



## **Root to Fruit (2): An Evolutionary Approach for Sorting Algorithms**

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### **ABSTRACT**

This paper continues the earlier thought of evolutionary study of sorting problem and sorting algorithms (Root to Fruit (1): An Evolutionary Study of Sorting Problem) [1] and concluded with the chronological list of early pioneers of sorting problem or algorithms. Latter in the study graphical method has been used to present an evolution of sorting problem and sorting algorithm on the time line.

**Key words:** Evolutionary study of sorting, History of sorting  
Early Sorting algorithms, list of inventors for sorting.

### **INTRODUCTION**

In spite of plentiful literature and research in sorting algorithmic domain there is mess found in documentation as far as credential concern<sup>2</sup>. Perhaps this problem found due to lack of coordination and unavailability of common platform or knowledge base in the same domain. Evolutionary study of sorting algorithm or sorting problem is foundation of futuristic knowledge base for sorting problem domain<sup>1</sup>. Since sorting activity is known as pre-requisition or supportive activity (searching, Matching etc.) for the various other computer related activities<sup>3</sup>. This activity (sorting) has a distinct place in the computing and programming domain.

It could possible and quit obvious that some of the important contributors or pioneers

name and their contribution may skipped from the study. Therefore readers have all the rights to extent this study with the valid proofs. Ultimately our objective behind this research is very much clear, that to provide strength to the evolutionary study of sorting algorithms and shift towards a good knowledge base to preserve work of our forebear for upcoming generation. Otherwise coming generation could receive hardly information about sorting problems and syllabi may restrict with some major/fundamental algorithms only<sup>4</sup>. Evolutionary approach of sorting can make learning process alive and gives one more dimension to student for thinking<sup>4</sup>. Whereas, this thinking become a mark of respect to all our ancestors<sup>5</sup>.

### **Origin of sorting problem**

The sorting problem asks us to rearrange the items of the given list in the proper order<sup>6</sup> to

other side according to mathematician, for sorting there should be exist of the relationship of the total then only sorting is possible. Computing domain basically invented to deal with data or information storing where need of the sorting is like anything for the organizing and managing data. Sorting activity plays vital role in computing context it makes many questions about the easier to answers<sup>6</sup>.

In this domain, voluminous material is available however still sorting is called as unsolved problem<sup>7</sup>, which leads the evolutionary study of sorting. While looking back in the history of sorting there were absence of evidences which can tell us about exact nativity of sorting problem or sorting algorithm.

However, in the computing context from the dawn of the computer and computing programming there is involvement of the sorting has been found. First program on the sorting problem was recorded in 1945 by John Van neuman and it was histories first sorting algorithm and it was Merge sort<sup>3</sup>. Even before merge sort in 1880, Holirith sorting machine sorting problem was solved by using radix sort therefore in the timeline study of sorting algorithms radix sort comes first<sup>3</sup>

### Origin of sorting algorithms

The story of sorting algorithms starts from the radix sort. Sorting algorithm is the ultimate solution of the sorting problem. search of sorting algorithm or sorting techniques takes us back in the era when development of electronics were in the phase of paradigm shift in data storage and that to ample data comes in the mess due to heavy volume, found efficient technique for handle this data, result in to sorting and searching problem. Further more in this context of the sorting problem a strong evidences found in the mid of ninetieth century. whereas in 1880 for the processing of the large census data of United state, a machine invented by Herman Hollerith, He was an American statistician did work with census department of United state and 100 of his invented machines were used to process on the 1890 census. Hollerith machine includes punch, tabulator and sorters. this machine based on the radix sort and A key idea was that data could be encoded by the locations

of holes in a card. Hollerith determined that data punched in specified locations on a card, in the now-familiar rows and columns, could be counted or sorted mechanically<sup>3</sup>.

Contribution of Donald Knuth, Robert Fiendler, L.j. Comrie's and NIST website in the Computing history and sorting context is really unbeatable. Their Pedagogy, used literature and comments helps us a lot while digging the roots of the sorting algorithms.

