CODE OPTIMIZATION THROUGH STATIC ANALYSIS

COURSE: CS 4TB3

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WHY OPTIMIZE CODE?

- Reduce code run-time
- Reduce processor utilization
- Improve portability of software across multiple systems.

AREAS OF OPTIMIZATION

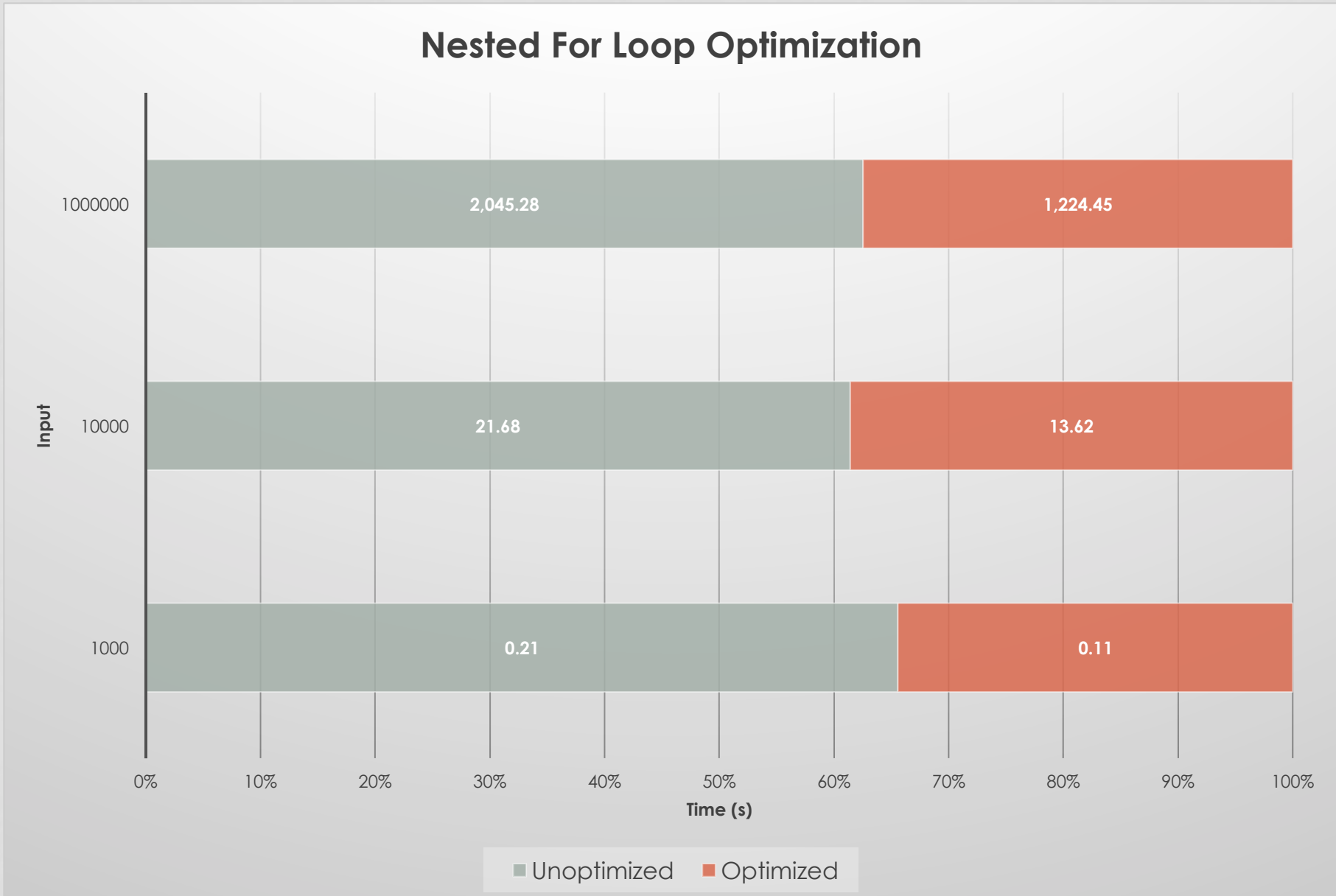
- Nested for-loop optimization
- If-else and removal of the else clause
- Finite differences to avoid multiplication
- Loop overhead optimization

NESTED FOR-LOOP OPTIMIZATION

Un - Optimized	Optimized

For (int i = 1; i <= N; i++)
{
  for (int j = 1; j <= N; j++) {
  System.out.print(i*j);
  }
}
	For(int i=1; i<=N*N; i++)
	{
	  System.out.print(i);
	}

Run Time Analysis	
Un-optimized	**Optimized**
N = 1000 | Time = 0.20798492431640625	N = 1000 | Time = 0.10916376113891602
N = 10,000 | Time = 21.67640471458435	N = 10,000 | Time = 13.620356321334839
N = 100,000 | Time = 2045.2782616619541	N = 100,000 | Time = 1224.4540052413043

