Example Documentation for the Minimum Selection Method

This method repeatedly selects the minimum from the remaining list, and put it at the end of the already sorted list. The general situation is depicted below.

```
<table>
<thead>
<tr>
<th>Sorted portion</th>
<th>unsorted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>i-1</td>
</tr>
</tbody>
</table>
```

All here are not greater than the unsorted portion. The variable \( i \) controls the outer loop. In the inner loop, \( j \) scans the array portion \( a[i..n] \) to find the minimum “min” at \( k \). After this \( a[i] \) is moved to \( a[k] \), and min is stored in \( a[i] \). Then one cycle is finished and we increase \( i \) by 1 to go to the next cycle. When we finish the cycle for \( i=n-1 \), we can finish the whole job for sorting. The source program follows.

```c
#include <stdio.h>
#include <math.h>
main()
{
    int i,j,k,n,min,t;
    int a[10000];
    printf("input size \n");
    scanf("%d",&n);
    /*for (i=1;i<=n;i++) { scanf("%d",&a[i]);};*/
    for (i=1;i<=n;i++) a[i]=random()%1000;
    t=clock();
    for (i=1;i<=n-1;i++)
    { min=a[i]; k=i;
        for (j=i+1;j<=n;j++)
        { if (a[j]<min) {
            min=a[j]; k=j;}
        }
        a[k]=a[i]; a[i]=min;
    }
    for (i=1;i<=10;i++) { printf("%d ",a[i]);}
    printf("ntime= %d millise
",(clock()-t)/1000);
}
```

Let us estimate the efficiency of this algorithm by the number of key comparisons. When \( i=1 \), we spend \( n-1 \) comparisons to find the minimum, and then \( n-2 \) comparisons to find the second minimum with \( i=2 \), and so on. Thus the total number of comparisons can be evaluated by \( n-1 + n-2 + \ldots + 1 = n(n-1)/2 \sim n^2/2 = O(n^2) \).

Obviously the cpu time consumed by other parts of the program is proportional to the above number, that is, proportional to \( n^2 \) squared, which is not efficient. The merit of this program is that it is easy to understand and memorize, and easy to implement. Thus it is good to sort a small set of data items, when other methods are not available at hand.