In 1938, The idea of merging sort invented by Jame W. Bryce. A machine known as *collator* use to merge cards from two different stations in the one sorting operation<sup>3, 8</sup>.

Mean time computer were arrived in picture and designer and programmers of computing machines feel the need of powerful search method and sorting was intimately involved in this development. The first sorting technique was used in "EDVAC" Computer and credit of this invention goes to John Von Neuman

Germany 1945: Scientist K Zuse works independently for the computer z4 which was used for the commercial purpose. He constructed a program s seems Insertion sort. Z4 is also known as world's first commercial computer.

To -other side a word "Algorithm" joined with the sorting technique after the mid of nineteenth. Even history of the word algorithm is equally interesting. A word algorithm first time traced in 9<sup>th</sup> century. This terminology invented by Muhammad Bin Musa al-Khwarizmi (Persian scientist and mathematician)<sup>9</sup>

### Primary concern for sorting algorithms:

By now plenty number of the sorting algorithms and their variants makes domain become rich some of them are better than other. However there is absence of the generalized sorting algorithm which can suits best in the entire or all available situation<sup>6</sup>

Below is the list of inventors of sorting and their sorting invention along with invention year (Chronological order)

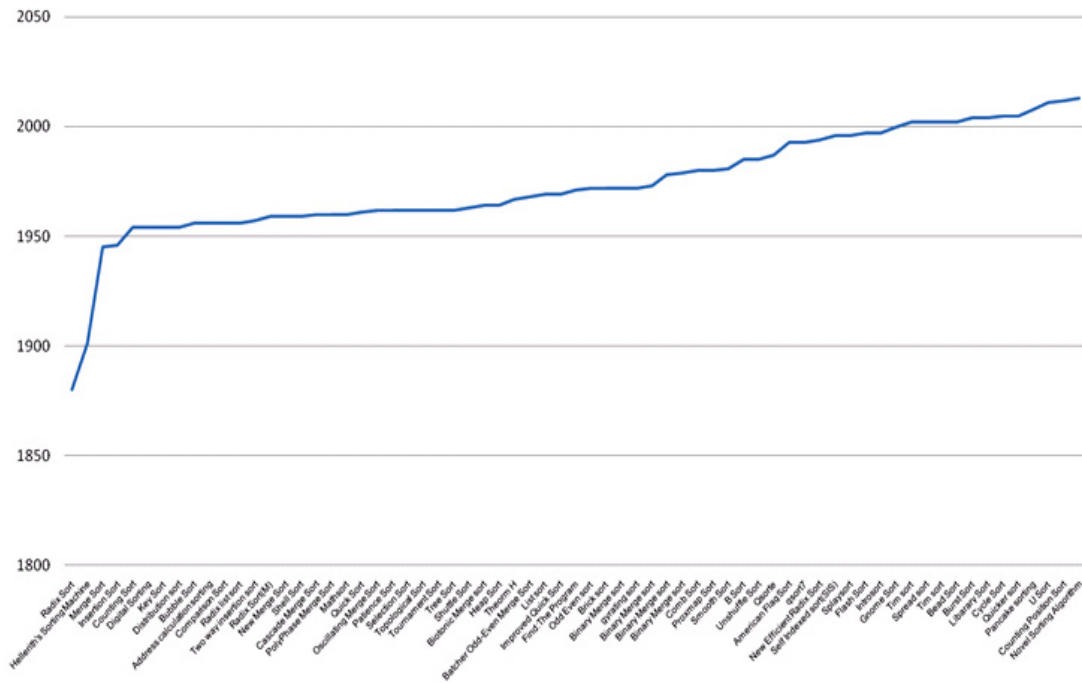
Sr. No.	Sorting Algorithm	Inventors Name	Invention Year
	Radix Sort [10]	Herman Hollerith	1880
1	Hellerith's Sorting Machine[3]	Herman Hellerith	1901
2	Merge Sort[3]	John Van Neumann	1945
3	Insertion Sort(Binary Insertion)[11]	john Mauchly	1946
4	Counting Sort[11]	Harold H. Seward	1954
5	Digital Sorting[12]		1954
6	Key Sort[13]		1954
7	Distribution sort [14]	H.Seward	1954
8	Bubble Sort(Exchange sort) [2]	Inversion	1956
9	Address calculation sorting[14]	Issac and singleton	1956
10	Comparison Sort [12]	E.H.Friend	1956
11	Radix list sort [15]	E.H.Friend	1956
12	Two way insertion sort [16]	D.J.Wheeler	1957
13	Radix Sort(Modified)[17]	P.Hildebrandt,H.Rising,J Schwartz	1959
14	New Merge Sort [18]	B.K. Betz & W.C. Carter	1959
15	Shell Sort [19]	Donald L Shell	1959
16	Cascade Merge Sort [20]	R.L.Gilstad	1960
17	PolyPhase [20] Merge Sort/Fobinocii Sort	R.L.Gilstad	1960
18	Mathsort	W.Feurzeig	1960
19	Quick Sort [21](Partition Exchange sort)	CAR Hoare	1961
