



# Parallel and Distributed Computing

## Project Report

### Sorting Tabular Rows Exhibiting OpenMP VS Sequential

Groups Members:

1. Kashif Ali 20P-0648
2. Muzamil 20P-0108
3. Amanullah 20P-0109

## ✚ Introduction:

The OpenMP API supports multi-platform shared-memory parallel programming in C/C++ and Fortran. The OpenMP API defines a portable, scalable model with a simple and flexible interface for developing parallel applications on platforms from the desktop to the supercomputer.

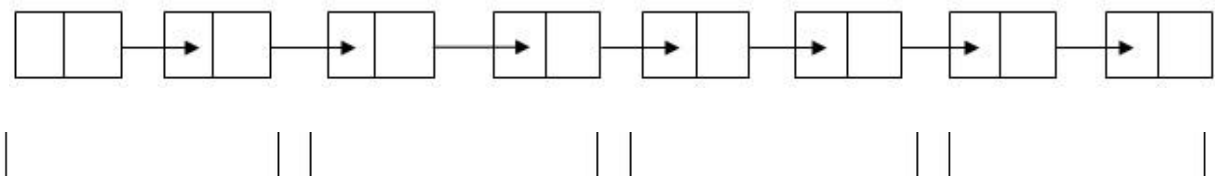
Contrary to that sequential programming runs your code line by line, in a default control structure. This approach might take more time than parallel programming as the resources are not shared in sequential programming.

In this project we will be sorting tabular data parallel through OpenMP and sequentially. Then the difference would be presented through graphical analysis on the basis of time consumption by both the methods.

The data structure used for this project is Linked List, and the sorting we used is Merge Sort. Merge Sort is well known algorithm which is based on divide and conquer approach, and so we have used Linked List as it is easy to divide data in it comparatively to other data structures and this will be helpful for input-intermediate-output data decomposition.

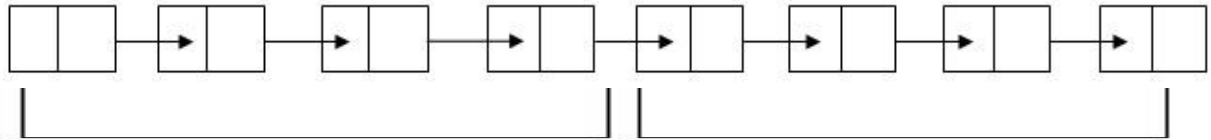
## ✚ System Diagram

No. of threads = 4

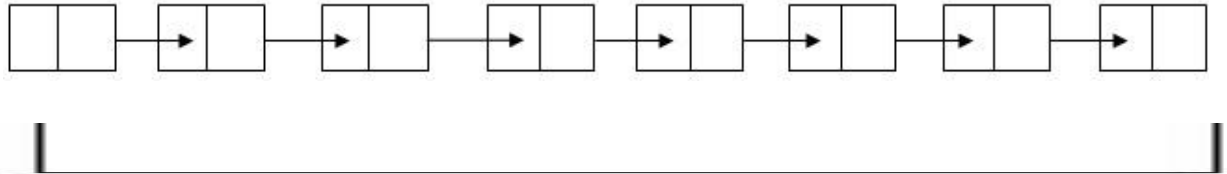


Each thread will break Linked List into equal chunk sizes, and will apply Merge Sort on its own input data. After applying the Merge Sort, Number of threads will decrease and chunk sizes will increase.

