Sorting

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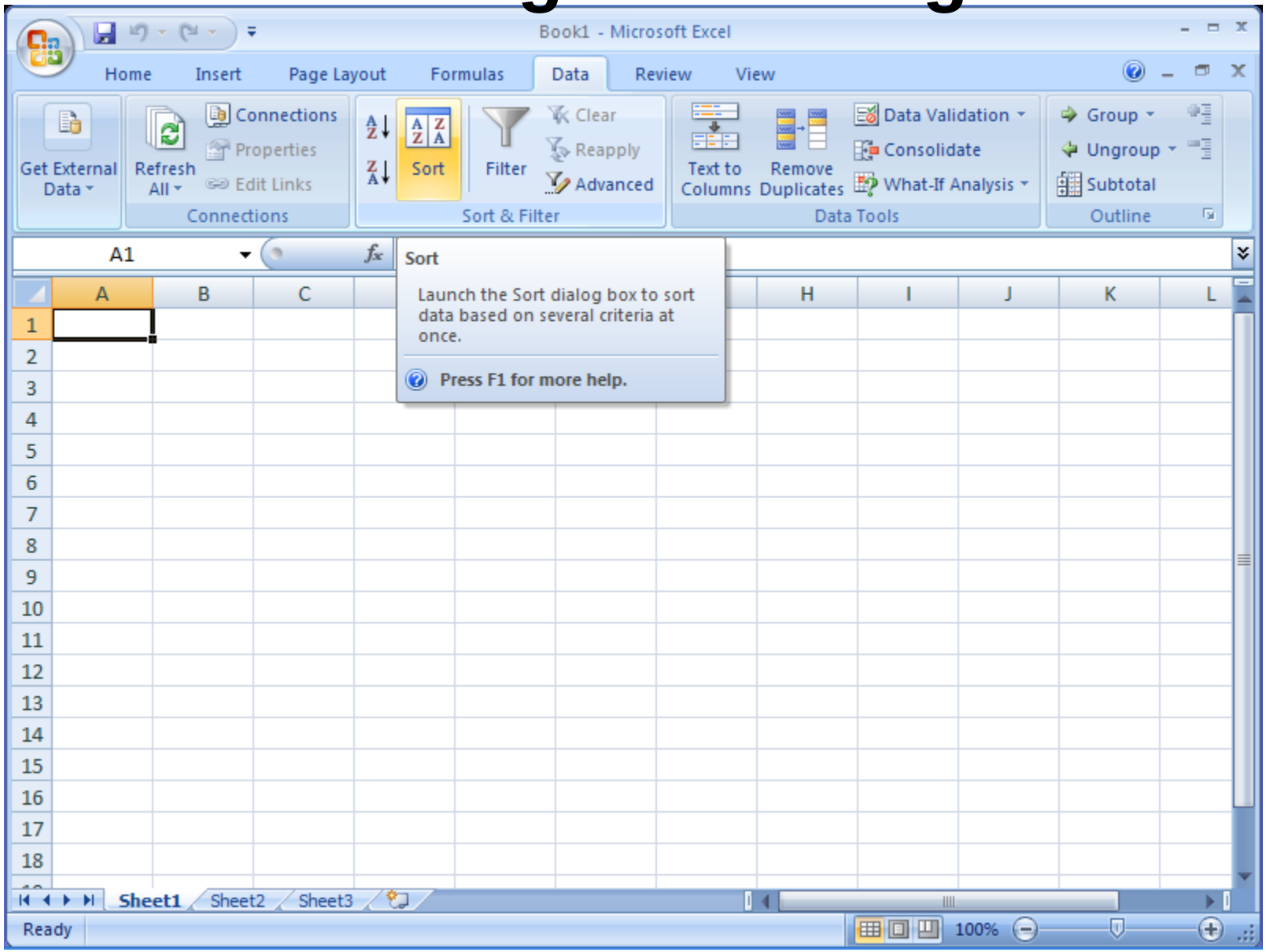
Where Is Sorting Used? Everywhere

- list student records by their student IDs
- print names in a phone book by the alphabetic order
- find the cheapest airfare on a travel web site
- determine the shortest route between two cities
- rank the best matches in web search
- …

Sorting = Ordering



Selection Sort

Suppose an array has n elements, stored in array x.

