Result in CS machine

[ziqi1756@csa1 Assignment-1-Matrix-Multiplication]$ python3 multiprocessing_matrix_multiplication.py

matrix size: 1

brute forcing...

brute force running time: 1.430511474609375e-05

number of processors: 1

parallel matrix multiplication...

actual number of processors: 1

multiprocessing running time: 0.017744779586791992

validating the result...

True

number of processors: 2

parallel matrix multiplication...

actual number of processors: 1

multiprocessing running time: 0.004422187805175781

validating the result...

True

number of processors: 4

parallel matrix multiplication...

actual number of processors: 1

multiprocessing running time: 0.004401683807373047

validating the result...

True

number of processors: 8

parallel matrix multiplication...

actual number of processors: 1

multiprocessing running time: 0.00426030158996582

validating the result...

True

summary

matrix size: 1

run time [(1, 0.017744779586791992), (1, 0.004422187805175781), (1, 0.004401683807373047), (1, 0.00426030158996582)]

speed up: [1.0, 4.012669829631227, 4.031361715957101, 4.165146342828362]

efficiency: [1.0, 4.012669829631227, 4.031361715957101, 4.165146342828362]

matrix size: 2

brute forcing...

brute force running time: 1.811981201171875e-05

number of processors: 1

parallel matrix multiplication...
actual number of processors: 1
multiprocessing running time: 0.004459381103515625
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multiprocessing running time: 0.006894588470458984
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multiprocessing running time: 0.008828401565551758
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 4
multiprocessing running time: 0.007523298263549805
validating the result...
True

summary
matrix size: 2
run time [(1, 0.004459381103515625), (2, 0.006894588470458984), (4, 0.008828401565551758), (4, 0.007523298263549805)]
speed up: [1.0, 0.646794384120617, 0.5051176105214832, 0.5927428299794011]
efficiency: [1.0, 0.3233971920603085, 0.1262794026303708, 0.14818570749485027]

matrix size: 4
brute forcing...
brute force running time: 3.3855438232421875e-05
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multiprocessing running time: 0.0064792633056640625
validating the result...
True

number of processors: 2

parallel matrix multiplication...
actual number of processors: 2
multiprocessing running time: 0.005528926849365234
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multiprocessing running time: 0.008667230606079102
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multiprocessing running time: 0.011768817901611328
validating the result...
True

summary
matrix size: 4
run time [(1, 0.0064792633056640625), (2, 0.005528926849365234), (4, 0.008667230606079102), (8, 0.011768817901611328)]
speed up: [1.0, 1.171884432945235, 0.7475586609083157, 0.5505449536080386]
efficiency: [1.0, 0.5859422164726175, 0.18688966522707892, 0.06881811920100482]

matrix size: 8
brute forcing...
brute force running time: 0.00013494491577148438
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multiprocessing running time: 0.006957054138183594
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multiprocessing running time: 0.006610870361328125
validating the result...
True

number of processors: 4

parallel matrix multiplication...
actual number of processors: 4
multiprocessing running time: 0.008512735366821289
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multiprocessing running time: 0.011617660522460938
validating the result...
True

summary
matrix size: 8
run time [(1, 0.006957054138183594), (2, 0.006610870361328125), (4, 0.008512735366821289), (8, 0.011617660522460938)]
speed up: [1.0, 1.0523658395845354, 0.8172524856462681, 0.5988343457560334]
efficiency: [1.0, 0.5261829197922677, 0.20431312141156702, 0.07485429321950418]

matrix size: 16
brute forcing...
brute force running time: 0.0008380413055419922
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multiprocessing running time: 0.021717548370361328
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multiprocessing running time: 0.015778064727783203
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multiprocessing running time: 0.015370607376098633
validating the result...
True

number of processors: 8

parallel matrix multiplication...
actual number of processors: 8
multiprocessing running time: 0.01767134666442871
validating the result...
True

summary
matrix size: 16
run time [(1, 0.021717548370361328), (2, 0.015778064727783203), (4, 0.015370607376098633), (8, 0.01767134666442871)]
speed up: [1.0, 1.3764393000695094, 1.4129271432781647, 1.228969629919454]
efficiency: [1.0, 0.6882196500347547, 0.3532317858195412, 0.15362120373993174]

matrix size: 32
brute forcing...
brute force running time: 0.005939483642578125
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multiprocessing running time: 0.13787364959716797
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multiprocessing running time: 0.08051490783691406
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multiprocessing running time: 0.09130048751831055
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multiprocessing running time: 0.20778179168701172
validating the result...
True