No. of threads = 2



No. of threads = 1



## Source Data Description

employee.txt - Notepad

```
File Edit Format View Help
0 snkex 18182 d
1 raxoh 6043 c
2 ftixz 16081 c
3 cxfbe 1639 b
4 xaqau 18739 b
5 ngaou 2684 c
6 csgna 694 b
7 oqgaa 3951 c
8 mxwhg 361 b
9 ykrqy 7186 b
10 xmdee 18890 c
11 pxuph 6259 b
12 pmacm 9456 b
13 lrxze 16445 d
14 nabfo 366 c
15 rxqdz 18548 b
16 uromj 4748 b
17 urnyj 10694 d
18 kaswj 18590 d
19 gjugk 8304 a
20 oecao 2058 d
21 qmoxn 10652 b
22 uffni 8314 c
23 rrasd 10918 c
24 mqnox 16106 b
25 fpsll 6447 a
26 sfgza 17879 a
27 ssxnu 4007 b
28 quty 8687 c
29 yekns 19276 a
30 jcubf 2309 b
31 qaylj 17434 d
32 grmve 18309 c
33 bpevr 2169 b
34 txkkm 16673 c
35 armxu 8819 a
```

This text file is our source data, it is a record of 500 employees. It consists of a person's id, name, salary and department.

## Parallel Region Pseudocode

```
{
    #pragma omp for schedule(dynamic)
    for (int i = 0; i < ListSize; i++)
        insert(&head, emp[i]);
}
```

In this parallel region, we are placing our input file data into Linked List parallel using “#pragma omp for”, and we are using dynamic scheduling in it.

```
#pragma omp parallel num_threads(threadsize) shared(head,choice) private(temp1,threadnum,str)
{
    Node* temp1 = NULL;
    #pragma omp for schedule(static)
    for (int i = 0; i < ListSize; i++)
    {
        #pragma omp critical
        {
            /*int threadnum = omp_get_thread_num();*/
            insert(&temp1, head->data);

            //cout << "thread id: " << threadnum << " inserted record with id: " << head->data.id << endl;
            deleteNode(&head, head);
        }
    }
}
```

In this parallel region, multiple threads are being created, the number of threads is stored in threadsize variable. There are two parameters that are shared, one is the head which is the head node of our linked list. And the second one is the choice, in which the user is selecting the option according to which input category, the data should be sorted. Lastly temp1 is a private parameter which is used for input data decomposition, as each thread will make its own Linked List.

The next block is of Input data decomposition, in this we are using “omp for” directives and in that for directive we are using “omp critical” directive as Linked Lists are dependent data structure because every next node is dependent over

the previous node's pointer, critical region stops the thread from interfering in between loop iterations and mixing up the pointers and nodes.

Lastly each thread is inserting a node into its private Linked List and deleting the node from primary Linked List.

```
if (divider == 2)
{
    #pragma omp critical
    {
        str = " and I have data : ";
        print(temp1, omp_get_thread_num(), str);
    }
}

temp1 = mergeSort(temp1, choice);

if (divider == 2)
{
    #pragma omp critical
    {
        str = " and I sorted data : ";
        print(temp1, omp_get_thread_num(), str);
    }
}
```

This block is used for printing intermediate results into local results file.

```
#pragma omp for schedule(static)
for (int i = 0; i < ListSize; i++)
{
    #pragma omp critical
    {
        append(&head, temp1->data);
        deleteNode(&temp1, temp1);
        //cout << endl; print(head); cout << endl; //Remove Bar to observe cycles :)
    }
}
```

In this block, Output data decomposition is taking place. Each thread is adding its sorted nodes into the primary Linked List and deleting it from the private temp1 Linked List.