Each iteration finds (i.e. selects) the smallest among the remaining elements.

```
for (index1 = 0; index1 < n - 1; index1 ++)
{
    minIndex = index1;     /* index of the minimum element */
    for (index2 = index1 + 1; index2 < n; index2 ++)
    {
        if (x[minIndex] < x[index2]) { minIndex = index2; }
    }
    if (index1 != minIndex) { swap(&x[index1], &x[minIndex]); }
}
```


find a smaller element

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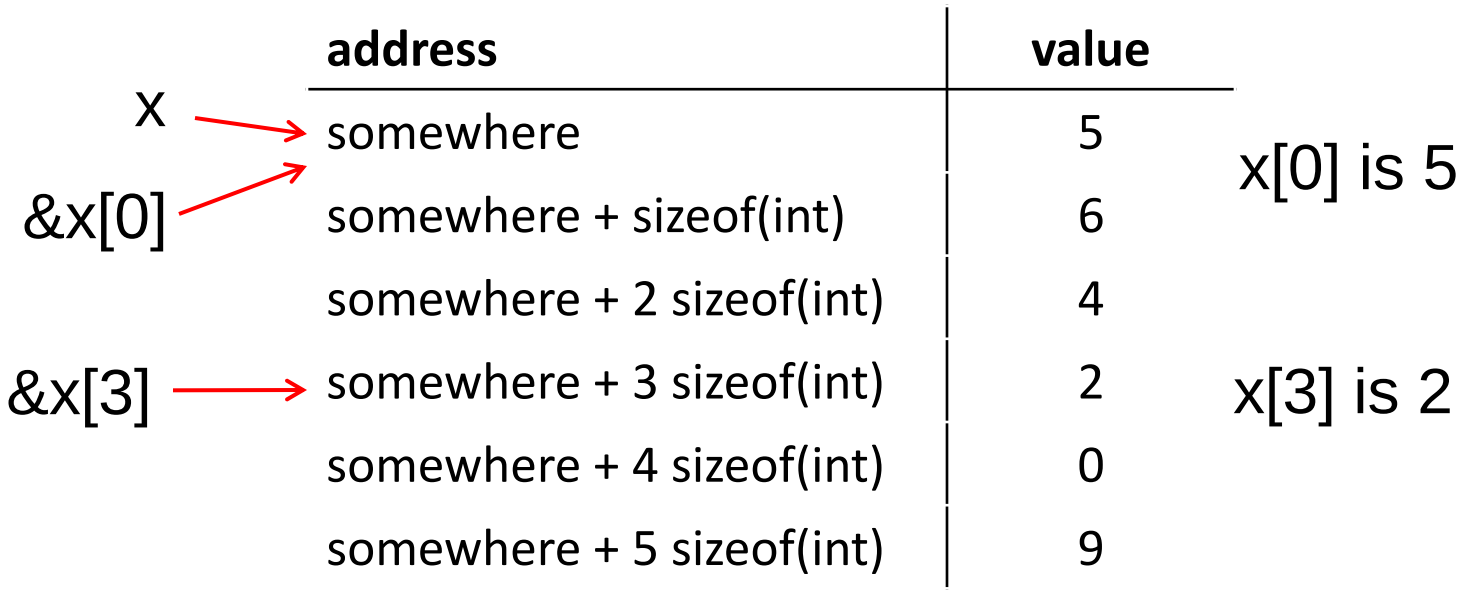
```c
#include <stdio.h>
void swap(int * a, int * b)
{
    int temp = *a;
    (*a) = (*b);
    (*b) = temp;
}
void printArray(int * x, int n)
{
    int i;
    for (i = 0; i < n; i ++)
        { printf("%8d", x[i]);  }
    printf("\n");
}
int main(int argc, char * argv[])
{
    int x[] = {6, 7, 3, 2, 0, 9, -4, 1};
    int n = sizeof(x) / sizeof(int);
    printArray(x, n);
    int ind1, ind2, minInd;
    for (ind1 = 0; ind1 < n - 1; ind1 ++)
        {
            minInd = ind1;
            for (ind2 = ind1 + 1; ind2 < n; ind2 ++)
                {
                    if (x[minInd] > x[ind2])
                        { minInd = ind2; }
                }
            if (minInd != ind1)
                {
                    printf("\nind1 = %d, minInd = %d, x[ind1] = %d, x[minInd] = %d\n",
                           ind1, minInd, x[ind1], x[minInd]);
                    swap(&x[ind1], &x[minInd]);
                    printArray(x, n);
                }
        }
    printArray(x, n);
    return 0;
}
```

