To:
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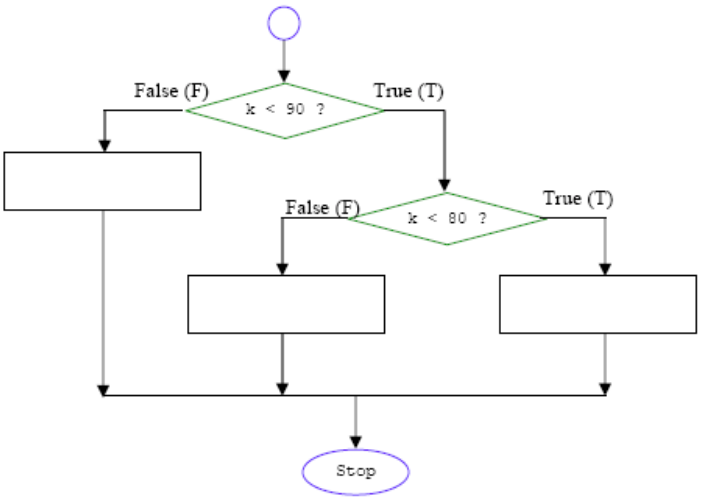
C LAB WORKSHEET 8a
C & C++ Selection: C/C++ if and if-else Part 3

Items in this page:

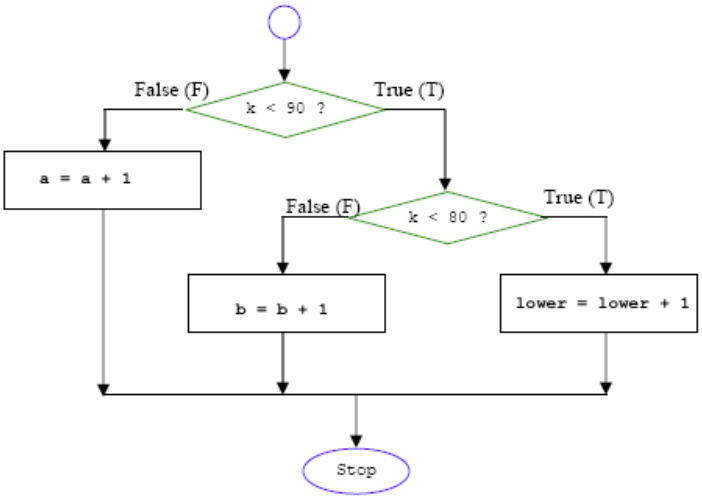
9. The following experiment should give the same result as the previous one. Only the logic has been rearranged. Complete the flowchart and the program so that the output is same as before.

```
#include <stdio.h>

int main(void)
{
    int i, k, a = 0, b = 0, lower = 0;
    printf("Enter the sample input line by line:\n");
    for(i = 1; i <= 7; i = i + 1)
    {
        scanf_s("%d", &k, 1);
        if(k < 90)
            if(k < 80)
                _____________________________
            else
                _____________________________
        else
        _____________________________________
    }
    printf("A's = %d\tB's = %d\tLower = %d\n", a, b, lower);
    return 0;
}
```




```
if(k < 90)
    if(k < 80)
        lower = lower + 1;
    else
        b = b + 1;
else
   a = a + 1;
```

```
Enter the sample input line by line:
79
91
80
59
100
60
89
A's = 2 B's = 2 Lower = 3
Press any key to continue . . .
```



10. Next, let us test the conditions for all five grades, namely A, B, C, D and F. In the blank space, for each grade, place the appropriate statement something like the following:

```
printf("A.\n");
```

