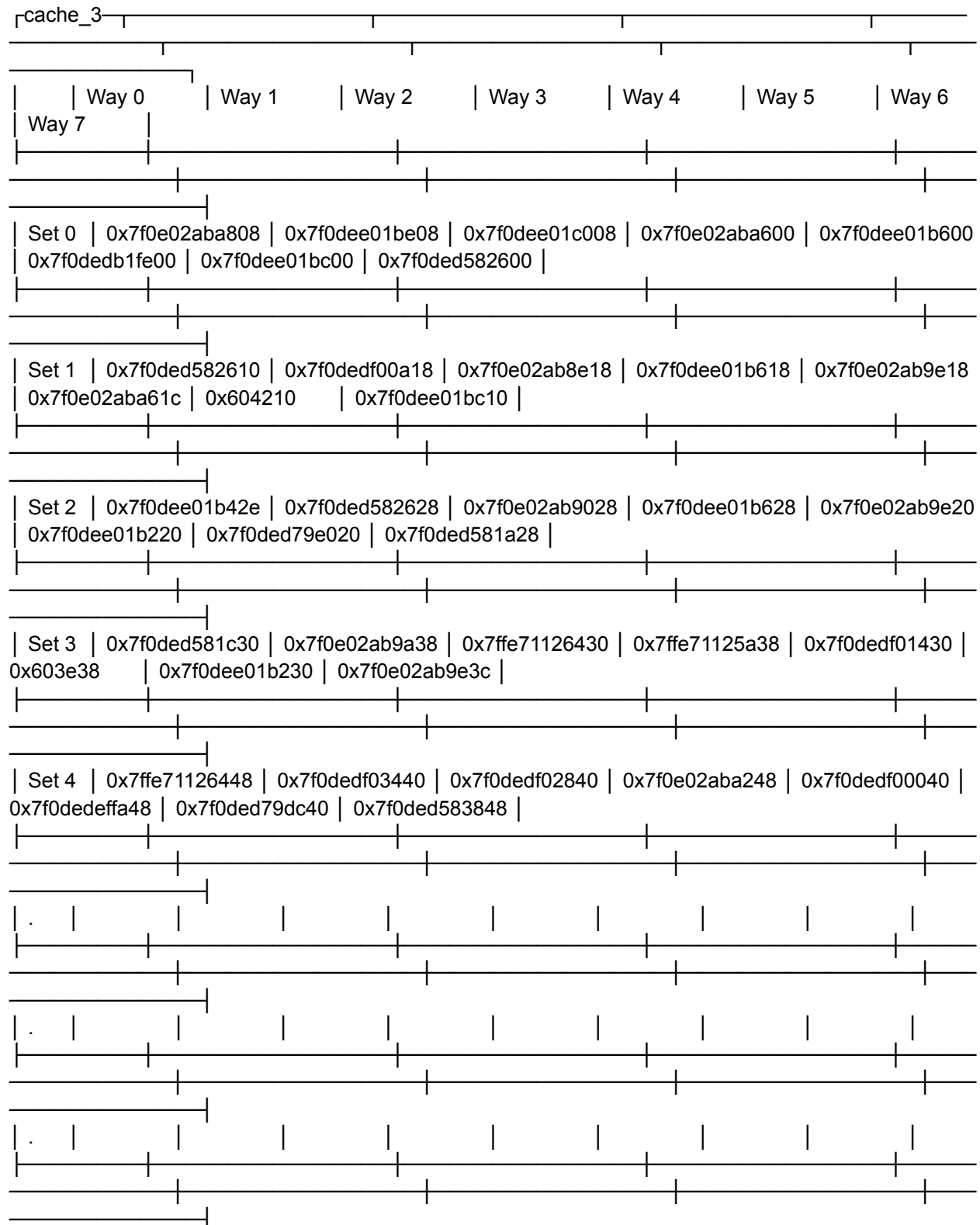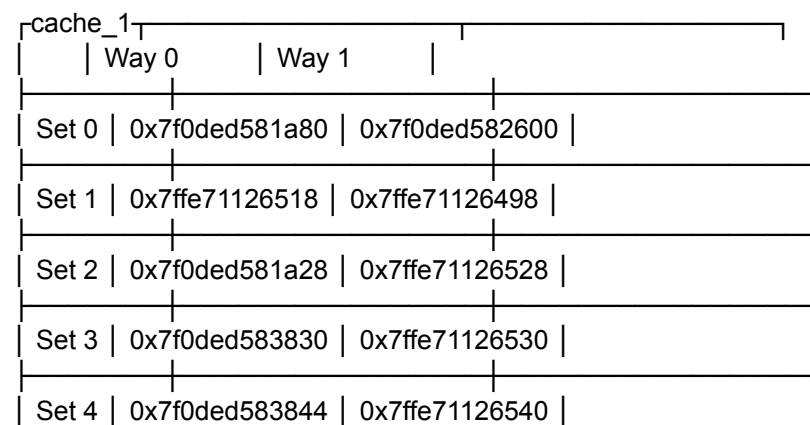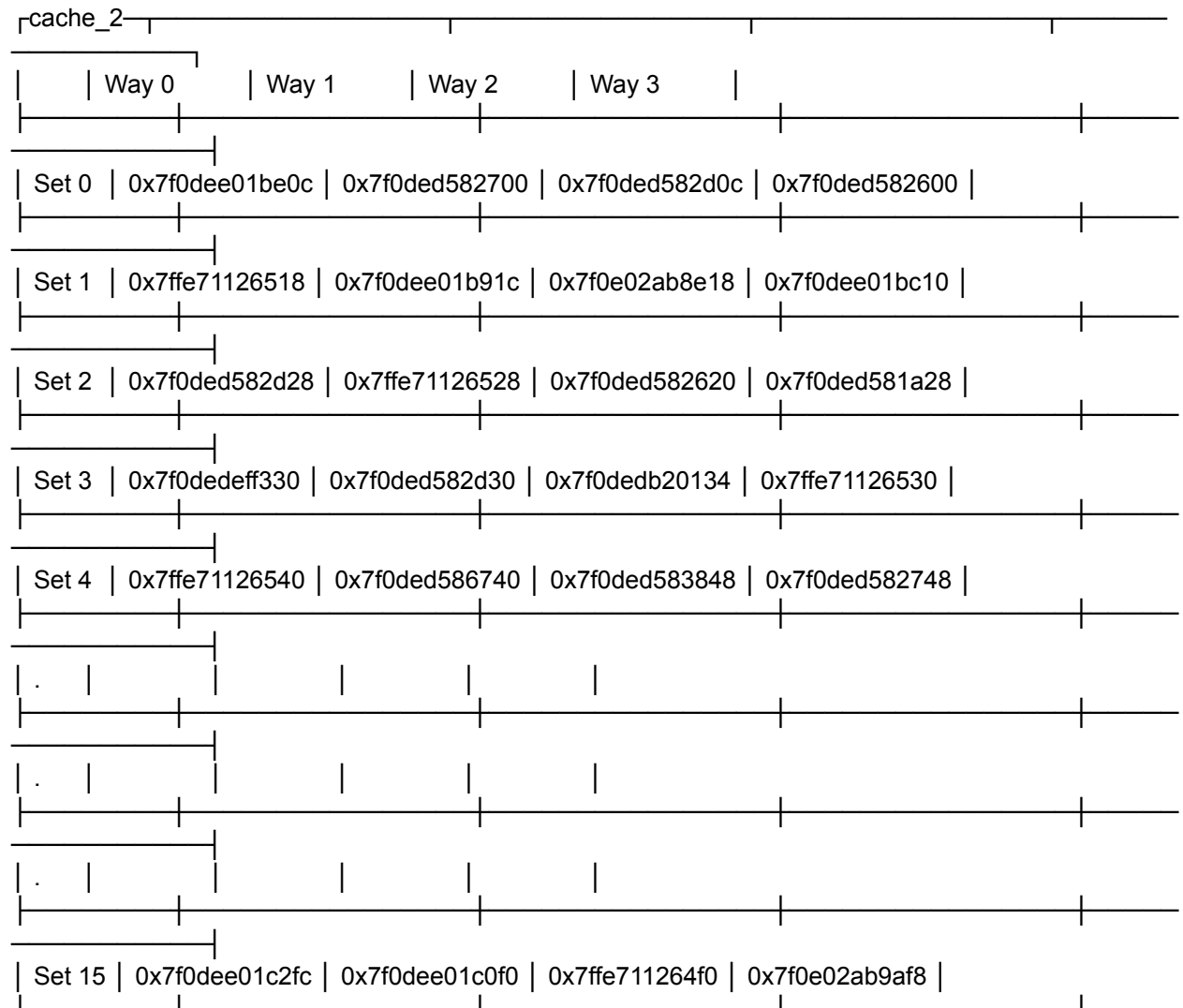real    2m6.676s
user    0m21.227s
sys     0m2.459s
/home/grads/vmn5118/CachePerformanceOnMatMul
```

Matrix Size 150x150:

Using 1 Cache :

```
Number of instructions: 262352
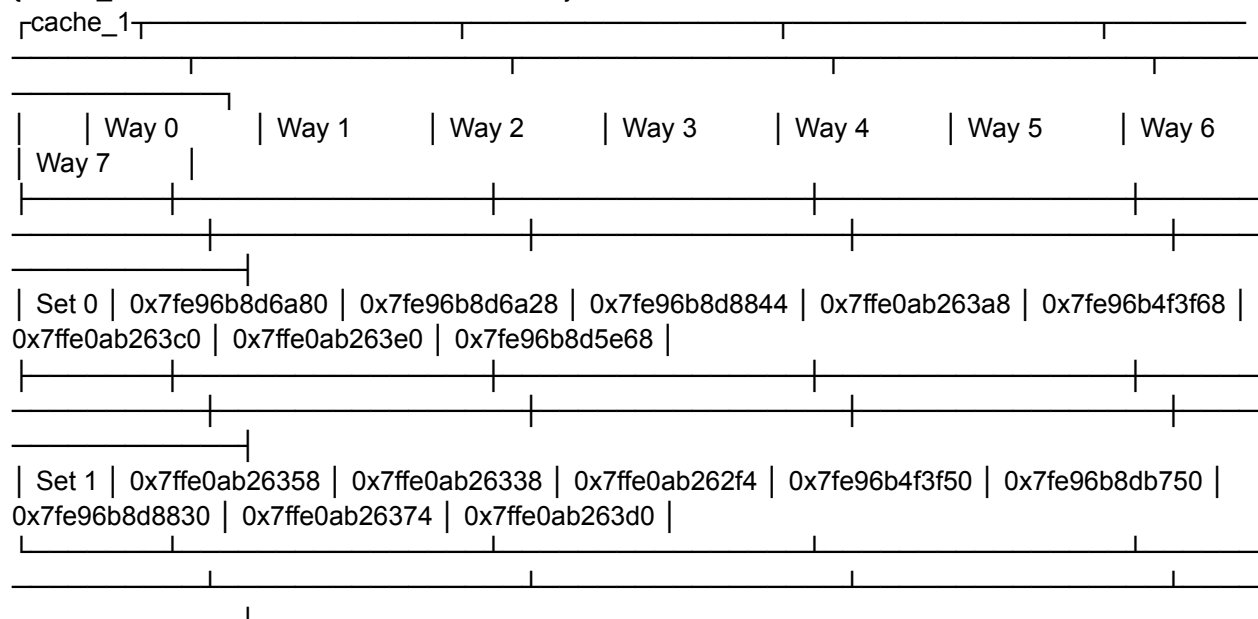Total cycles taken: 65085352
cache_1
        Number of accesses: 262352
        Number of hits: 206986
        Number of misses: 55366
AMATs:
{'cache_1': 212.03707995365005, 'mem': 1000}
```

cache_1

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6 | Way 7 |

| Set 0 | 0x7fe96b8d6a80 | 0x7fe96b8d6a28 | 0x7fe96b8d8844 | 0x7ffe0ab263a8 | 0x7fe96b4f3f68 | 0x7ffe0ab263c0 | 0x7ffe0ab263e0 | 0x7fe96b8d5e68 |