20	Oscillating [22] Merge Sort	Sheldon Sobel	1962
21	Patience [23] Sort	C. L. Mallow	1962
22	Selection [2] Sort	NA	1962
23	Topological Sort	Kahn	1962
24	Tournament Sort(tree sort) [21]	K.E..lversion	1962
25	Tree Sort(Modified)[24]	K.E..lversion	1962
26	Shuttle [2] Sort		1963
27	Biotonic Merge sort[25]	US Patent3228946(1969)K.E.Batcher	1964
28	Heap Sort [2]	J.W.J Willams	1964
29	Theorm H[25]	Douglas H.Hunt	1967
30	Batcher Odd-Even Merge Sort[23]	Ken Batcher	1968
31	List sort/List merge sort[8]	L.J.Woodrum&A.D.Woodall	1969
32	Improved Quick sort[16]	Singleton	1969
33	Find:The Program[26]	CAR Hoare	1971
34	Odd Even sort/Brick sort/Odd even Transport sort[23]	Habermann	1972
35	Brick sort	Habermann	1972
36	Binary Merge sort [27]	F.K.Hawang& S.Lin	1972
37	gyrating sort [23]	R.M.Karp	1972
38	Binary Merge sort[2]	F.K.Hawang& D.N. Deutsh	1973
39	Binary Merge sort[2]	C.Christen	1978
40	Binary Merge sort[2]	G.K.Manacher	1979
41	Comb Sort[23]	W?odzimierz Dobosiewicz rediscovered by-Steph[26]en Lacey and Richard Box in 1991	1980
42	Proxmap Sort[23]	Thomas A. Standish	1980
43	Smooth Sort[2]	Edsger Dijkstra	1981

44	B Sort[23]	Wainright	1985
45	Unshuffle Sort[23]	Art S. Kagel	1985
46	Qsorte [2]	Wainright	1987
47	American Flag Sort[12]		1993
48	qsort7 [16]	Benteley & Mcilroy	1993
49	New Efficient Radix Sort[17]	Arne Anderson & Stefan Nilson	1994
50	Self Indexed sort(SIS)[28]	Yingxu Wang	1996
51	Splaysort[23]	Moggat, Eddy & Petersson	1996
52	Flash Sort[23]	Karl-Dietrich Neubert	1997
53	Introsort	David Musser	1997
54	Gnome Sort[23]	Dr. Hamid Sarbazi-Azad	2000
55	Tim sort[29]	Tim Peters	2002
56	Spread sort[7]	Steven J. Ross	2002
57	Tim sort [2]	Tim Peters	2002
58	Bead Sort[30]	Joshua J. Arulanandham, Cristian S. Calude and Michael J. Dinneen	2002
59	Burst Sort[31]	Ranjan sinha	2004
60	Library Sort/Gapped Insertion sort[32]	Michael A. Bender, Martín Farach-Colton, and Miguel Mosteiro	2004
61	Cycle Sort [33]	B.K.Haddon	2005
62	Quicker sort [12]	R.S. Scowen	2005
63	Pancake sorting[23]	Professor Hal Sudborough	2008
64	U Sort [34]	Upendra singh aswal	2011
65	Counting Position Sort [35]	Nitin Arora	2012
66	Novel Sorting Algorithm [36]	R.Shrinivas & A.Raga Deepthi	2013
67	Bogo Sort(Monkey sort/ Slow sort/Stupid Sort)[13]	NA	NA
68	Bucket Sort [11]	NA	NA
69	J Sort[23]	Jason Morrison	NA
70	SS06 Sort [16]	K.K.Sudharajan & S.Chakraborty	NA
71	Stooge Sort[23]	Prof.Howard Fine and Howard	NA
72	Strand Sort[23]	NA	NA
73	Trim Sort[23]	NA	NA
74	Punch Card Sorter[2]	A. S. C. Ross	NA

