Direct sort

Computation time:

Number of cores	Time (seconds) - for one processor
1	0.291636
2	0.164410
4	0.095916
8	0.054761

Communication time:

Number of cores	Time (seconds) - for one processor
1	0.001807
2	0.003126
4	0.010554
8	0.055909

Execution time:

Number of cores	Time (seconds) - for one processor
1	0.293443
2	0.167536
4	0.106470
8	0.105186

Total time:

Number of cores	Time (seconds)
1	0.295189
2	0.208235
4	0.135371
8	0.106490

In depth:

Microsoft Windows [Version 10.0.19042.928]
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C:\Users\Ionut\source\repos\DirectSort\Debug>mpiexec -n 1 DirectSort
Processor number 0:
-computation time: 0.291636
-communication = 0.001807
-total execution = 0.293443
All processing took 0.295189

C:\Users\Ionut\source\repos\DirectSort\Debug>mpiexec -n 2 DirectSort
Processor number 0:
-computation time: 0.164410
-communication = 0.003126
-total execution = 0.167536
All processing took 0.168311
Processor number 1:
-computation time: 0.152946
-communication = 0.054278
-total execution = 0.207224
All processing took 0.208235

C:\Users\Ionut\source\repos\DirectSort\Debug>mpiexec -n 4 DirectSort
Processor number 1:
-computation time: 0.080650
-communication = 0.052127
-total execution = 0.132777
All processing took 0.133792
Processor number 0:
-computation time: 0.095916
-communication = 0.010554
-total execution = 0.106470
All processing took 0.106903
Processor number 3:

-computation time: 0.073779
-communication = 0.057211
-total execution = 0.130990
All processing took 0.132020
Processor number 2:
-computation time: 0.076642
-communication = 0.057587
-total execution = 0.134228
All processing took 0.135371

C:\Users\Ionut\source\repos\DirectSort\Debug>mpiexec -n 8 DirectSort
Processor number 3:
-computation time: 0.049827
-communication = 0.054914
-total execution = 0.104741
All processing took 0.105582
Processor number 7:
-computation time: 0.050118
-communication = 0.056658
-total execution = 0.106776
All processing took 0.107848
Processor number 6:
-computation time: 0.049695
-communication = 0.063496
-total execution = 0.113191
All processing took 0.114166
Processor number 1:
-computation time: 0.050660
-communication = 0.054526
-total execution = 0.105186
All processing took 0.106217
Processor number 2:
-computation time: 0.049890
-communication = 0.055909
-total execution = 0.105799
All processing took 0.106862
Processor number 5:
-computation time: 0.049717
-communication = 0.063237
-total execution = 0.112954
All processing took 0.113897
Processor number 4:
-computation time: 0.056973
-communication = 0.055926
-total execution = 0.112899
All processing took 0.113225
Processor number 0:
-computation time: 0.094168

-communication = 0.012059
-total execution = 0.106226
All processing took 0.106490

Bucket sort

Computation time:

Number of cores	Time (seconds) - for one processor
1	0.580475
2	0.288115
4	0.143644
8	0.099302

Communication time:

Number of cores	Time (seconds) - for one processor
1	0.000915
2	0.002768
4	0.018190
8	0.025227

Execution time:

Number of cores	Time (seconds) - for one processor
1	0.581390
2	0.290883
4	0.215679
8	0.124529

Total time:

Number of cores	Time (seconds)
1	0.584648
2	0.295313
4	0.222356
8	0.181157

In depth:

Microsoft Windows [Version 10.0.19042.928]
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C:\Users\Ionut\source\repos\BucketSort\Debug>mpiexec -n 1 BucketSort
Processor number 0:
-computation time: 0.580475
-communication = 0.000915
-total execution = 0.581390
All processing took 0.584648

C:\Users\Ionut\source\repos\BucketSort\Debug>mpiexec -n 2 BucketSort
Processor number 1:
-computation time: 0.282281
-communication = 0.059904
-total execution = 0.342185
All processing took 0.346468
Processor number 0:
-computation time: 0.288115
-communication = 0.002768
-total execution = 0.290883
All processing took 0.295313

C:\Users\Ionut\source\repos\BucketSort\Debug>mpiexec -n 4 BucketSort
Processor number 2:
-computation time: 0.153588
-communication = 0.061569
-total execution = 0.215158
All processing took 0.222097

```
Processor number 0:
-computation time: 0.143644
-communication = 0.018190
-total execution = 0.161835
All processing took 0.166346
Processor number 1:
-computation time: 0.158327
-communication = 0.056457
-total execution = 0.214784
All processing took 0.221800
Processor number 3:
-computation time: 0.153541
-communication = 0.062138
-total execution = 0.215679
All processing took 0.222356

C:\Users\Ionut\source\repos\BucketSort\Debug>mpiexec -n 8 BucketSort
Processor number 5:
-computation time: 0.104123
-communication = 0.070674
-total execution = 0.174797
All processing took 0.183207
Processor number 2:
-computation time: 0.104729
-communication = 0.069004
-total execution = 0.173732
All processing took 0.181896
Processor number 4:
-computation time: 0.111199
-communication = 0.063482
-total execution = 0.174681
All processing took 0.182282
Processor number 0:
-computation time: 0.099302
-communication = 0.025227
-total execution = 0.124529
All processing took 0.126361
Processor number 6:
-computation time: 0.101232
-communication = 0.070887
-total execution = 0.172119
All processing took 0.174110
Processor number 7:
-computation time: 0.096963
-communication = 0.077576
-total execution = 0.174539
All processing took 0.182070
Processor number 3:
```