## Snapshots of Input Data (On Each Thread)

### Local Input Data of Each Thread at 4 threads

Hi this is thread : 1	and I have data : 27	ssxnu	4007	b	Hi this is thread : 3	and I have data : 34	txkkm	16673	c
Hi this is thread : 1	and I have data : 30	jcubf	2309	b	Hi this is thread : 3	and I have data : 36	ynjfy	2354	c
Hi this is thread : 1	and I have data : 35	qrmxu	8819	a	Hi this is thread : 3	and I have data : 40	qkyjx	19617	d
Hi this is thread : 1	and I have data : 39	aiqax	1845	b	Hi this is thread : 3	and I have data : 41	svhhd	15653	a
Hi this is thread : 1	and I have data : 42	vetzu	6351	b	Hi this is thread : 3	and I have data : 43	xvpnx	6087	b
Hi this is thread : 1	and I have data : 44	ldstg	11498	b	Hi this is thread : 3	and I have data : 22	uffni	8314	c
Hi this is thread : 1	and I have data : 45	xtzco	5865	d	Hi this is thread : 3	and I have data : 54	aegy	9611	c
Hi this is thread : 1	and I have data : 47	derbb	12276	d	Hi this is thread : 3	and I have data : 55	qkehs	9764	c
Hi this is thread : 1	and I have data : 49	toyhk	3621	b	Hi this is thread : 3	and I have data : 61	yguip	3732	b
Hi this is thread : 1	and I have data : 48	fijvk	11429	d	Hi this is thread : 3	and I have data : 89	zlkuc	18828	d
Hi this is thread : 1	and I have data : 50	qthkn	853	c	Hi this is thread : 3	and I have data : 99	bolmk	9574	a
Hi this is thread : 1	and I have data : 51	pgzqb	17895	a	Hi this is thread : 3	and I have data : 100	kxzwk	3143	b
Hi this is thread : 1	and I have data : 52	zebix	11856	b	Hi this is thread : 3	and I have data : 104	scnrr	13638	b
Hi this is thread : 1	and I have data : 62	utfri	4850	b	Hi this is thread : 3	and I have data : 124	lfxzs	11224	b
Hi this is thread : 1	and I have data : 60	wsobc	14756	c	Hi this is thread : 3	and I have data : 126	xcvad	15971	a
Hi this is thread : 1	and I have data : 64	hoxwo	1374	c	Hi this is thread : 3	and I have data : 125	mnfty	12523	c
Hi this is thread : 1	and I have data : 67	uddrv	10177	d	Hi this is thread : 3	and I have data : 123	mslwo	11049	c
Hi this is thread : 1	and I have data : 70	vottr	7405	d	Hi this is thread : 3	and I have data : 130	hrfbw	11662	b
Hi this is thread : 1	and I have data : 68	qgupx	3334	c	Hi this is thread : 3	and I have data : 127	hzcff	17278	c
Hi this is thread : 1	and I have data : 72	prmr	7064	d	Hi this is thread : 3	and I have data : 131	pplhs	13340	b
Hi this is thread : 1	and I have data : 73	agemc	14100	b	Hi this is thread : 3	and I have data : 133	pzhnz	3865	d
Hi this is thread : 1	and I have data : 75	hrecs	7433	a	Hi this is thread : 3	and I have data : 136	jzunu	452	c
Hi this is thread : 1	and I have data : 77	snepg	8234	c	Hi this is thread : 3	and I have data : 137	mrjgk	12138	c
Hi this is thread : 1	and I have data : 87	mvtrd	2270	c	Hi this is thread : 3	and I have data : 139	aymlk	2520	b