summary

matrix size: 32
run time [(1, 0.13787364959716797), (2, 0.08051490783691406), (4, 0.09130048751831055), (8, 0.20778179168701172)]
speed up: [1.0, 1.7123990239973468, 1.510108580411655, 0.6635502008032128]
efficiency: [1.0, 0.8561995119986734, 0.37752714510291374, 0.0829437751004016]

matrix size: 64
brute forcing...
brute force running time: 0.04588794708251953
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multiprocessing running time: 1.0575041770935059
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multiprocessing running time: 0.6256117820739746
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multiprocessing running time: 0.641352653503418
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multiprocessing running time: 2.2767128944396973
validating the result...
True

summary
matrix size: 64
run time [(1, 1.0575041770935059), (2, 0.6256117820739746), (4, 0.641352653503418), (8, 2.2767128944396973)]
speed up: [1.0, 1.690352079987622, 1.6488653649701788, 0.46448727886427654]
efficiency: [1.0, 0.845176039993811, 0.4122163412425447, 0.05806090985803457]

matrix size: 128
brute forcing...

brute force running time: 0.374253511428833
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multiprocessing running time: 8.01627516746521
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multiprocessing running time: 4.656193733215332
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multiprocessing running time: 4.890866279602051
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multiprocessing running time: 19.20838475227356
validating the result...
True

summary
matrix size: 128
run time [(1, 8.01627516746521), (2, 4.656193733215332), (4, 4.890866279602051), (8, 19.20838475227356)]
speed up: [1.0, 1.7216369478530216, 1.639029715635051, 0.41733208027897195]
efficiency: [1.0, 0.8608184739265108, 0.40975742890876277, 0.052166510034871494]

[ziqi1756@csa1 Assignment-1-Matrix-Multiplication]$ python3 multithreading_matrix_multiplication.py
matrix size: 1
brute forcing...
brute force running time: 1.5020370483398438e-05
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.0003075599670410156
validating the result...

True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.0003829002380371094
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.00019741058349609375
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.00015497207641601562
validating the result...
True

summary
matrix size: 1
run time [(1, 0.0003075599670410156), (1, 0.0003829002380371094), (1, 0.00019741058349609375), (1, 0.00015497207641601562)]
speed up: [1.0, 0.8032378580323786, 1.5579710144927537, 1.9846153846153847]
efficiency: [1.0, 0.8032378580323786, 1.5579710144927537, 1.9846153846153847]

matrix size: 2
brute forcing...
brute force running time: 1.2636184692382812e-05
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.0001537799835205078
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multithreading running time: 0.00027108192443847656
validating the result...

True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multithreading running time: 0.00048542022705078125
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 4
multithreading running time: 0.0005099773406982422
validating the result...
True

summary
matrix size: 2
run time [(1, 0.0001537799835205078), (2, 0.00027108192443847656), (4, 0.00048542022705078125), (4, 0.0005099773406982422)]
speed up: [1.0, 0.5672823218997362, 0.31679764243614933, 0.3015427769985975]
efficiency: [1.0, 0.2836411609498681, 0.07919941060903733, 0.07538569424964937]

matrix size: 4
brute forcing...
brute force running time: 2.7418136596679688e-05
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.00022554397583007812
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multithreading running time: 0.0002799034118652344
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multithreading running time: 0.0005431175231933594
validating the result...

True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multithreading running time: 0.0010445117950439453
validating the result...
True

summary
matrix size: 4
run time [(1, 0.00022554397583007812), (2, 0.0002799034118652344), (4, 0.0005431175231933594), (8, 0.0010445117950439453)]
speed up: [1.0, 0.8057921635434412, 0.41527655838454786, 0.21593243551700525]
efficiency: [1.0, 0.4028960817717206, 0.10381913959613696, 0.026991554439625656]

matrix size: 8
brute forcing...
brute force running time: 0.00012540817260742188
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.0003917217254638672
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multithreading running time: 0.0005478858947753906
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multithreading running time: 0.0007524490356445312
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multithreading running time: 0.0011439323425292969
validating the result...