| Set 1 | 0x7ffe0ab26358 | 0x7ffe0ab26338 | 0x7ffe0ab262f4 | 0x7fe96b4f3f50 | 0x7fe96b8db750 | 0x7fe96b8d8830 | 0x7ffe0ab26374 | 0x7ffe0ab263d0 |

```
real    1m57.909s
user    0m14.962s
```

sys   0m1.779s

Using 2 Cache :

Number of instructions: 262352
Total cycles taken: 26534944
cache_2
        Number of accesses: 49500
        Number of hits: 31720
        Number of misses: 17780
cache_1
        Number of accesses: 262352
        Number of hits: 206985
        Number of misses: 55367
AMATs:
{'cache_1': 80.18083715732675, 'cache_2': 375.19191919191917, 'mem': 1000}

```
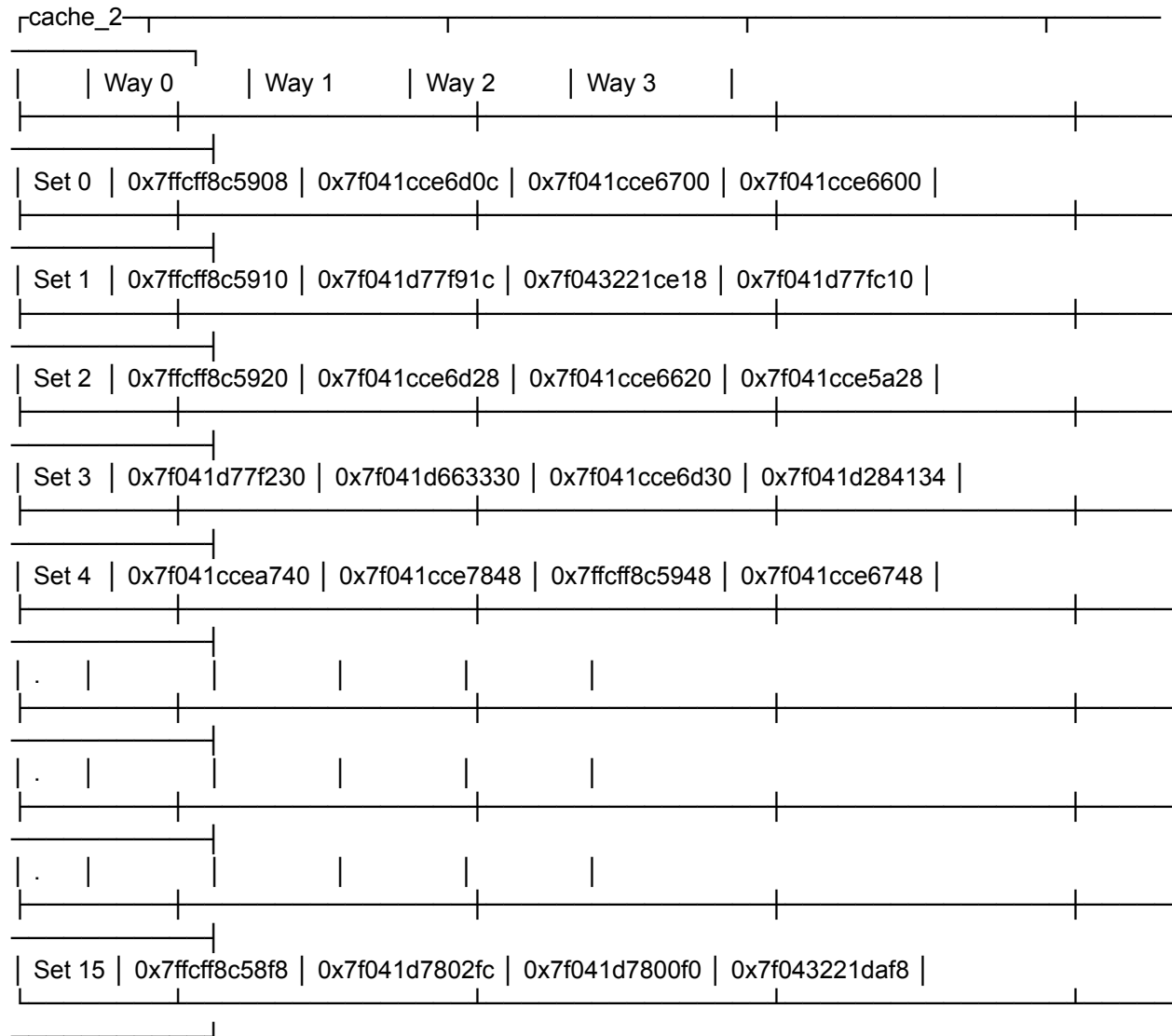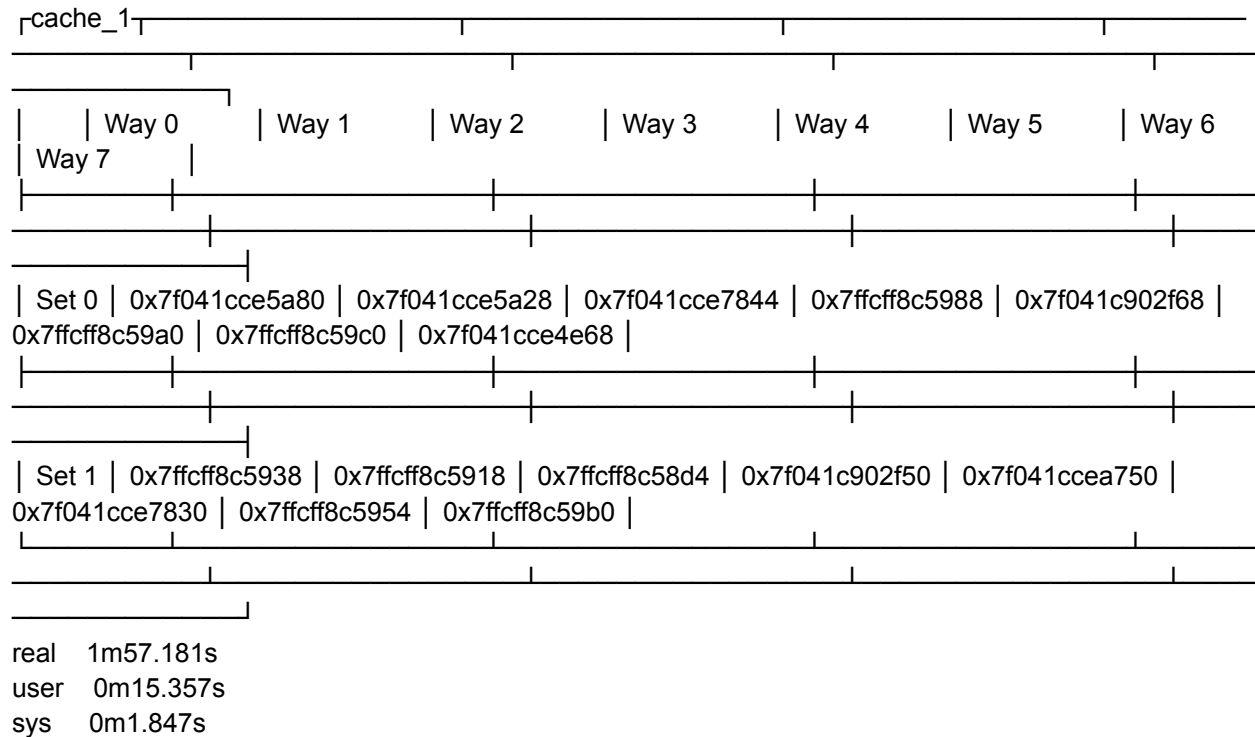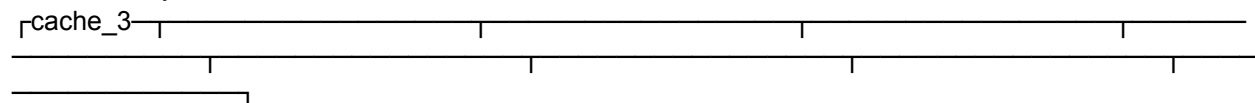┌cache_2─┬─────────────────────────────────────────────────────────────────┬──────────────┬──────────────┐