Hi this is thread : 1	and I have data : 90	yskui	11148	a	Hi this is thread : 3	and I have data : 138	wrhcy	12127	a
Hi this is thread : 1	and I have data : 88	baaxp	14399	a	Hi this is thread : 3	and I have data : 141	vyman	8711	c
Hi this is thread : 1	and I have data : 93	txhej	16331	b	Hi this is thread : 3	and I have data : 143	ncntk	8389	a
Hi this is thread : 1	and I have data : 92	onaf	8350	d	Hi this is thread : 3	and I have data : 144	xrnam	3250	c
Hi this is thread : 1	and I have data : 95	cvmxv	10435	a	Hi this is thread : 3	and I have data : 146	krfzh	16001	c
Hi this is thread : 1	and I have data : 98	nxuvu	1415	c	Hi this is thread : 3	and I have data : 147	junsx	13042	b
Hi this is thread : 1	and I have data : 101	kdllv	1593	b	Hi this is thread : 3	and I have data : 149	hlslu	14577	d
Hi this is thread : 1	and I have data : 103	tqtdu	19735	d	Hi this is thread : 3	and I have data : 148	tvcty	15847	a
Hi this is thread : 1	and I have data : 105	cwxmw	9049	d	Hi this is thread : 3	and I have data : 152	rjilb	3745	c
Hi this is thread : 1	and I have data : 107	dupdg	6641	b	Hi this is thread : 3	and I have data : 158	fcksq	12918	c
Hi this is thread : 1	and I have data : 111	gyvat	7413	a	Hi this is thread : 3	and I have data : 164	nzoik	4237	b
Hi this is thread : 1	and I have data : 110	vpms	11388	d	Hi this is thread : 3	and I have data : 178	twnp	7692	d
Hi this is thread : 1	and I have data : 122	uoagt	7145	a	Hi this is thread : 3	and I have data : 182	dnorc	12133	a
Hi this is thread : 1	and I have data : 155	yfpvb	10036	c	Hi this is thread : 3	and I have data : 181	lphwz	3307	d
Hi this is thread : 1	and I have data : 156	flaak	7848	a	Hi this is thread : 3	and I have data : 183	etxhm	4448	b
Hi this is thread : 1	and I have data : 157	haiel	2026	a	Hi this is thread : 3	and I have data : 185	ptpnk	722	b
Hi this is thread : 1	and I have data : 159	jqrf	13682	b	Hi this is thread : 3	and I have data : 187	stngd	5265	b
Hi this is thread : 1	and I have data : 161	evmt	7255	b	Hi this is thread : 3	and I have data : 194	yufif	18651	c
Hi this is thread : 1	and I have data : 162	opqgk	1762	a	Hi this is thread : 3	and I have data : 208	nfayy	3574	d
Hi this is thread : 1	and I have data : 163	gmhcr	17498	d	Hi this is thread : 3	and I have data : 222	ygnr	5899	a
Hi this is thread : 1	and I have data : 160	raugs	5874	a	Hi this is thread : 3	and I have data : 225	glufe	18270	a
Hi this is thread : 1	and I have data : 165	lqmsy	3255	b	Hi this is thread : 3	and I have data : 239	sjyoy	15926	b
Hi this is thread : 1	and I have data : 166	hsvrp	6396	b	Hi this is thread : 3	and I have data : 242	ofeim	12238	b
					Hi this is thread : 3	and I have data : 246	adabd	8891	a
					Hi this is thread : 3	and I have data : 251	vdget	2050	b
					Hi this is thread : 3	and I have data : 253	ggcje	2486	c