True

summary
matrix size: 8
run time [(1, 0.0003917217254638672), (2, 0.0005478858947753906), (4, 0.0007524490356445312), (8, 0.0011439323425292969)]
speed up: [1.0, 0.7149695387293299, 0.520595690747782, 0.34243434764485203]
efficiency: [1.0, 0.35748476936466494, 0.1301489226869455, 0.042804293455606504]

matrix size: 16
brute forcing...
brute force running time: 0.0008182525634765625
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.001971006393432617
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multithreading running time: 0.002070903778076172
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multithreading running time: 0.002244710922241211
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multithreading running time: 0.002809286117553711
validating the result...
True

summary
matrix size: 16
run time [(1, 0.001971006393432617), (2, 0.002070903778076172), (4, 0.002244710922241211), (8, 0.002809286117553711)]
speed up: [1.0, 0.951761455215289, 0.8780669144981412, 0.7016040057710261]
efficiency: [1.0, 0.4758807276076445, 0.2195167286245353, 0.08770050072137826]

matrix size: 32
brute forcing...
brute force running time: 0.006018400192260742
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 0.015001296997070312
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multithreading running time: 0.014823198318481445
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multithreading running time: 0.013681411743164062
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multithreading running time: 0.015772581100463867
validating the result...
True

summary
matrix size: 32
run time [(1, 0.015001296997070312), (2, 0.014823198318481445), (4, 0.013681411743164062), (8, 0.015772581100463867)]
speed up: [1.0, 1.012014861756711, 1.096472884427715, 0.9510996901216839]
efficiency: [1.0, 0.5060074308783555, 0.27411822110692874, 0.11888746126521049]

matrix size: 64
brute forcing...
brute force running time: 0.047434329986572266
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1

multithreading running time: 0.13367486000061035
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multithreading running time: 0.12688231468200684
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multithreading running time: 0.1212308406829834
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multithreading running time: 0.11884856224060059
validating the result...
True

summary
matrix size: 64
run time [(1, 0.13367486000061035), (2, 0.12688231468200684), (4, 0.1212308406829834), (8, 0.11884856224060059)]
speed up: [1.0, 1.0535342166134583, 1.1026473069684293, 1.124749491962679]
efficiency: [1.0, 0.5267671083067291, 0.2756618267421073, 0.14059368649533488]

matrix size: 128
brute forcing...
brute force running time: 0.36438798904418945
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 1.0173559188842773
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2

multithreading running time: 1.0700581073760986

validating the result...

True

number of processors: 4

parallel matrix multiplication...

actual number of processors: 4

multithreading running time: 1.070342779159546

validating the result...

True

number of processors: 8

parallel matrix multiplication...

actual number of processors: 8

multithreading running time: 1.0676295757293701

validating the result...

True

summary

matrix size: 128

run time [(1, 1.0173559188842773), (2, 1.0700581073760986), (4, 1.070342779159546), (8, 1.0676295757293701)]

speed up: [1.0, 0.9507482928931281, 0.9504954288411467, 0.9529109552714036]

efficiency: [1.0, 0.47537414644656406, 0.23762385721028667, 0.11911386940892545]

matrix size: 256

brute forcing...

brute force running time: 3.193373441696167

number of processors: 1

parallel matrix multiplication...

actual number of processors: 1

multithreading running time: 8.49372148513794

validating the result...

True

number of processors: 2

parallel matrix multiplication...

actual number of processors: 2

multithreading running time: 9.12512731552124

validating the result...

True

number of processors: 4

parallel matrix multiplication...

actual number of processors: 4

multithreading running time: 9.262306928634644
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8
multithreading running time: 8.990013122558594
validating the result...
True

summary
matrix size: 256
run time [(1, 8.49372148513794), (2, 9.12512731552124), (4, 9.262306928634644), (8, 8.990013122558594)]
speed up: [1.0, 0.9308058059300366, 0.9170200847997594, 0.9447952265858977]
efficiency: [1.0, 0.4654029029650183, 0.22925502119993985, 0.1180994033232372]

matrix size: 512
brute forcing...
brute force running time: 37.5497841835022
number of processors: 1
parallel matrix multiplication...
actual number of processors: 1
multithreading running time: 79.369961977005
validating the result...
True

number of processors: 2
parallel matrix multiplication...
actual number of processors: 2
multithreading running time: 80.47326278686523
validating the result...
True

number of processors: 4
parallel matrix multiplication...
actual number of processors: 4
multithreading running time: 83.42097020149231
validating the result...
True

number of processors: 8
parallel matrix multiplication...
actual number of processors: 8

multithreading running time: 83.41899728775024

validating the result...

True

summary

matrix size: 512

run time [(1, 79.369961977005), (2, 80.47326278686523), (4, 83.42097020149231), (8, 83.41899728775024)]

speed up: [1.0, 0.9862898461967133, 0.9514389701450051, 0.9514614722977517]

efficiency: [1.0, 0.49314492309835667, 0.23785974253625128, 0.11893268403721896]