# Elementary Sorting Algorithms

Data Structures CS2001

# Overview

- Bubble Sort and it’s implementation Details
- Insertion Sort and it’s implementation Details
- Selection Sort and it’s implementation Details
- Shell Sort and it’s implementation Details

# Sorting


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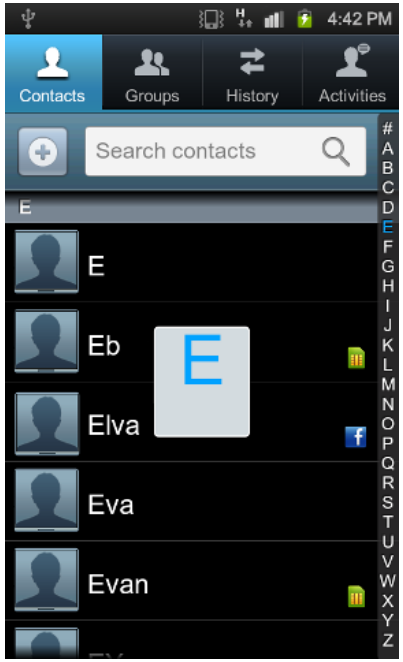
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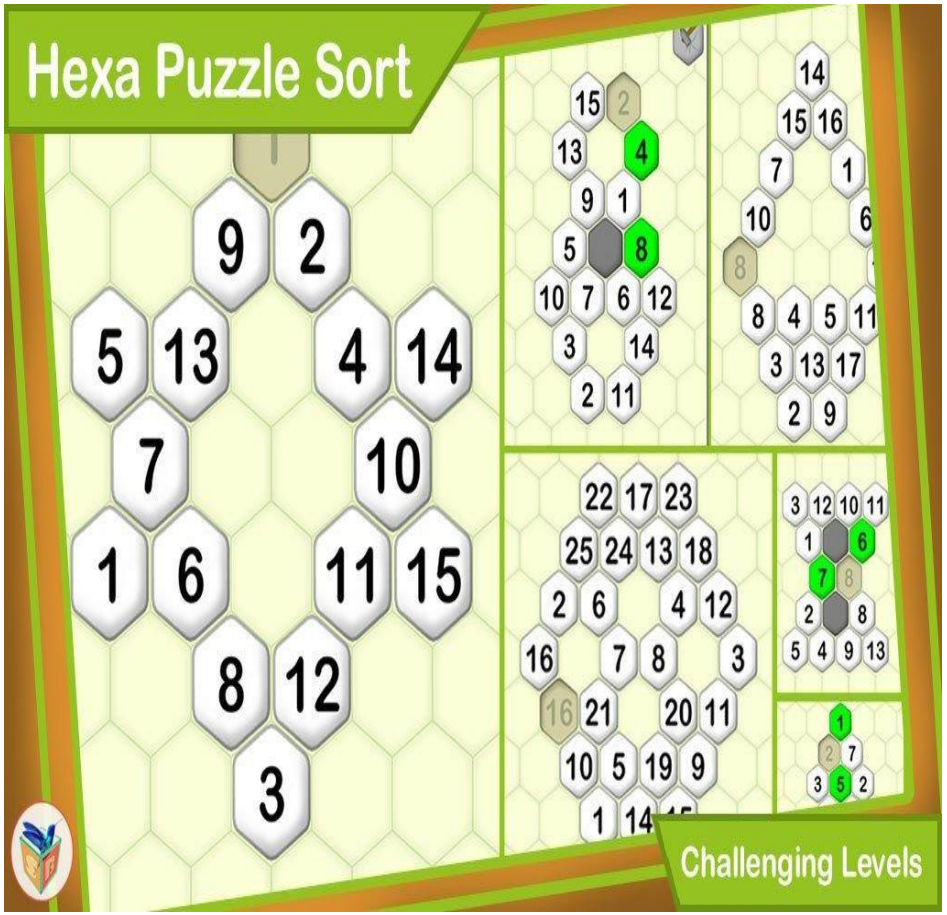
# A B C D E F G H I J K L M N O P Q R S T U V W X Y Z


