MONASH University

ASSIGNMENT 1

Algorithms and Data Structures

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FIT2004
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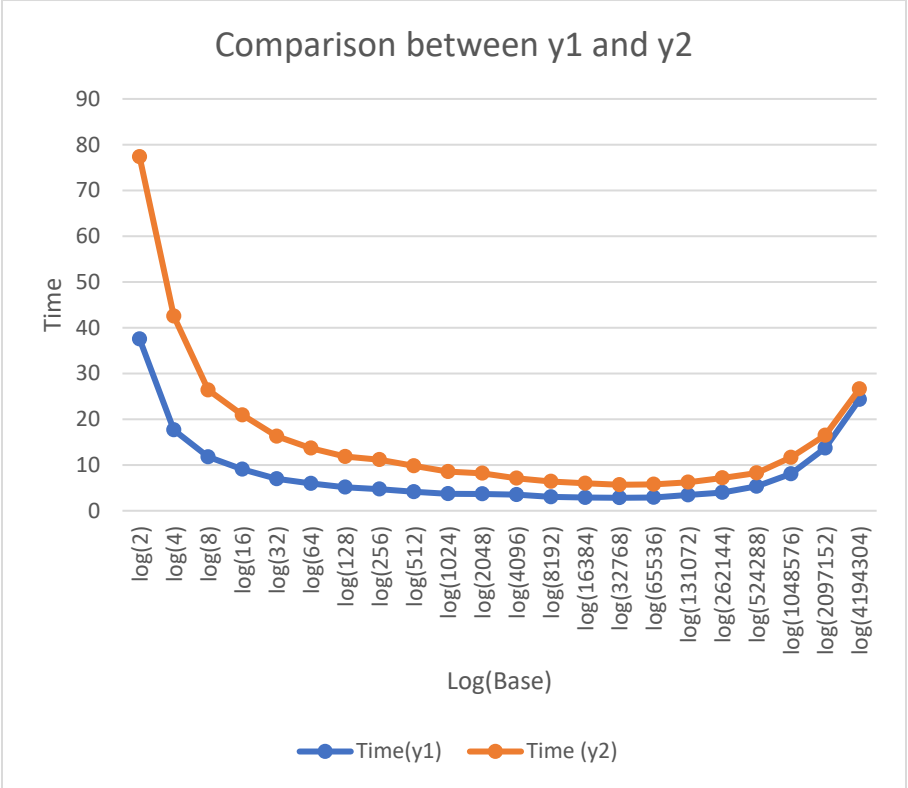
Base1	Time(y1)	Time (y2)
log(2)	37.5257664	77.33926
log(4)	17.6544204	42.51335
log(8)	11.7617509	26.38961
log(16)	9.06538725	20.93197
log(32)	6.98537397	16.27453
log(64)	5.9611609	13.66847
log(128)	5.14704967	11.84035
log(256)	4.72731328	11.16113
log(512)	4.13998365	9.811771
log(1024)	3.71002603	8.549147
log(2048)	3.67416	8.179137
log(4096)	3.52158689	7.106082
log(8192)	3.01896691	6.395825
log(16384)	2.8892405	5.995142
log(32768)	2.83342576	5.682808
log(65536)	2.91222429	5.771574
log(131072)	3.44378495	6.222365
log(262144)	3.98235464	7.169834
log(524288)	5.33773208	8.248952
log(1048576)	8.05746102	11.65385
log(2097152)	13.694391	16.49492
log(4194304)	24.3269718	26.6308



The complexity of radix sort is O((n+b)log(m)) where n is the number of elements in the list and b is the base and m is the maximum element in the list

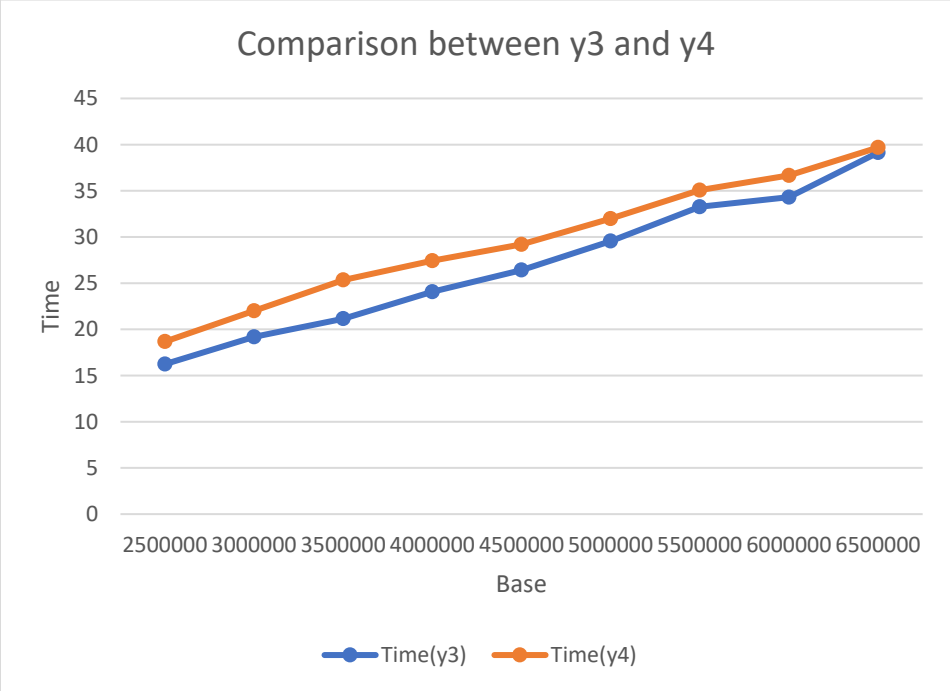
From the above graph its clearly visible that if you have a large exponent and many elements in the list, it causes the complexity of the radix sort algorithm to increase. However, if you have a small base, for example 4 or 8, radix sort takes the most time to sort a large set of data. The ideal scenario is when we have a relatively large value of the base (around 2^{14}) and then, even with a large set of data, we can see radix sort completely sorting the list in around 5 seconds.

Y1 has data in which the values have a range of 2^{15} and Y2 has data in which the values have a range of 2^{16}.

Despite the bases and number of elements being the same for y1 and y2, y2 takes more time to radix sort as the complexity is O((n+b)log(M)) where M is the value of the largest data. Log(2^{16}) > Log(2^{15}) hence the overall time complexity for y2 is greater than y1 as represented by the graph. However when

we use a higher base, the graph lines get really close to each other since the base begins to affect the overall value and Log(M) makes a less difference in the value of the complexity.

Base2	Time(y3)	Time(y4)
2500000	16.23863	18.6779366
3000000	19.18771	22.0092609
3500000	21.15345	25.3454225
4000000	24.07106	27.4313116
4500000	26.42248	29.1959231
5000000	29.55322	31.984762
5500000	33.26661	35.0728211
6000000	34.31175	36.6628006
6500000	39.14137	39.6902978



However, if the data set contains large values but the elements only have a few values, it takes more time as shown by the graphs of y3 and y4. The value of base is so much that log(M) in (n+b)log(M) barely makes a difference and instead, the graph is almost linear. The base directly influences the complexity of the radix sort.