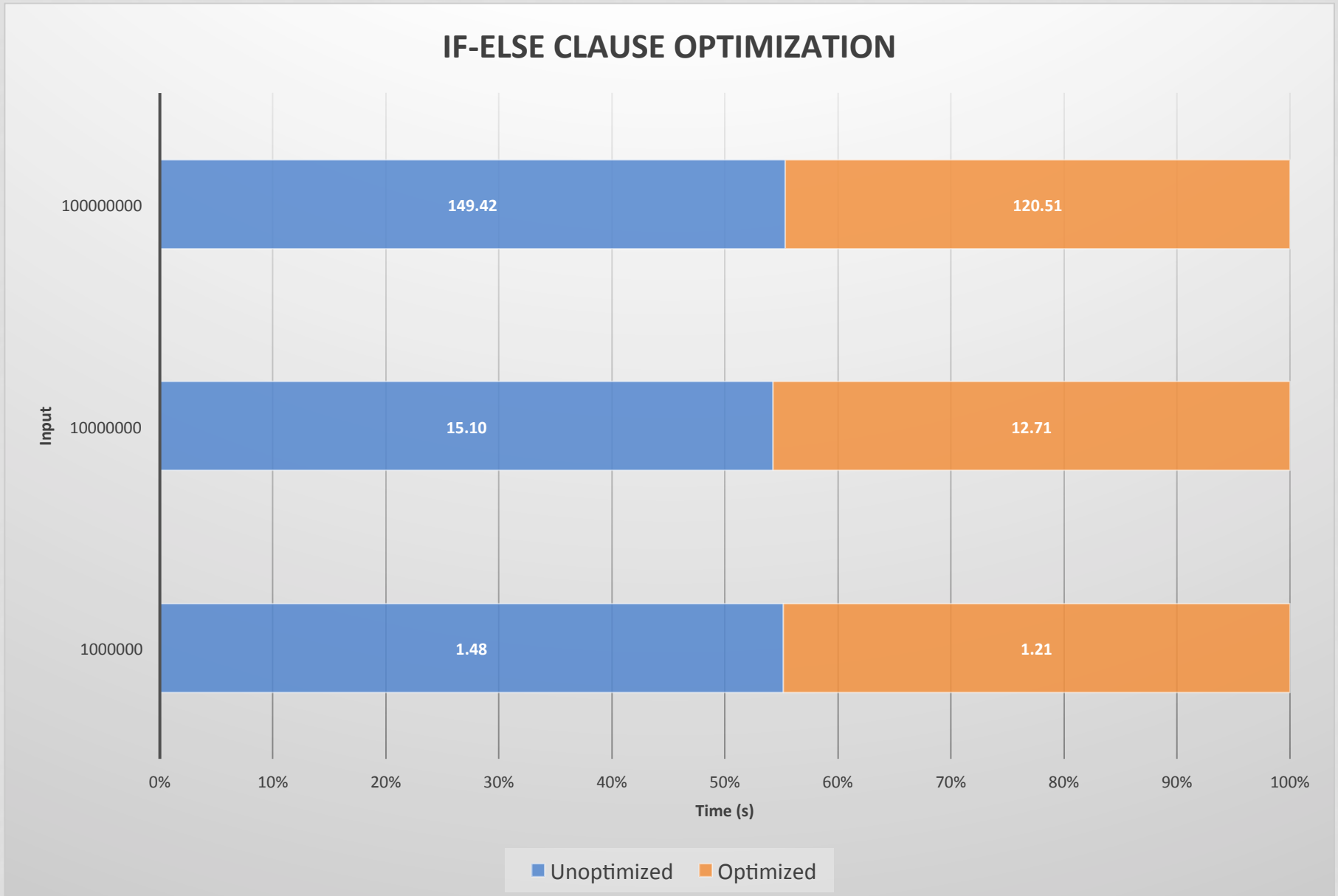

Nested For Loop Optimization
Input
1000000
10000
1000
2,045.28
1,224.45
21.68
13.62
0.21
0.11
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Time (s)
Unoptimized
Optimized

IF-ELSE CLAUSE OPTIMIZATION

Un - Optimized	Optimized

If (x >5) {
  y = True;
} else {
  y = False;
}
	Y = false;
	
	If (x >5) {
	  y = True;
	}

Run Time Analysis (N = # of iterations)	
Un-optimized	**Optimized**
N = 1000000 | Time = 1.4830670356750488	N = 1000000 | Time = 1.2050196647644043
N = 10000000 | Time = 15.099145889282227	N = 10000000 | Time = 12.713328838348389
N = 100000000 | Time = 149.41616511344967	N = 100000000 | Time = 120.51267957687537