│        │                                                                   │              │              │
└────────┘  │ Way 0  │ Way 1  │ Way 2  │ Way 3  │
┌────────┐  ├────────┼────────┼────────┼────────┤
│ Set 0  │ 0x7ffcff8c5908 │ 0x7f041cce6d0c │ 0x7f041cce6700 │ 0x7f041cce6600 │
├────────┤
│ Set 1  │ 0x7ffcff8c5910 │ 0x7f041d77f91c │ 0x7f043221ce18 │ 0x7f041d77fc10 │
├────────┤
│ Set 2  │ 0x7ffcff8c5920 │ 0x7f041cce6d28 │ 0x7f041cce6620 │ 0x7f041cce5a28 │
├────────┤
│ Set 3  │ 0x7f041d77f230 │ 0x7f041d663330 │ 0x7f041cce6d30 │ 0x7f041d284134 │
├────────┤
│ Set 4  │ 0x7f041ccea740 │ 0x7f041cce7848 │ 0x7ffcff8c5948 │ 0x7f041cce6748 │
├────────┤
│ .      │        │        │        │        │
├────────┤
│ .      │        │        │        │        │
├────────┤
│ .      │        │        │        │        │
├────────┤
│ Set 15 │ 0x7ffcff8c58f8 │ 0x7f041d7802fc │ 0x7f041d7800f0 │ 0x7f043221daf8 │
└────────┘
```

```
┌cache_1┐
│       ┬            ┬            ┬            ┬            ┬
├───────┤
┌───────┐
│   │ Way 0   │ Way 1   │ Way 2   │ Way 3   │ Way 4   │ Way 5   │ Way 6
│ Way 7   │
├───────┼────────────┬────────────┬────────────┬────────────┬
├───────┤
│ Set 0 │ 0x7f041cce5a80 │ 0x7f041cce5a28 │ 0x7f041cce7844 │ 0x7ffcff8c5988 │ 0x7f041c902f68 │
0x7ffcff8c59a0 │ 0x7ffcff8c59c0 │ 0x7f041cce4e68 │
├───────┼────────────┬────────────┬────────────┬────────────┬
├───────┤
