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Program Structures & Algorithms

Fall 2021

Assignment No. 5

Task

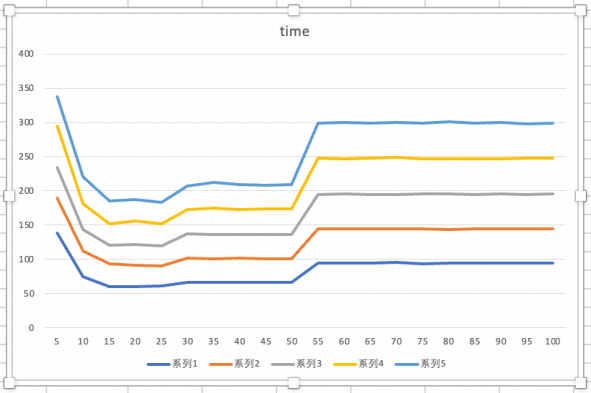
- 1.A cutoff (defaults to, say, 1000) which you will update according to the first argument in the command line when running. It's your job to experiment and come up with a good value for this cutoff. If there are fewer elements to sort than the cutoff, then you should use the system sort instead.
- 2.Recursion depth or the number of available threads. Using this determination, you might decide on an ideal number (t) of separate threads (stick to powers of 2) and arrange for that number of partitions to be parallelized (by preventing recursion after the depth of $lg\ t$ is reached).
- 3.An appropriate combination of these.

Part 1

First, I use different size array to find out the best percent of the array size to cutoff. I set the threads as 16 default and increase the size of array by 1000000 each time. As the chart shows under.

size 2000000	percent	time	size 3000000	percent	time	size 4000000	percent	time
	5	138.5		5	189.9		5	234.5
	10	75.2		10	112.2		10	144.2
	15	60.8		15	93.2		15	120.8
	20	60.1		20	91.2		20	122
	25	61		25	90.2		25	120.1
	30	66.1		30	101.9		30	137.1
	35	66.9		35	101.4		35	136.4
	40	66.4		40	101.8		40	136.6
	45	66.7		45	101.1		45	136.2
	50	66.5		50	101.4		50	136.8
	55	94.5		55	144.4		55	195.1
	60	94.6		60	144.9		60	195.6
	65	95		65	144.7		65	194.9
	70	95.3		70	144.4		70	194.8
	75	94.1		75	144.4		75	195.4
	80	94.7		80	144.1		80	195.4
	85	94.8		85	144.8		85	194.5
	90	94.5		90	144.4		90	195.5
	95	94.7		95	145.1		95	194.7
	100	94.6		100	144.7		100	195.4

size 5000000	percent	time	size 6000000	percent	time
	5	294.8		5	337.2
	10	181.7		10	220.7
	15	151.9		15	185.2
	20	156.4		20	187.3
	25	152		25	183.8
	30	173.2		30	207.7
	35	175.1		35	212.2
	40	172.7		40	208.9
	45	173.9		45	208.6
	50	174.4		50	209.2
	55	247.7		55	299.1
	60	247		60	300.2
	65	248		65	299.2
	70	248.9		70	300
	75	247		75	299.1
	80	247		80	301.1
	85	247.1		85	299.4
	90	247.3		90	300.2
	95	247.4		95	298.3
	100	247.5		100	299.2

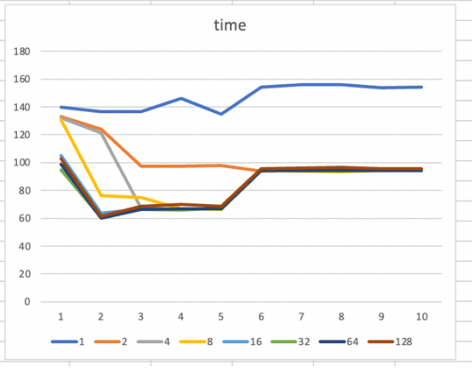


I think the 20% - 25% percent of the array size is the best cutoff.

Part2

Set the size of array as 2000000, test different threads, as the chart and the data, the 64 threads do the better work. After 16 threads, the improvement is not obvious.

size = 2000000								
Cutoff\threads	1	2	4	8	16	32	64	128
10%	139.6	132.9	132.1	130.6	104.9	94.9	98.6	102.7
20%	136.6	123.9	121.3	76.3	63.5	60.5	60	61.6
30%	136.7	97.5	67.3	75.1	66.8	66.2	66.2	68.6
40%	146	97.3	66.5	67	66.5	66.1	66.6	70
50%	134.8	97.9	66.8	66.5	67.4	67.3	66.9	68.4
60%	154	94	95.2	94.4	94.3	94.5	94.5	95.6
70%	156.1	94.3	94.5	94	94.5	94.7	94.3	96.3
80%	155.8	94	94.5	93.6	94.6	94.7	94.2	96.4
90%	153.9	94.3	94.7	94.3	94.9	94.3	94.1	95.7
100%	154	94.1	94.4	94.2	94.5	94.7	94.2	95.8



Part3

As can be seen from the above data, 20%-25% of the array size cut off and the 64 threads do the best work.