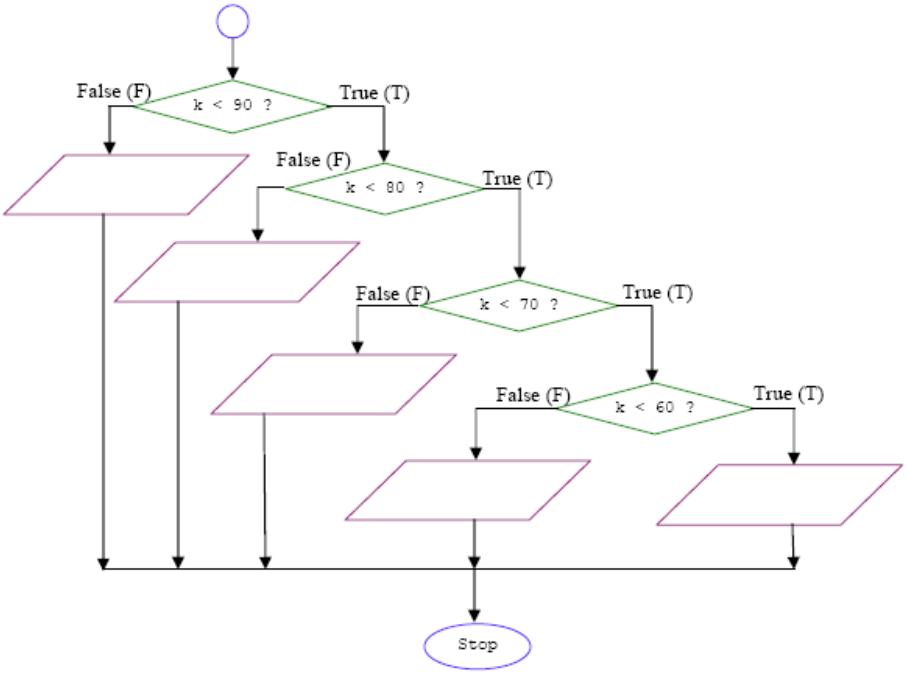
Each else that is lined up under an if is that condition's false side. Complete the code and the flowchart.

```
#include <stdio.h>

int main(void)
{
    int i, k;
    printf("Enter the sample input line by line:\n");
    for(i = 1; i <= 7; i = i + 1)
    {
        scanf_s("%d", &k, 1);
        if(k < 90)
```

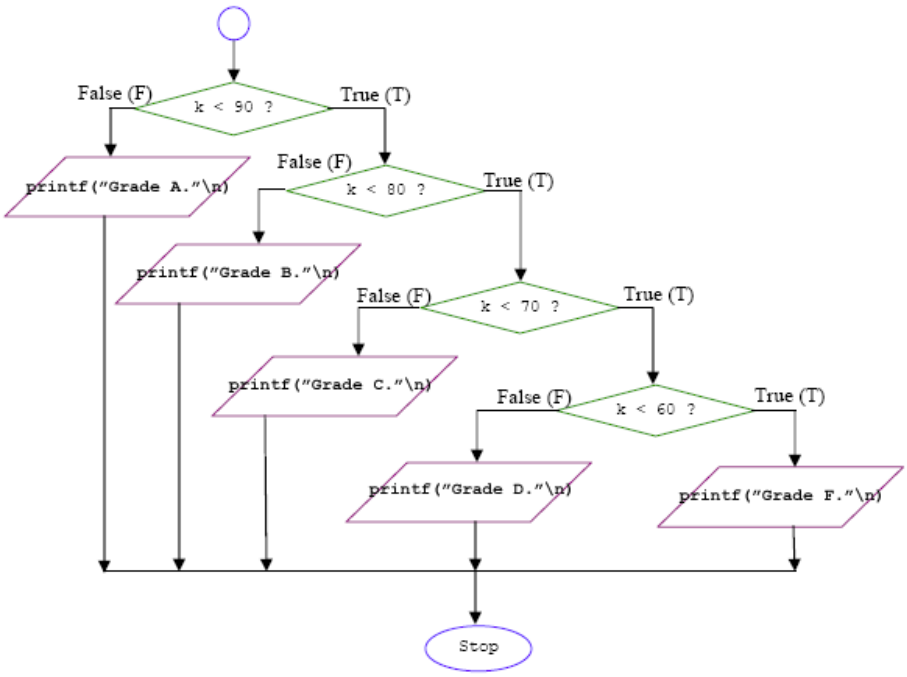
```
if(k < 90)
   if(k < 80)
      if(k < 70)
         if(k < 60)
            printf("Grade F.\n");
         else
            printf("Grade D.\n");
      else
         printf("Grade C.\n");
   else
      printf("Grade B.\n");
else
   printf("Grade A.\n");
```

```
            if(k < 80)
                if(k < 70)
                    if(k < 60)
                        _____________________________
                    else
                        _____________________________
                else
                    _____________________________
            else
                _____________________________
        else
            _____________________________
    }
    return 0;
}
```

```
Enter the sample input line by line:
79
Grade C.
91
Grade A.
80
Grade B.
59
Grade F.
100
Grade A.
60
Grade D.
89
Grade B.
Press any key to continue . . .
```



- The following is the completed flowchart.



a. On the F (false) side of k < 90? Only A grades are selected. On the T (true) side of that condition, which grades are selected, A, B, C, D and/or F?
b. On the T side of k < 80?, which grades are selected?
c. On the T side of k < 70?, which grades are selected? What about on the F side?
d. Grades that end up getting a B must go through how many decision diamonds?

e. Grades that end up getting a D must go through how many decision diamonds?