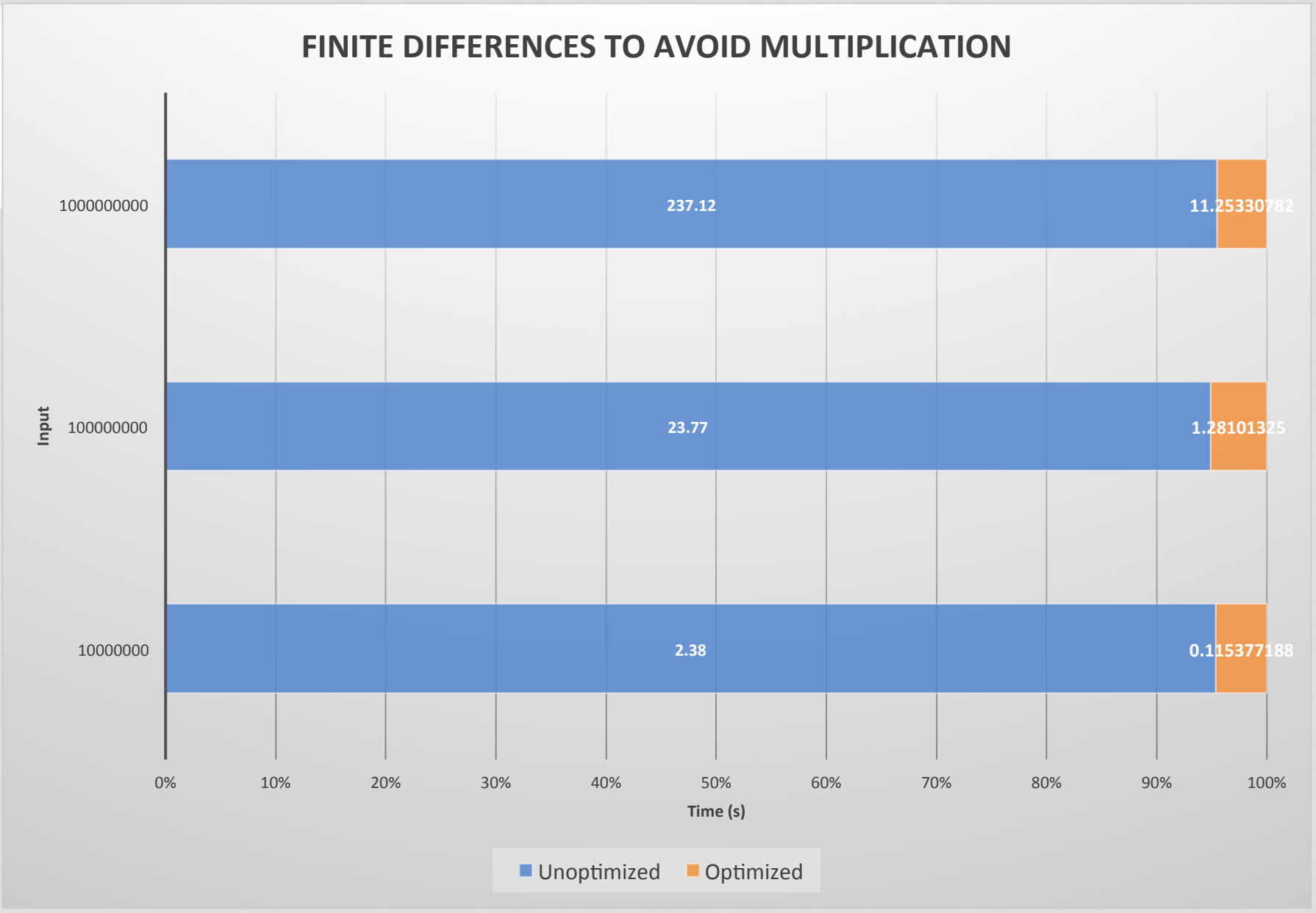

IF-ELSE CLAUSE OPTIMIZATION
Input
100000000
10000000
1000000
149.42
120.51
15.10
12.71
1.48
1.21
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Time (s)
Unoptimized
Optimized

FINITE DIFFERENCES TO AVOID MULTIPLICATION

Un - Optimized	Optimized

for(i=0;i<10;i++){
System.out.println(i*10);
}
	for(i=0;i<100;i+=10){
	System.out.println(i);
	}

Run Time Analysis	
Un-optimized	**Optimized**
N = 10000000 | Time = 2.3757030963897705	N = 10000000 | Time = 0.11537718772888184
N = 100000000 | Time = 23.768911361694336	N = 100000000 | Time = 1.2810132503509521
N = 1000000000| Time = 237.12478756904601	N = 1000000000| Time = 11.253307819366455

