

# Visualization of Data Movements and Accesses

Til Mohr

# Sum of Matrix Elements

Listing 1: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

# Sum of Matrix Elements

Listing 2: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Matrix in Memory:

1	2	3	4
---	---	---	---

# Sum of Matrix Elements

Listing 3: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

0	0
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

--	--

Number of cache misses: 0

# Sum of Matrix Elements

Listing 4: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

0	0
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

1	2
---	---

Number of cache misses: 1

# Sum of Matrix Elements

Listing 5: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

1	0
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

1	2
---	---

Number of cache misses: 1

# Sum of Matrix Elements

Listing 6: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

1	0
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

3	4
---	---

Number of cache misses: **2**

# Sum of Matrix Elements

Listing 7: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Matrix in Memory:

1	2	3	4
---	---	---	---

Current Item:

0	1
---	---

Cache:

3	4
---	---

Number of cache misses: **2**



# Sum of Matrix Elements

Listing 8: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

0	1
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

1	2
---	---

Number of cache misses: 3

# Sum of Matrix Elements

Listing 9: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

1	1
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

1	2
---	---

Number of cache misses: **3**

# Sum of Matrix Elements

Listing 10: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for column in 0..2 {
4     for row in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

1	1
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

3	4
---	---

Number of cache misses: 4

# Sum of Matrix Elements - Reordered Loops

Listing 11: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for row in 0..2 {
4     for column in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

0	0
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

--	--

Number of cache misses: 0

# Sum of Matrix Elements - Reordered Loops

Listing 12: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for row in 0..2 {
4     for column in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

0	0
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

1	2
---	---

Number of cache misses: 1

# Sum of Matrix Elements - Reordered Loops

Listing 13: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for row in 0..2 {
4     for column in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

0	1
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

1	2
---	---

Number of cache misses: 1

# Sum of Matrix Elements - Reordered Loops

Listing 14: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for row in 0..2 {
4     for column in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

1	0
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

--	--

Number of cache misses: 1

# Sum of Matrix Elements - Reordered Loops

Listing 15: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for row in 0..2 {
4     for column in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

1	0
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

3	4
---	---

Number of cache misses: **2**



# Sum of Matrix Elements - Reordered Loops

Listing 16: Matrix Summation

```
1 let matrix = Matrix::random(2, 2);
2 let mut sum = 0;
3 for row in 0..2 {
4     for column in 0..2 {
5         sum += matrix.get(row, column);
6     }
7 }
8 sum
```

Matrix:

	0	1
0	1	2
1	3	4

Current Item:

1	1
---	---

Matrix in Memory:

1	2	3	4
---	---	---	---

Cache:

3	4
---	---

Number of cache misses: **2**