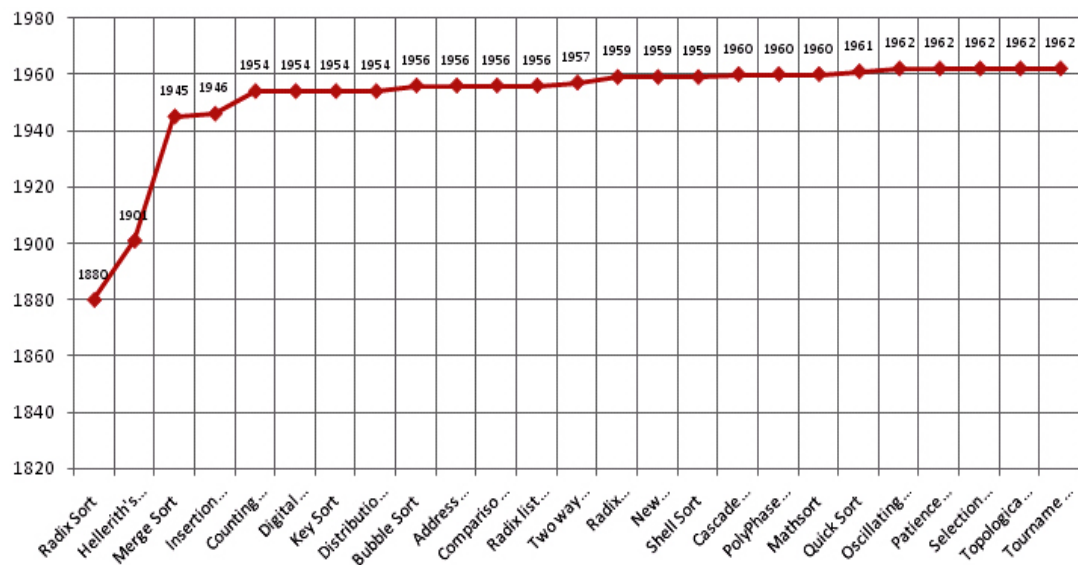
## CONCLUSION

Most of the sorting algorithms were invented in the period of 1954 to 1985 and radix sort is first sorting algorithm which was used commercially in 1980 census machine which was invented by Herman Hollirith . Whereas, the search

of efficient sorting algorithm is alive so far. There is voluminous sorting algorithms are available but generalization of sorting algorithm is not possible; Due to, distinct nature of individual sorting problems. To store, manage and update this ample information about sorting algorithms there is need of knowledge base.