hi this is thread • ? and I have data	1'm	gjugk	8304	^	Hi this is thread	0	and I have data • 17A	bgneo	17977	b
HP this is thread 2 and I have data	21	qmoxn	18652		HP this is thread	0	and I have data ' 177	bakzx	9820	d
Hi this is thread : 2 and I have data	23	rzasd	10918		Hi this is thread	0	and I have data ' 176	xsobw	15B#1	b
Hi this is thread 2 and I have data	26	s*gza	17879	^	Hi this is thread	0	and I have data ' 179	vsehk	143#6	b
HP this is thread 2 and I have data	29	yekns	19276		Hi this is thread	0	and I have data 188	vjwfm	256	b
Hi this is thread • 2 and I have data 33		bevr	2169	'	HP this is thread	0	and I have data ' 18	zzgzm	15795	c
Hi this is thread : 2 and I have data : 37		resoc	2518		Hi this is thread	0	and I have data ' 186	aoldt	16609	b
Hi this is thread : 2 and I have data 38		cknrg	445	a	Hi this is thread	0	and I have data ' 190	ugrrq	6267	b
Hi this is thread : 2 and I have data 46		jcjoc	9976	d	Hi this is thread	0	and I have data ' 193	vicuw	447	a
Hi this is thread : 2 and I have data : 56		csagt	18367	b	HP this is thread	0	and I have data ' 197	gj(al	5g35	a
Hi this is thread : 2 and I have data 78		ys<df	15327	a	Hi this is thread	0	and I have data ' 205	ulnwl	2867	d
Hi this is thread 2 and I have data 79		lvpub	3266	d	Hi this is thread	0	and I have data ' 207	lzwxr	2078	a
Hi this is thread 2 and I have data B2		uipye	3069	b	Hi this is thread	0	and I have data ' 211	sjbyy	2877	b
Hi this is thread : 2 and I have data : 85		bsglz	1^387		HP this is thread	0	and I have data ' 21^	niqcy	11BB2	b
Hi this is thread : 2 and I have data : 86		eefzj	16783	a	Hi this is thread	0	and I have data ' 215	rrgvn	8887	
Hi this is thread : 2 and I have data 91		ajjgl	3257	-	Hi this is thread	0	and I have data ' 218	logth	5899	b
Hi this is thread 2 and I have data 9		ycvyo	5689	c	Hi this is thread	0	and I have data ' 221	edegv	9054	d
HP this is thread 2 and I have data 182		eqzve	1158B	a	Hi this is thread	0	and I have data ' 22	gf^ay	9378	d
Hi this is thread • 2 and I have data 109		avokj	17398	c	Hi this is thread	0	and I have data ' 228	lxjsj	19B77	a
HP this is thread 2 and I have data 11		^qplt	18287	a	Hi this is thread	0	and I have data ' 229	mgcwp	17676	
Hi this is thread : 2 and I have data 115		kichl	319	d	Hi this is thread	0	and I have data ' 236	ymhmc	7371	
Hi this is thread : 2 and I have data 117					Hi this is thread	0	and I have data ' 237	bhelt	188	
Hi this is thread : 2 and I have data 119		aiaxr	18987	a	Hi this is thread	0	and I have data ' 240	gcyob	12862	a
Hi this is thread : 2 and I have data 120		yvgrn	38^2	d	Hi this is thread	0	and I have data ' 2d-0	bghjs	9176	c
HP this is thread 2 and I have data 121		mzyor	19144	a	Hi this is thread	0	and I have data ' 2 S	wzucn	128#3	c
Hi this is thread : 2 and I have data 128		mhcsc	7517	b	Hi this is thread	0	and I have data ' 2*8	lcctg	12172	a
Hi this is thread • 2 and I have data 129		uvtmf	14013	a	Hi this is thread	0	and I have data ' 287	gocme	6291	b
Hi this is thread : 2 and I have data : 132		hzyxp	13195	d	Hi this is thread	0	and I have data ' 259	fi^an	2892	d
Hi this is thread : 2 and I have data 13		gzokw	10276	c	Hi this is thread	0	and I have data ' 261	uzuqn	773"	c
Hi this is thread 2 and I have data 135		aaolw	838	b	Hi this is thread	0	and I have data ' 261	lbnde	18388	c
HP th-is is thread 2 and I have data 18		galyi	6776	b		0				
				d		0				d
Hi this is thread : 2 and I have data : 145				c		0				b
				b		0				b
		trwhq	8443	b	Hi this is thread	0	and I have data			
					Hi this is thread	0	and I have data	hnzif	9000	
				b	Hi this is thread	0	and I have data			
Hi this is thread : 2 and I have data : 206				b	Hi this is thread	0	and I have data			d
				a	Hi this is thread	0	and I have data			d
				c	Hi this is thread	0	and I have data	445		
				b	Hi this is thread	0	and I have data	446	vkbod	7537
		anfsq	6321	c	Hi this is thread	0	and I have data			b
				b	Hi this is thread	0	and I have data			c
				c	Hi this is thread	0	and I have data			b
				b	Hi this is thread	0	and I have data			c
		vrvnk	3046	a	Hi this is thread	0	and I have data • 451	clvvu	1943	b
HP this is thread 2 and I have data 226		cwbqx	11249	c	Hi this is thread	0	and I have data • 452	tjxnf	9943	b
Hi this is thread • 2 and I have data 235		eycto	12978		Hi this is thread	0	and I have data • 453	hzuik	5625	d
Hi this is thread : 2 and I have data : 243		wlicl	1445		Hi this is thread	0	and I have data • 453			