Ans:

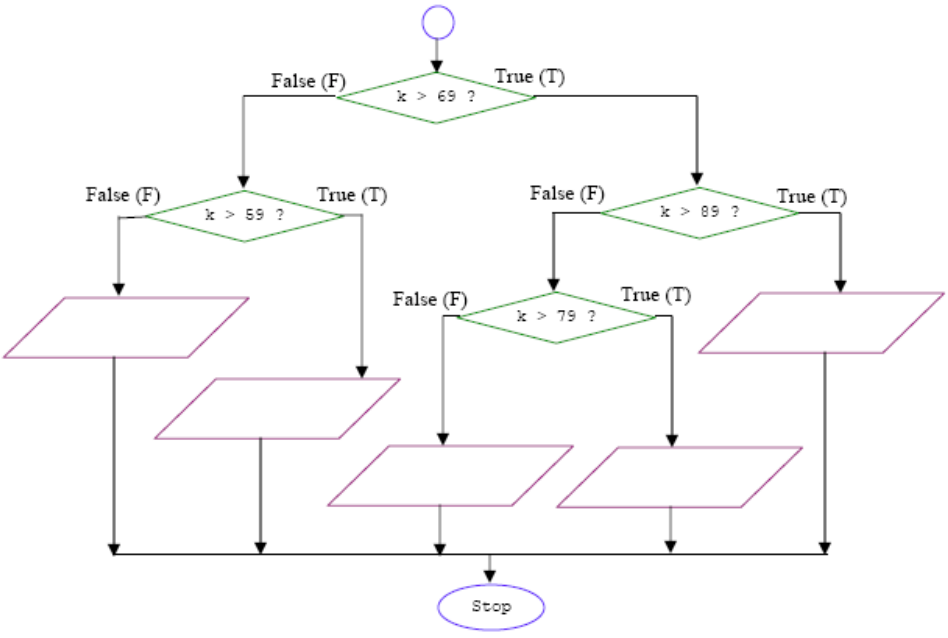
a. B, C, D and F.
b. C, D and F.
c. On the True side are D and F. On the False side, C was selected.
d. 2 decision diamonds.
e. 4 decision diamonds.

11. The following experiment performs the same steps as in the previous one. However, since the logic is rearranged, the printf() will need to be placed at different locations. Complete the code and the flowchart.