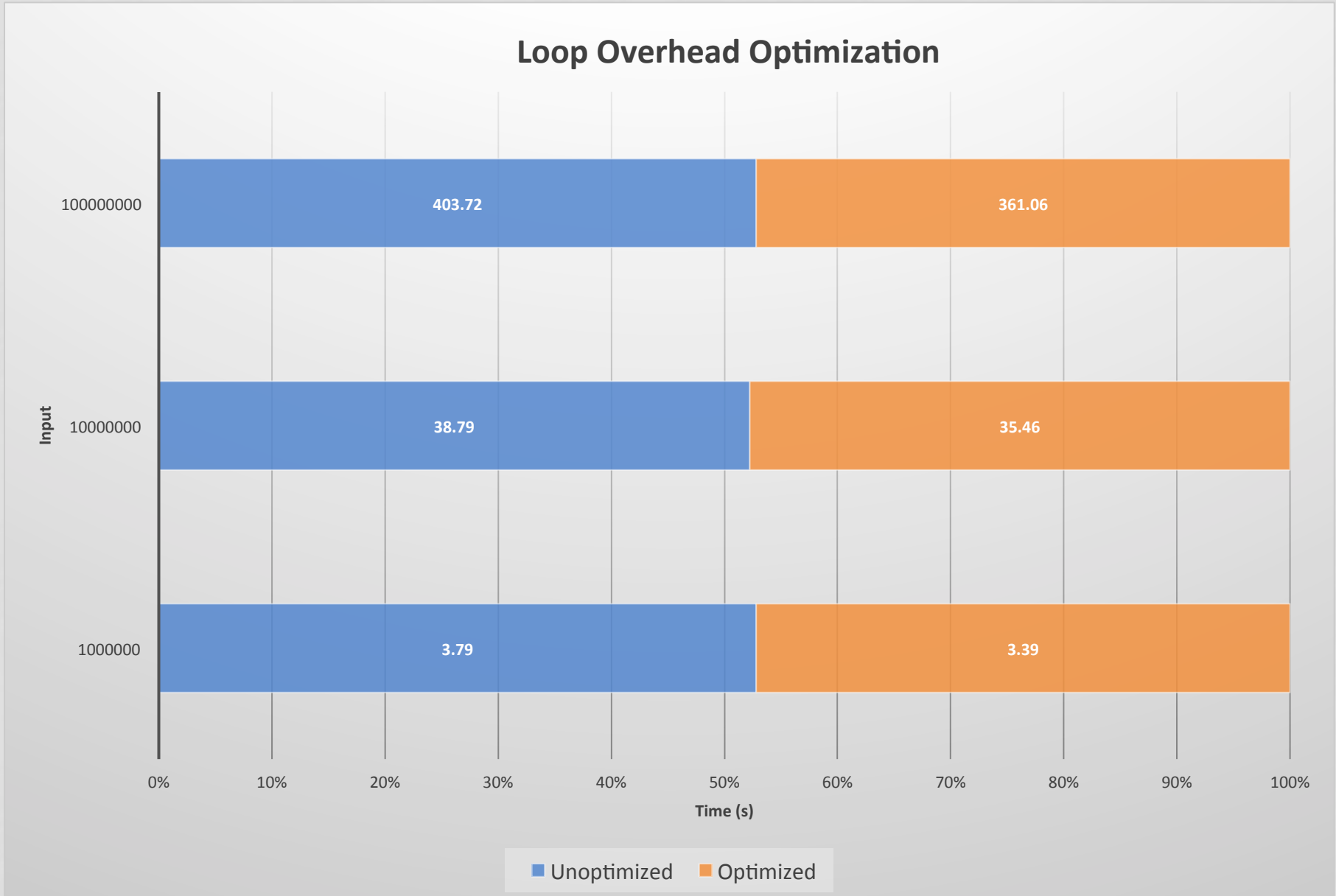

FINITE DIFFERENCES TO AVOID MULTIPLICATION
1000000000
100000000
10000000
Input
237.12
11.25330782
23.77
1.28101325
2.38
0.115377188
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Time (s)
Unoptimized
Optimized

LOOP OVERHEAD OPTIMIZATION

Un - Optimized	Optimized

For(i=0;i<100;i++){
System.out.print(i);
}
	i=99;
	do{
	System.out.print(i);
	i--;
	} while(i >= 0);

Run Time Analysis	
Un-optimized	**Optimized**
N = 10000000 | Time = 3.79261517524719	N = 10000000 | Time = 3.38699173927307
N = 100000000 | Time = 38.7858934402465	N = 100000000 | Time = 35.4579067230224
N = 1000000000| Time = 403.723316192626	N = 1000000000| Time = 361.055302619934


Loop Overhead Optimization
100000000
10000000
1000000
Input
403.72
361.06
38.79
35.46
3.79
3.39
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Time (s)
Unoptimized
Optimized

LIVE DEMO