# Snapshots of Output Data (On Each Thread)

## Local Output Data of Each Thread at 4 threads


Hi this is thread : 1	and I sorted data : 204	abgom	7419	a	Hi this is thread : 2	and I sorted data : 33	bpevr	2169	b
Hi this is thread : 1	and I sorted data : 73	agenc	14100	b	Hi this is thread : 2	and I sorted data : 85	bsqlz	14387	a
Hi this is thread : 1	and I sorted data : 39	aiqax	1845	b	Hi this is thread : 2	and I sorted data : 406	cixid	17580	d
Hi this is thread : 1	and I sorted data : 348	apdsh	14754	c	Hi this is thread : 2	and I sorted data : 301	ckmur	8473	a
Hi this is thread : 1	and I sorted data : 262	atlth	11891	c	Hi this is thread : 2	and I sorted data : 38	cknrg	445	a
Hi this is thread : 1	and I sorted data : 233	awqmo	1306	d	Hi this is thread : 2	and I sorted data : 199	coupd	12488	d
Hi this is thread : 1	and I sorted data : 88	baaxp	14399	a	Hi this is thread : 2	and I sorted data : 56	csagt	18367	b
Hi this is thread : 1	and I sorted data : 191	bbcb1	3287	c	Hi this is thread : 2	and I sorted data : 335	cvitv	9711	c
Hi this is thread : 1	and I sorted data : 195	bgerm	9464	c	Hi this is thread : 2	and I sorted data : 226	cwbqx	11249	a
Hi this is thread : 1	and I sorted data : 288	bofdp	9176	d	Hi this is thread : 2	and I sorted data : 275	cyhgu	8089	a
Hi this is thread : 1	and I sorted data : 346	bpjeq	16060	a	Hi this is thread : 2	and I sorted data : 268	ddjvm	5704	c
Hi this is thread : 1	and I sorted data : 232	bqjhr	15372	d	Hi this is thread : 2	and I sorted data : 206	digts	15368	b
Hi this is thread : 1	and I sorted data : 398	byvxa	9117	a	Hi this is thread : 2	and I sorted data : 393	djaty	8449	b
Hi this is thread : 1	and I sorted data : 188	cqtlc	9255	b	Hi this is thread : 2	and I sorted data : 391	dkqpk	8328	b
Hi this is thread : 1	and I sorted data : 167	csorq	5814	a	Hi this is thread : 2	and I sorted data : 210	dpzct	14057	a
Hi this is thread : 1	and I sorted data : 329	cumpx	4830	a	Hi this is thread : 2	and I sorted data : 201	dqalw	16595	a
Hi this is thread : 1	and I sorted data : 95	cvmxv	10435	a	Hi this is thread : 2	and I sorted data : 86	eeefzj	16783	b
Hi this is thread : 1	and I sorted data : 105	cwxmw	9049	d	Hi this is thread : 2	and I sorted data : 212	enzbv	4537	c
Hi this is thread : 1	and I sorted data : 400	ddxzl	2472	a	Hi this is thread : 2	and I sorted data : 380	eqdyu	10032	a
Hi this is thread : 1	and I sorted data : 47	derbb	12276	d	Hi this is thread : 2	and I sorted data : 102	eqzve	11580	a
Hi this is thread : 1	and I sorted data : 315	dmyty	7581	d	Hi this is thread : 2	and I sorted data : 357	esopv	10812	a
Hi this is thread : 1	and I sorted data : 296	dptef	941	c	Hi this is thread : 2	and I sorted data : 235	eyctp	12978	c
Hi this is thread : 1	and I sorted data : 107	dupdg	6641	b	Hi this is thread : 2	and I sorted data : 289	fmiwl	14369	b
Hi this is thread : 1	and I sorted data : 247	ecynh	1889	d	Hi this is thread : 2	and I sorted data : 114	faplt	18287	a
Hi this is thread : 1	and I sorted data : 267	eqtxv	14050	c	Hi this is thread : 2	and I sorted data : 385	frdtk	11928	d