│ Set 1 │ 0x7ffcff8c5938 │ 0x7ffcff8c5918 │ 0x7ffcff8c58d4 │ 0x7f041c902f50 │ 0x7f041ccea750 │
0x7f041cce7830 │ 0x7ffcff8c5954 │ 0x7ffcff8c59b0 │
├───────┼────────────┬────────────┬────────────┬────────────┬
├───────┤
```

real   1m57.181s
user   0m15.357s
sys   0m1.847s

Using 3 Cache :

Number of instructions: 262352
Total cycles taken: 15008504
cache_3
        Number of accesses: 15863
        Number of hits: 9114
        Number of misses: 6749
cache_2
        Number of accesses: 57681
        Number of hits: 40345
        Number of misses: 17336
cache_1
        Number of accesses: 262352
        Number of hits: 197694
        Number of misses: 64658
AMATs:
{'cache_1': 43.86481338284825,
 'cache_2': 173.92541558070158,
 'cache_3': 525.4554623967724,
 'mem': 1000}

```
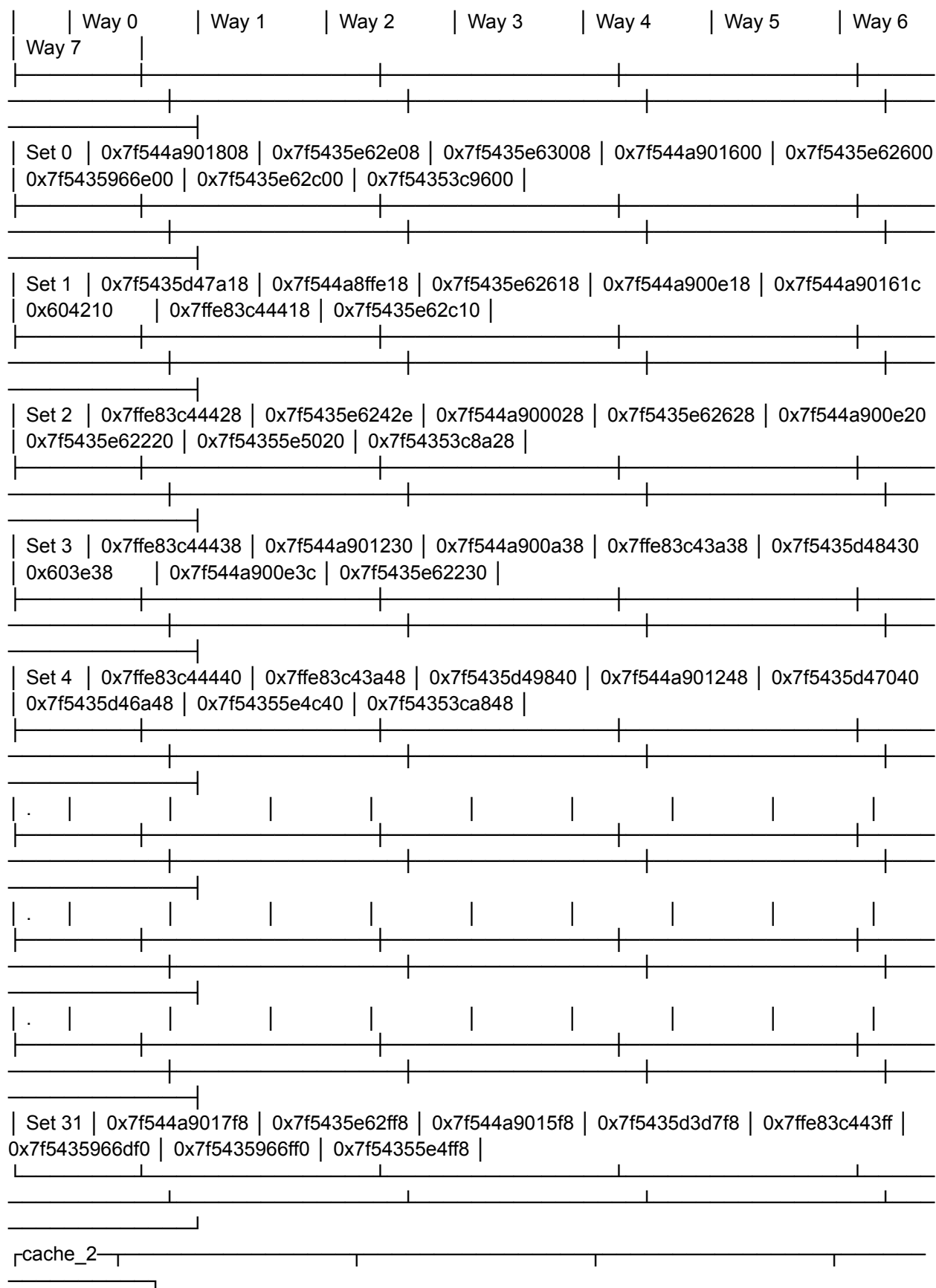┌cache_3┐
│       ┬            ┬            ┬            ┬
├───────┤           ┬            ┬            ┬
┌───────┐
```

| | Way 0 | Way 1 | Way 2 | Way 3 | Way 4 | Way 5 | Way 6 |
| Way 7 |

| Set 0 | 0x7f544a901808 | 0x7f5435e62e08 | 0x7f5435e63008 | 0x7f544a901600 | 0x7f5435e62600 | 0x7f5435966e00 | 0x7f5435e62c00 | 0x7f54353c9600 |

| Set 1 | 0x7f5435d47a18 | 0x7f544a8ffe18 | 0x7f5435e62618 | 0x7f544a900e18 | 0x7f544a90161c | 0x604210 | 0x7ffe83c44418 | 0x7f5435e62c10 |

| Set 2 | 0x7ffe83c44428 | 0x7f5435e6242e | 0x7f544a900028 | 0x7f5435e62628 | 0x7f544a900e20 | 0x7f5435e62220 | 0x7f54355e5020 | 0x7f54353c8a28 |