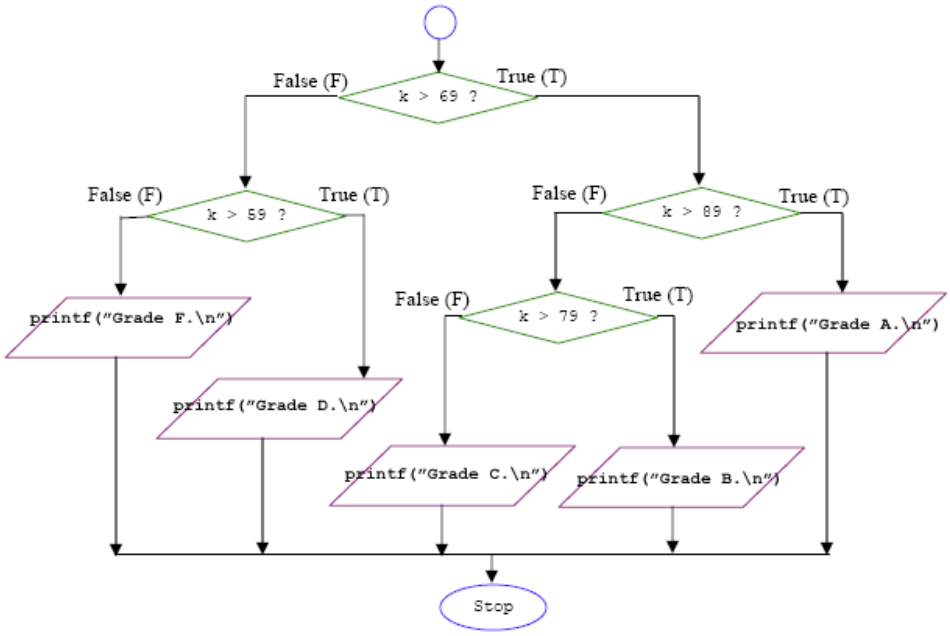
```
#include <stdio.h>

int main(void)
{
    int i, k;
    printf("Enter the sample input line by line:\n");
    for(i = 1; i <= 7; i = i + 1)
    {
        scanf_s("%d", &k, 1);
        if(k > 69)
            if(k > 89)
                _____________________________
            else if(k > 79)
                _____________________________
            else
                _____________________________
        else if(k > 59)
            _____________________________
        else
            _____________________________
    }
    return 0;
}
```

```
if(k > 69)
   if(k > 89)
      printf("Grade A.\n");
   else if(k > 79)
      printf("Grade B.\n");
   else
      printf("Grade C.\n");
   else if(k > 59)
      printf("Grade D.\n");
   else
      printf("Grade F.\n");
```

```
Enter the sample input line by line:
79
Grade C.
91
Grade A.
80
Grade B.
59
Grade F.
100
Grade A.
60
Grade D.
89
Grade B.
Press any key to continue . . .
```



- The following is a completed flowchart for the previous question.



a. F grades will go through two conditions: k > 69?, which would be false and k > 59?, which also would be false. How many conditions that D grades go through?
b. How many conditions that C grades go through?
c. How many conditions that A grades go through?
d. If k > 79? were changed to k <= 80?, then what changes would be necessary in the flowchart?
e. When a grade that is read into the variable k enters this set of nested if's, it has a choice of going through how many different paths?
f. The control of execution may take how many different paths at any one time?

Ans:

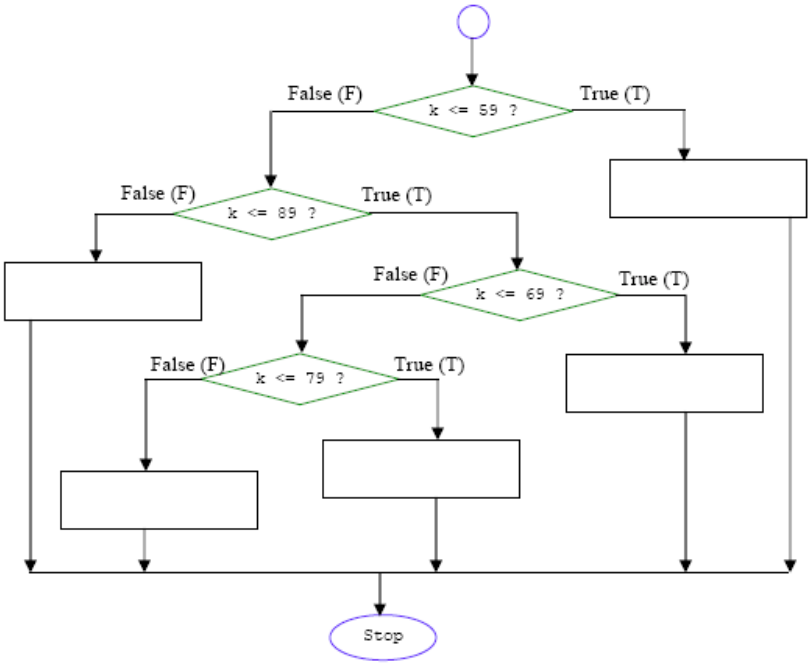
a. Also 2 conditions same as F but both are True.
b. 3 conditions.
c. 2 conditions.
d. The True (T) and False (F) positions need to be exchanged for the k > 79 decision diamond.
e. 5 different paths based on the path toward the Stop.
f. At any one time it will take 2 paths based on the True (T) and False (F) paths.

12. The following experiment performs the same steps as in the last two previous experiments. However, it count the number of grades in each category instead of printing them. Complete the code and the flowchart.