involve 94
involve v përfshij
involved v i përfshirë
involvement n përfshirje
inward adj shpirtëror
inwards adv nga brenda
iodine n jod
irate adj nevrik
ireland n Irlandë
irish adj irlandez
iron n hekur
iron v hekuros
ironic adj ironik
irony n ironi
irrational adj i paarsyeshëm
irregular adj i parregullt
irrelevant adj irelavant
irreparable adj i pandreqshëm
irrespective adj pavarësisht
irreversible adj i pakthyeshëm
irrevocable adj i papranueshëm
irrigate v ujit, ujis
irrigation n ujitje, vaditje
irritate v ngacmoj, ngas
irritating adj i nevrikosshëm
islamic adj islamik
island n ishull
isle n ishull, ujdhesë
isolate v veçoj, izoloj
isolation n izolim
issue n çështje
italian adj italian
italy n Itali
itch v kruaj
itchiness n kruarje
item n gjë, send
itemize v i detajuar
itinerary n itinerar
ivory n i fildishtë
J
jackal n çakall
jacket n xhaketë
jackpot n çmim i parë
jaguar n jaguar
jail n burg
jail v burgos
jailer n rojtar burgu
jam n ngjeshje, shtrëngim
janitor n rojë, portier
January n Janar
Japan n Japoni
Japanese adj japonez
jar n vorbë, qyp
jasmine n jasemi
jaw n nofull, grykë
jealous adj xheloz
jealousy n xhelozi
jeans n xhinse
jeopardize v rrezikoj
jerk v tërheq, shkul

# Sorting Applications



# Sorting Algorithm

- Bubble Sort
- Insertion Sort
- Selection Sort
- Shell Sort
- Merge Sort
- Quick Sort
- Radix Sort
- Count Sort
- Heap Sort
- Topological Sort

# Bubble Sort

- It is a naïve sorting algorithm
- Performs slow for large number of inputs
- Bubbles out the largest element after every iteration
- Working principle of Bubble Sort

# Implementation Details of Bubble Sort

```
Algorithm Bubble_Sort(A)
Input: An array of size n
Output: Sorted array
For(i=0 to n-1) do
        For(j=0 to n-1-i) do
                if(a[j] > a[j+1]) then
                        Swap(a[j],a[j+1])
                end if
        end for
End for
```

# Selection Sort

- It is a simple algorithm
- Inefficient for large number of inputs
- Repeatedly finds the minimum element and insert it into the sorted sub array.
- Working principle of selection sort

# Implementation Details of Selection Sort

```
Algorithm Selection_Sort(A)
Input: An array of size n
Output: Sorted array
For(i=0 to A.size) do
        min_value=i
        for(j=i+1 to A.size) do
                if(A[j] < A [min_value]) then
                        min_value= j
                end if
        end for
        swap(A[min_value], A[j])
End for
```

# Insertion Sort

- Insertion sort performs faster than bubble sort
- It works the same way as organization of play cards
- Pick an element from unsorted list and insert it at the correct position
- Working principle of insertion sort

# Implementation Details of Insertion Sort

```
Algorithm Insertion_Sort(A)
Input:  An array of size n
Output: Sorted Array
 for (j = 1 to A.size)  do
      temp = A[j]
      i = j-1
      while (i>=0 && A[i] > temp) do
         A[i+1] = A[i]
         i = i-1
      end while
      A[i+1] = temp
End for
```

# Shell Sort

- It is a variation of insertion sort
- It starts sorting pairs of element far apart from each other
- By the end, the gap is reduced to 1
  - It will act like insertion sort algorithm
- Working principle

# Implementation Details of Shell Sort

```
Algorithm Shell_Sort(A)
Input:  An array of size n
Output: Sorted Array
 for (gap = n/2 ; gap > 0 ; gap/=2)  do
      for (i= gap ; i < n; i+=1) do
           temp= A[i]
           for(j=i ; j >= gap && A[j-gap] > temp ; j-=gap) do
                      A[j] = A[ j - gap]
           end for
           A[j]= temp
      end for
End for
```

# Properties of Sorting Algorithms

| Property | Description |
| --- | --- |
| Adaptive | A sort is adaptive if it runs faster on a partially sorted array |
| Stable | A sort is stable if it preserves the relative order of equal keys in the database |
| In-place | A sort is in-place when it does not require extra storage space to sort the elements |

# Properties of Sorting Algorithms

| Algorithm | Adaptive | Stable | In-place |
|---|---|---|---|
| Bubble Sort | No | Yes | Yes |
| Selection Sort | No | No | Yes |
| Insertion Sort | Yes | Yes | Yes |
| Shell Sort | Yes | No | Yes |

# Summary

- Sorting makes searching easy
- For large number of elements binary search will outperform as compared to linear search
- Elementary sorting techniques are good for small scale. However for larger scale some advanced sorting techniques are required.