--:-- sort.c All (39,1) (C/l Abbrev)----------

Array and Pointer

```
int x[] = {5, 6, 4, 2, 0, 9};
```



Print an Array

number of elements

```
void printArray(int * x, int n)
{
    int i;
    for (i = 0; i < n; i ++)
    {  printf("%8d", x[i]);  }
    printf("\n");
}
```

pointer to the beginning of the array

each number has 8 digits
(insert space if needed)

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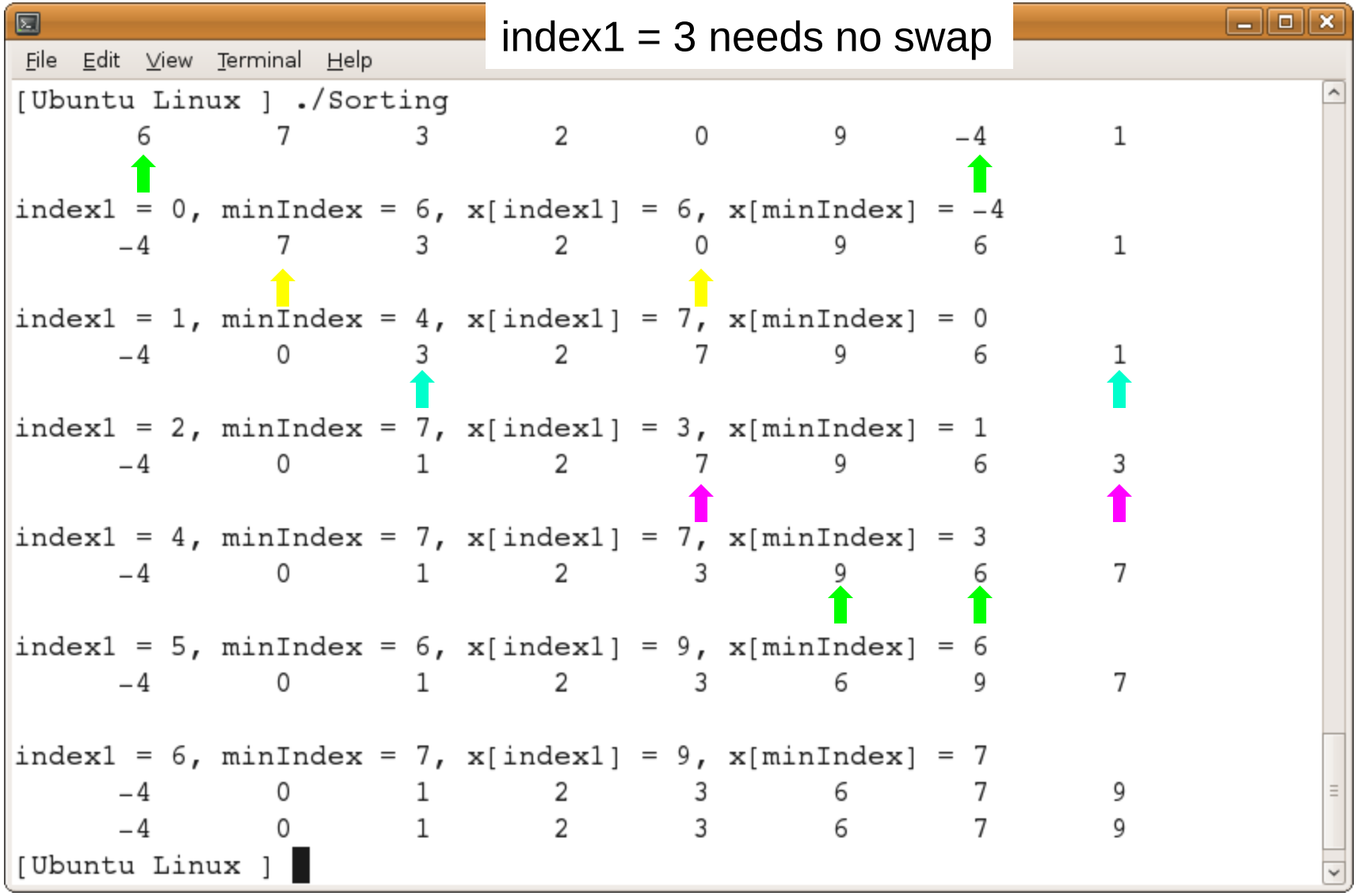
```c
#include <stdio.h>
void swap(int * a, int * b)
{
    int temp = *a;
    (*a) = (*b);
    (*b) = temp;
}
void printArray(int * x, int n)
{
    int i;
    for (i = 0; i < n; i ++)
        { printf("%8d", x[i]);  }
    printf("\n");
}
int main(int argc, char * argv[])
{
    int x[] = {6, 7, 3, 2, 0, 9, -4, 1};
    int n = sizeof(x) / sizeof(int);
    printArray(x, n);
    int ind1, ind2, minInd;
    for (ind1 = 0; ind1 < n - 1; ind1 ++)
        {
            minInd = ind1;
            for (ind2 = ind1 + 1; ind2 < n; ind2 ++)
                {
                    if (x[minInd] > x[ind2])