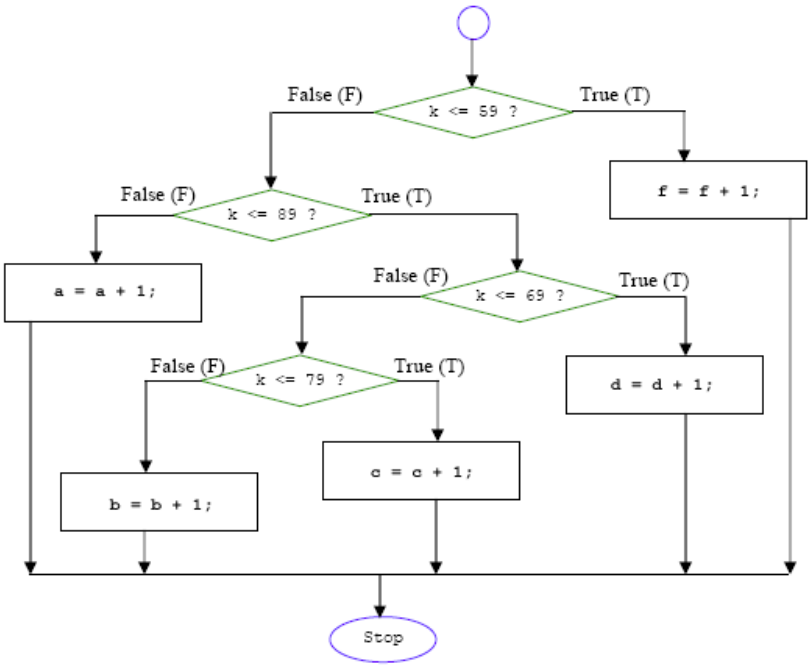
```
#include <stdio.h>

int main(void)
{
    int i, k, a=0, b=0, c=0, d=0, f=0;
    printf("Enter the sample input line by line:\n");
    for(i = 1; i <= 7; i = i + 1)
    {
        // for older compiler you can try using scanf()
        scanf_s("%d", &k, 1);
        if(k <= 59)
            _____________________________
        else if(k <= 89)
            if(k <= 69)
                _____________________________
            else if(k <= 79)
                _____________________________
         else
            _____________________________
        else
            _____________________________
    }
    printf("A's = %d\t", a);
    printf("B's = %d\t", b);
    printf("C's = %d\t", c);
    printf("D's = %d\t", d);
    printf("F's = %d\n", f);
    return 0;
}
```

```
if(k <= 59)
   f = f + 1;
else if(k <= 89)
   if(k <= 69)
      d = d + 1;
   else if(k <= 79)
      c = c + 1;
   else
      b = b + 1;
   else
      a = a + 1;
```

```
Enter the sample input line by line:
79
91
80
59
100
60
89
A's = 2 B's = 2 C's = 1 D's = 1 F's = 1
Press any key to continue . . .
```



- The following is the answer for the flowchart diagram.



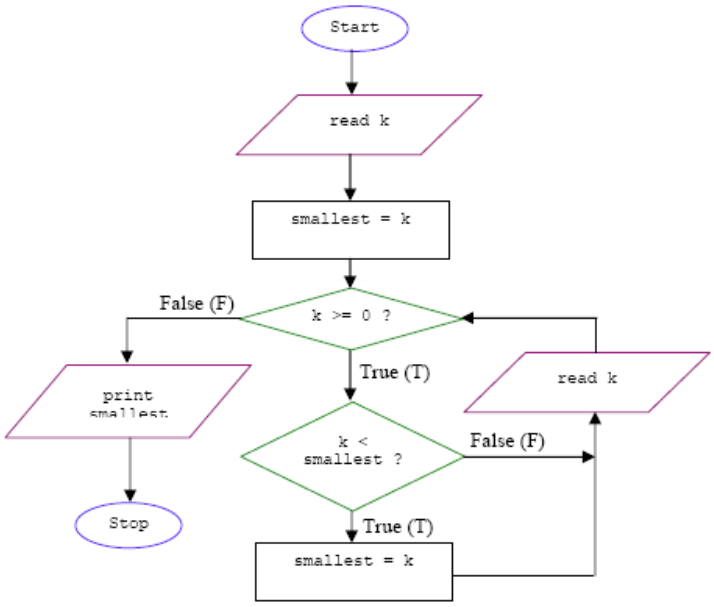
For each of these questions, choose from among the grades of A, B, C, D and F.