**Fig. 1: Evolutionary Graph for Sorting Algorithms**



**Fig. 2: Sorting Algorithms (1880-1962)**

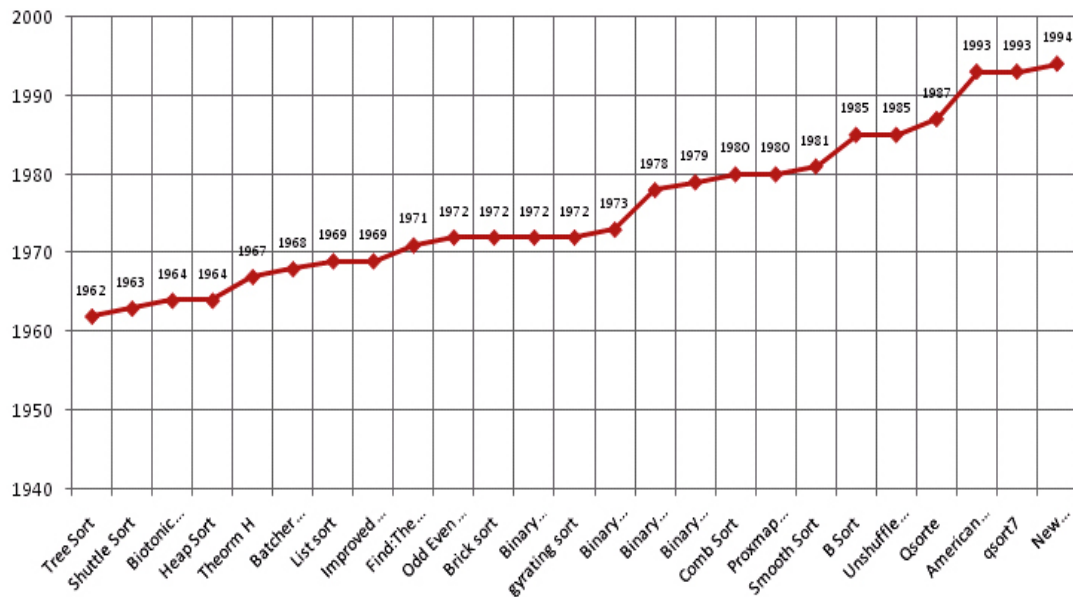


Fig. 3: Sorting Algorithms (1962-1994)

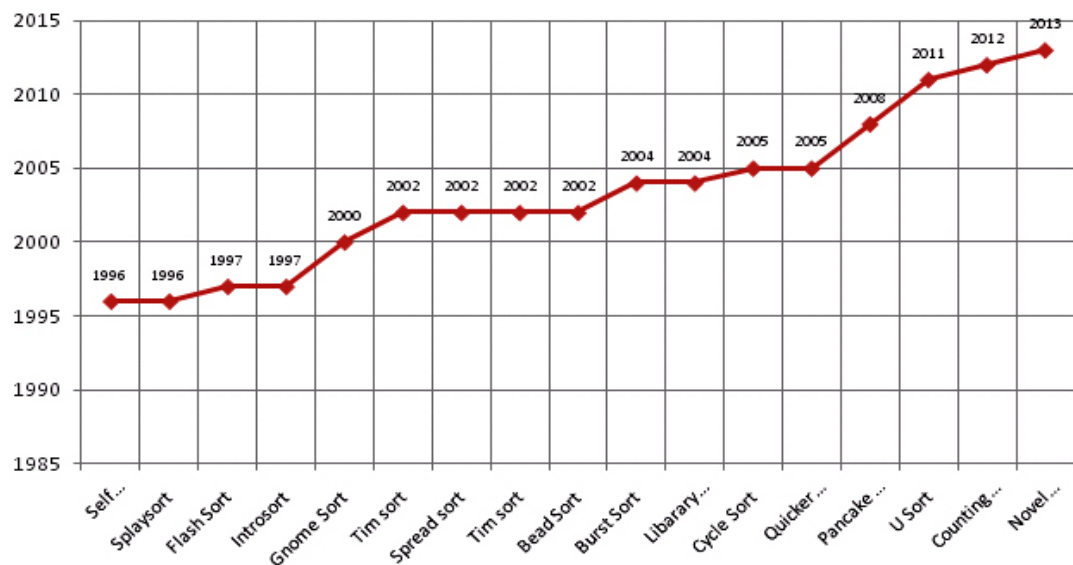


Fig. 4: Sorting Algorithms (1996-2013)

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