-computation time: 0.101193
-communication = 0.072523
-total execution = 0.173716
All processing took 0.181983
Processor number 1:
-computation time: 0.103740
-communication = 0.069293
-total execution = 0.173034
All processing took 0.181157

Odd even

Computation time:

Number of cores	Time (seconds) - for a random processor from the existing ones
1	0.583181
2	0.297562
4	0.190931
8	0.162883

Communication time:

Number of cores	Time (seconds) - for a random processor from the existing ones
1	0.001779
2	0.002819
4	0.003553
8	0.051904

Execution time:

Number of cores	Time (seconds) - for a random processor from the existing ones
1	0.584960
2	0.300381
4	0.194484
8	0.166596

Total time :

Number of cores	Time (seconds)
1	0.586847
2	0.301198
4	0.245093
8	0.166881

In depth:

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C:\Users\Ionut\source\repos\OddEven\Debug>mpiexec -n 1 OddEven
Processor number 0:
-computation time: 0.583181
-communication = 0.001779
-total execution = 0.584960
All processing took 0.586847

C:\Users\Ionut\source\repos\OddEven\Debug>mpiexec -n 2 OddEven
Processor number 1:
-computation time: 0.297584
-communication = 0.054404
-total execution = 0.351988
All processing took 0.352822
Processor number 0:
-computation time: 0.297562
-communication = 0.002819
-total execution = 0.300381
All processing took 0.301198

```
C:\Users\Ionut\source\repos\OddEven\Debug>mpiexec -n 4 OddEven
Processor number 1:
-computation time: 0.191139
-communication = 0.051883
-total execution = 0.243022
All processing took 0.244155
Processor number 3:
-computation time: 0.190005
-communication = 0.052974
-total execution = 0.242979
All processing took 0.243910
Processor number 0:
-computation time: 0.190931
-communication = 0.003553
-total execution = 0.194484
All processing took 0.194875
Processor number 2:
-computation time: 0.189909
-communication = 0.053886
-total execution = 0.243796
All processing took 0.245093

C:\Users\Ionut\source\repos\OddEven\Debug>mpiexec -n 8 OddEven
Processor number 3:
-computation time: 0.162363
-communication = 0.053993
-total execution = 0.216356
All processing took 0.217873
Processor number 2:
-computation time: 0.162274
-communication = 0.053862
-total execution = 0.216136
All processing took 0.217124
Processor number 6:
-computation time: 0.161062
-communication = 0.054505
-total execution = 0.215567
All processing took 0.215954
Processor number 7:
-computation time: 0.161103
-communication = 0.054374
-total execution = 0.215477
All processing took 0.216743
Processor number 5:
-computation time: 0.162095
-communication = 0.054278
-total execution = 0.216373
```

All processing took 0.218031
Processor number 1:
-computation time: 0.163343
-communication = 0.051904
-total execution = 0.215247
All processing took 0.216199
Processor number 4:
-computation time: 0.161718
-communication = 0.054515
-total execution = 0.216233
All processing took 0.216620
Processor number 0:
-computation time: 0.162883
-communication = 0.003714
-total execution = 0.166596
All processing took 0.166881

Shell sort

Computation time:

Number of cores	Time (seconds) - for a random processor from the existing ones
1	0.209245
2	0.097350
4	0.056098
8	0.039993

Communication time:

Number of cores	Time (seconds) - for a random processor from the existing ones
1	0.000000
2	0.001811
4	0.002343
8	0.002942

Execution time:

Number of cores	Time (seconds) - for a random processor from the existing ones
1	0.209245
2	0.099161
4	0.058441
8	0.042930

Total time:

Number of cores	Time (seconds)
1	0.261308
2	0.152081
4	0.112357
8	0.094956

In depth:

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C:\Users\Ionut\source\repos\ShellSort\Debug>mpiexec -n 1 ShellSort
Processor number 0:
-computation time: 0.209245
-communication = 0.000000
-total execution = 0.209245
All processing took 0.261308