                        { minInd = ind2; }
                }
            if (minInd != ind1)
                {
                    printf("\nind1 = %d, minInd = %d, x[ind1] = %d, x[minInd] = %d\n",
                            ind1, minInd, x[ind1], x[minInd]);
                    swap(&x[ind1], &x[minInd]);
                    printArray(x, n);
                }
        }
    printArray(x, n);
    return 0;
}
```

--:-- sort.c All (39,1) (C/l Abbrev)----------


File Edit View Terminal Help
index1 = 3 needs no swap
[Ubuntu Linux] ./Sorting
6 7 3 2 0 9 -4 1
index1 = 0, minIndex = 6, x[index1] = 6, x[minIndex] = -4
-4 7 3 2 0 9 6 1
index1 = 1, minIndex = 4, x[index1] = 7, x[minIndex] = 0
-4 0 3 2 7 9 6 1
index1 = 2, minIndex = 7, x[index1] = 3, x[minIndex] = 1
-4 0 1 2 7 9 6 3
index1 = 4, minIndex = 7, x[index1] = 7, x[minIndex] = 3
-4 0 1 2 3 9 6 7
index1 = 5, minIndex = 6, x[index1] = 9, x[minIndex] = 6
-4 0 1 2 3 6 9 7
index1 = 6, minIndex = 7, x[index1] = 9, x[minIndex] = 7
-4 0 1 2 3 6 7 9
-4 0 1 2 3 6 7 9
[Ubuntu Linux]