| Set 3 | 0x7ffe83c44438 | 0x7f544a901230 | 0x7f544a900a38 | 0x7ffe83c43a38 | 0x7f5435d48430 | 0x603e38 | 0x7f544a900e3c | 0x7f5435e62230 |

| Set 4 | 0x7ffe83c44440 | 0x7ffe83c43a48 | 0x7f5435d49840 | 0x7f544a901248 | 0x7f5435d47040 | 0x7f5435d46a48 | 0x7f54355e4c40 | 0x7f54353ca848 |

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| . | | | | | | | |

| Set 31 | 0x7f544a9017f8 | 0x7f5435e62ff8 | 0x7f544a9015f8 | 0x7f5435d3d7f8 | 0x7ffe83c443ff | 0x7f5435966df0 | 0x7f5435966ff0 | 0x7f54355e4ff8 |

cache_2

| | Way 0 | Way 1 | Way 2 | Way 3 |

| Set 0 | 0x7ffe83c44400 | 0x7f54353c9700 | 0x7f54353c9d0c | 0x7f54353c9600 |

| Set 1 | 0x7ffe83c44418 | 0x7f5435e6291c | 0x7f544a8ffe18 | 0x7f5435e62c10 |

| Set 2 | 0x7f54353c9d28 | 0x7ffe83c44428 | 0x7f54353c9620 | 0x7f54353c8a28 |

| Set 3 | 0x7ffe83c44438 | 0x7f5435d46330 | 0x7f54353c9d30 | 0x7f5435967134 |

| Set 4 | 0x7ffe83c44448 | 0x7f54353cd740 | 0x7f54353ca848 | 0x7f54353c9748 |

| . |

| . |

| . |

| Set 15 | 0x7f5435e632fc | 0x7f5435e630f0 | 0x7f544a900af8 | 0x7ffe83c444fc |

cache_1

| | Way 0 | Way 1 |

| Set 0 | 0x7f54353c9600 | 0x7f54353c8a80 |

| Set 1 | 0x7ffe83c44498 | 0x7f54353c9d90 |

| Set 2 | 0x7f54353c8a28 | 0x7ffe83c444a8 |

| Set 3 | 0x7f54353ca830 | 0x7ffe83c444b8 |

| Set 4 | 0x7f54353ca844 | 0x7ffe83c444c0 |

| Set 5 | 0x7f54353cd750 | 0x7ffe83c444d0 |

| Set 6 | 0x7ffe83c444e0 | 0x7f54353c7e68 |

| Set 7 | 0x7ffe83c443f4 | 0x7ffe83c44474 |

```
real    3m30.723s
user    0m26.742s
sys     0m3.196s
```