C:\Users\Ionut\source\repos\ShellSort\Debug>mpiexec -n 2 ShellSort
Processor number 0:
-computation time: 0.097350
-communication = 0.001811
-total execution = 0.099161
All processing took 0.152846
Processor number 1:
-computation time: 0.097350
-communication = 0.052769
-total execution = 0.150119
All processing took 0.152081

```
C:\Users\Ionut\source\repos\ShellSort\Debug>mpiexec -n 4 ShellSort
Processor number 2:
-computation time: 0.054902
-communication = 0.055518
-total execution = 0.110420
All processing took 0.112094
Processor number 3:
-computation time: 0.054965
-communication = 0.054695
-total execution = 0.109660
All processing took 0.111320
Processor number 1:
-computation time: 0.056114
-communication = 0.053710
-total execution = 0.109824
All processing took 0.111359
Processor number 0:
-computation time: 0.056098
-communication = 0.002343
-total execution = 0.058441
All processing took 0.112357

C:\Users\Ionut\source\repos\ShellSort\Debug>mpiexec -n 8 ShellSort
Processor number 3:
-computation time: 0.039276
-communication = 0.053145
-total execution = 0.092421
All processing took 0.093924
Processor number 5:
-computation time: 0.039178
-communication = 0.053348
-total execution = 0.092526
All processing took 0.094091
Processor number 1:
-computation time: 0.039993
-communication = 0.052351
-total execution = 0.092344
All processing took 0.093821
Processor number 7:
-computation time: 0.038520
-communication = 0.053149
-total execution = 0.091669
All processing took 0.092702
Processor number 0:
-computation time: 0.039989
-communication = 0.002942
-total execution = 0.042930
```

All processing took 0.095567
Processor number 6:
-computation time: 0.038514
-communication = 0.054743
-total execution = 0.093257
All processing took 0.094431
Processor number 2:
-computation time: 0.039273
-communication = 0.053713
-total execution = 0.092986
All processing took 0.094267
Processor number 4:
-computation time: 0.039097
-communication = 0.054623
-total execution = 0.093720
All processing took 0.094956

Bitonic sort

Computation time:

Number of cores	Time (seconds) - for a random processor from the existing ones
1	0.526122
2	0.259832
4	0.175388
8	0.105190

Communication time:

Number of cores	Time (seconds) - for a random processor from the existing ones
1	0.00000
2	0.071760
4	0.095221
8	0.120778

Total time:

Number of cores	Time (seconds)
1	0.526122
2	0.331592
4	0.270609
8	0.225968

In depth:

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C:\Users\Ionut\source\repos\BitonicSort\Debug>mpiexec -n 1 BitonicSort
Processors: 1
Processor number 0:
-computation time: 0.526122
-communication = 0.00000
-total execution = 0.526122

C:\Users\Ionut\source\repos\BitonicSort\Debug>mpiexec -n 2 BitonicSort
Processors: 2
Processor number 0:
-computation time: 0.257981
-communication = 0.172704
-total execution = 0.430685
Processor number 1:
-computation time: 0.259832
-communication = 0.170070
-total execution = 0.429902

C:\Users\Ionut\source\repos\BitonicSort\Debug>mpiexec -n 4 BitonicSort
Processor number 2:
-computation time: 0.135735
-communication = 0.095221
-total execution = 0.230956
Processors: 4
Processor number 0:
-computation time: 0.175388

-communication = 0.097311
-total execution = 0.272699
Processor number 3:
-computation time: 0.174390
-communication = 0.103211
-total execution = 0.277601
Processor number 1:
-computation time: 0.136265
-communication = 0.099221
-total execution = 0.235486

C:\Users\Ionut\source\repos\BitonicSort\Debug>mpiexec -n 8 BitonicSort
Processor number 1:
-computation time: 0.105190
-communication = 0.120778
-total execution = 0.225968
Processor number 6:
-computation time: 0.110880
-communication = 0.11424
-total execution = 0.22512
Processor number 2:
-computation time: 0.112840
-communication = 0.11379
-total execution = 0.22663
Processor number 5:
-computation time: 0.104777
-communication = 0.10233
-total execution = 0.207107
Processors: 8
Processor number 0:
-computation time: 0.106839
-communication = 0.12135
-total execution = 0.228189
Processor number 4:
-computation time: 0.104950
-communication = 0.10690
-total execution = 0.21185
Processor number 7:
-computation time: 0.110285
-communication = 0.11197
-total execution = 0.222255
Processor number 3:
-computation time: 0.108722
-communication = 0.12397
-total execution = 0.232692

Speedup:

Direct sort:

1 processor -> S = 1
2 processors -> S = 1.41
4 processors -> S = 2.18
8 processors -> S = 2.77

Bucket sort:

1 processor -> S = 1
2 processors -> S = 1.97
4 processors -> S = 2.62
8 processors -> S = 3.22

Odd even sort:

1 processor -> S = 1
2 processors -> S = 1.94
4 processors -> S = 2.39
8 processors -> S = 3.51

Shell sort:

1 processor -> S = 1
2 processors -> S = 1.71
4 processors -> S = 2.32
8 processors -> S = 2.75

Bitonic sort:

1 processor -> S = 1
2 processors -> S = 1.58
4 processors -> S = 1.94
8 processors -> S = 2.32