Hi this is thread : 1	and I sorted data : 161	evmtn	7255	b	Hi this is thread : 2	and I sorted data : 436	fsibs	8378	b
Hi this is thread : 1	and I sorted data : 333	ffqbh	11960	c	Hi this is thread : 2	and I sorted data : 356	fuhty	19693	a
Hi this is thread : 1	and I sorted data : 48	fijvk	11429	d	Hi this is thread : 2	and I sorted data : 140	gaiyi	6776	b
Hi this is thread : 1	and I sorted data : 156	flaqk	7848	a	Hi this is thread : 2	and I sorted data : 19	gjugk	8304	a
Hi this is thread : 1	and I sorted data : 219	frtqz	11481	a	Hi this is thread : 2	and I sorted data : 408	gvvsi	10680	c
Hi this is thread : 1	and I sorted data : 173	ftuab	6259	d	Hi this is thread : 2	and I sorted data : 134	gzpkl	10276	d
Hi this is thread : 1	and I sorted data : 401	fviuu	8032	a	Hi this is thread : 2	and I sorted data : 316	hcikg	6419	a
Hi this is thread : 1	and I sorted data : 163	gmhcr	17498	d	Hi this is thread : 2	and I sorted data : 213	hdcvy	918	a
Hi this is thread : 1	and I sorted data : 336	gsjli	14017	c	Hi this is thread : 2	and I sorted data : 359	hdepr	4834	a
Hi this is thread : 1	and I sorted data : 293	gwydx	5881	a	Hi this is thread : 2	and I sorted data : 440	hjdeb	8647	d
Hi this is thread : 1	and I sorted data : 350	gynik	17006	c	Hi this is thread : 2	and I sorted data : 379	hrphq	2720	b
Hi this is thread : 1	and I sorted data : 111	gyvat	7413	a	Hi this is thread : 2	and I sorted data : 150	hxbkt	5140	c
Hi this is thread : 1	and I sorted data : 157	haiel	2026	a	Hi this is thread : 2	and I sorted data : 132	hzyxp	13195	d
Hi this is thread : 1	and I sorted data : 331	hgkge	5724	b	Hi this is thread : 2	and I sorted data : 209	idzrh	19216	b
Hi this is thread : 1	and I sorted data : 64	hoxvo	1374	c	Hi this is thread : 2	and I sorted data : 145	iiuyf	7906	d
Hi this is thread : 1	and I sorted data : 75	hrecs	7433	a	Hi this is thread : 2	and I sorted data : 318	ijtnl	5286	b
Hi this is thread : 1	and I sorted data : 290	hrscs	12564	d	Hi this is thread : 2	and I sorted data : 46	jcjoc	9976	d
Hi this is thread : 1	and I sorted data : 166	hsvrp	6396	b	Hi this is thread : 2	and I sorted data : 340	jpjkj	932	a
Hi this is thread : 1	and I sorted data : 227	ietwn	19119	b	Hi this is thread : 2	and I sorted data : 266	jsevj	17189	a
Hi this is thread : 1	and I sorted data : 307	ifkbj	12242	c	Hi this is thread : 2	and I sorted data : 18	kasvj	18590	d
Hi this is thread : 1	and I sorted data : 230	ieevm	12219	a	Hi this is thread : 2	and I sorted data : 115	kichl	319	d
Hi this is thread : 1	and I sorted data : 192	inaod	1569	a	Hi this is thread : 2	and I sorted data : 354	kohqa	13707	a
Hi this is thread : 1	and I sorted data : 231	iwklz	12946	b	Hi this is thread : 2	and I sorted data : 435	kwptm	17823	b
Hi this is thread : 1	and I sorted data : 196	iwkvm	8035	b	Hi this is thread : 2	and I sorted data : 345	lnwup	2177	d
Hi this is thread : 1	and I sorted data : 30	jcbuf	2309	b	Hi this is thread : 2	and I sorted data : 297	lphbd	10760	b
Hi this is thread : 1	and I sorted data : 254	iczcs	7293	d	Hi this is thread : 2	and I sorted data : 13	lrxze	16445	d



	and I sorted data	Hi this is thread : 0 and sorted data :	ddqrc	d
		Hi this is thread : 0 and sorted data :	deloq	b
	and I sorted data	Hi this is thread : 0 and sorted data :	dpqzo	b
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	dqdcc	c
and I sorted data		Hi this is thread : 0 and sorted data :	ebndz	c
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	edegv	d
		Hi this is thread : 0 and sorted data :	eovvv	d
		Hi this is thread : 0 and sorted data :	expvy	a
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	fasnv	a
and I sorted data		Hi this is thread : 0 and sorted data :	fifan	d
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	fjqle	b
		Hi this is thread : 0 and sorted data :	fvvbj	d
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	fwgu	c
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	gcypb	a
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	gipgb	c
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	gjfal	a
		Hi this is thread : 0 and sorted data :	gpswr	a
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	gqsub	b
		Hi this is thread : 0 and sorted data :	grqxb	b
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	gtonk	c
		Hi this is thread : 0 and sorted data :	gwyvi	b
and I sorted data		Hi this is thread : 0 and sorted data :	hkghn	b
		Hi this is thread : 0 and sorted data :	hnzif	a
and I sorted data		Hi this is thread : 0 and sorted data :	hseph	a
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	hvbmg	a
and I sorted data		Hi this is thread : 0 and sorted data :	hvkxr	a
Hi this is thread :and I sorted data	414	Hi this is thread : 0 and sorted data :	hzuik	d
		Hi this is thread : 0 and sorted data :	igaqb	c
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	jubmc	a
and I sorted data		Hi this is thread : 0 and sorted data :	kfkuy	7782d
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	khgtp	b
		Hi this is thread : 0 and sorted data :	kueyl	b
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	lbmde	c
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	lhdnm	d
and I sorted data		Hi this is thread : 0 and sorted data :	lnaot	d
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	logth	b
		Hi this is thread : 0 and sorted data :	lqfcb	c
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	lrctg	a
		Hi this is thread : 0 and sorted data :	lxjsj	a
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	lzwxr	a
		Hi this is thread : 0 and sorted data :	mcfbz	d
and I sorted data		Hi this is thread : 0 and sorted data :	mfwll	d
		Hi this is thread : 0 and sorted data :	ngcwp	c
and I sorted data		Hi this is thread : 0 and sorted data :	mollf	b
Hi this is thread :and I sorted data		Hi this is thread : 0 and sorted data :	mqnox	b
and I sorted data		Hi this is thread : 0 and sorted data :	mtzyw	a
		Hi this is thread : 0 and sorted data :	mugax	c
		Hi this is thread : 0 and sorted data :	mynms	a
and I sorted data		Hi this is thread : 0 and sorted data :	nduds	a
		Hi this is thread : 0 and sorted data :	nmear	b
: #26 cqvè 1161a		Hi this is thread : 0 and sorted data :	nozan	c

## Snapshots of Output Data (Final Data)

### Sorted Data with Name Category

 sorted data.txt - Notepad

File Edit Format View Help

135	aaolw	835	c
423	abfqm	17398	c
204	abqom	7419	a
246	adabd	8891	a
476	aduul	9730	d
54	aegy i	9611	c
360	aehtu	10699	b
118	afsmr	14336	c
73	agemc	14100	b
202	ahaie	17436	b
58	ahuei	6350	b
119	aiaxr	18987	c
39	aiqax	1845	b
285	aivfz	997	a
416	aivni	16023	c
91	ajjql	3257	a
338	allzi	5221	b
216	anfsq	6321	b
465	aogqi	19772	d
186	aoldt	16609	b
348	apdsh	14754	c
358	aqsgp	7675	c
262	atlth	11891	c
109	avokj	17398	c
464	awlxx	12613	c
233	awqmo	1306	d
139	aymlk	2520	b
88	baaxp	14399	a
323	baewd	13717	b
295	baksd	9643	b
177	bakzx	9020	d
191	bbcbl	3287	c
195	bgerm	9464	c
174	bgneo	17977	b
236	bhelt	188	c
83	hinhm	1689	h

## Comparison Graph