a. Which grades(s) are selected on the true side of k <= 59?
b. Which grades(s) are selected on the false side of k <= 59?
c. Which grades(s) are selected on the true side of k <= 89?
d. Which grades(s) are selected on the false side of k <= 89?
e. Which grades(s) are selected on the true side of k <= 69?
f. Which grades(s) are selected on the false side of k <= 69?
g. Which grades(s) are selected on the true side of k <= 79?
h. Which grades(s) are selected on the false side of k <= 79?

a. F.
b. A, B, C and D.
c. B, C and D.
d. A.
e. D.
f. B and C.
g. C.
h. B.

13. Run the following program and key in the following sample input (without the commas): 16, 21, 17, 43, 7, 52, -1. The program will determine the smallest number entered.

```
#include <stdio.h>

int main(void)
{
    int k, smallest;
    printf("Enter integers, when");
    printf(" done enter a ");
    printf("negative number\n");
    scanf_s("%d", &k, 1);
    // assign the first number to smallest variable
    smallest = k;
    // iterate while k >= 0
    for( ; k >= 0; )
    {
        // if the entered number is < smallest
        if(k < smallest)
            // then assign the number to smallest variable...
            smallest = k;
        // read the next input....repeat
        scanf_s("%d", &k, 1);
    }
    // print the smallest number...
    printf("The smallest number is %d\n", smallest);
    return 0;
}
```




```
Enter integers, when done enter a negative number
16 21 17 43 7 52 -1
The smallest number is 7
Press any key to continue . . .
```

a. Draw a tracechart for this experiment (left to you!).
b. What was the first value of the variable smallest?
c. The first time that the condition in the if statement was encountered, what were the values of k and smallest?
d. The second time that the if condition was tested, what were the values of k and smallest?
e. The third time that the if condition was tested, what were the values of k and smallest?
f. During the loop, the value of smallest was changed. What were the different values of smallest?
g. Does an if statement require a corresponding else statement? Why?
h. Is the scanf_s() executed inside the loop when the k < smallest is true or false, or irrespective of it?
i. If the data entered were 11, 22, 13, 19, 16, -1, how many times would smallest be changed?

a. Left for your assignment.
b. 16
c. k = 16, smallest =16.
d. k = 21, smallest = 16.
e. k = 17, smallest = 16.
f. 16 and 7.
g. Not really. It can be standalone in testing just a condition.
h. From the flowchart we can see that the scanf_s() executed inside the loop irrespective of k < smallest is True or False.
i. 0 time. It is already a smallest number entered as the first input.

To see the flow of this program clearer and used for troubleshooting you can add several line of codes as shown below.

```
#include <stdio.h>

int main(void)
{
    int k, smallest;
    printf("Enter integers, when");
    printf(" done enter a ");
    printf("negative number\n");
    scanf_s("%d", &k, 1);
    // assign the first number to smallest variable
    smallest = k;
    printf("smallest = %d, k = %d at pos1.\n", smallest, k);
    // iterate while k >= 0
    for( ; k >= 0; )
    {
        // if the entered number is < smallest
        printf("smallest = %d, k = %d at pos2.\n", smallest, k);
        if(k < smallest)
          // then assign the number to smallest variable...
          smallest = k;
        printf("smallest = %d, k = %d at pos3.\n", smallest, k);
        // read the next input....repeat
        scanf_s("%d", &k, 1);
        printf("smallest = %d, k = %d at pos4.\n", smallest, k);
    }
    // print the smallest number...
    printf("The smallest number is %d\n", smallest);
    return 0;
}
// Sample inputs: 16, 21, 17, 43, 7, 52, -1 and 11, 22, 13, 19, 16, -1
```

```
Enter integers, when done enter a negative number
16
smallest = 16, k = 16 at pos1.
smallest = 16, k = 16 at pos2.
smallest = 16, k = 16 at pos3.
21
smallest = 16, k = 21 at pos4.
smallest = 16, k = 21 at pos2.
smallest = 16, k = 21 at pos3.
17
smallest = 16, k = 17 at pos4.
smallest = 16, k = 17 at pos2.
smallest = 16, k = 17 at pos3.
43
smallest = 16, k = 43 at pos4.
smallest = 16, k = 43 at pos2.
smallest = 16, k = 43 at pos3.
7
smallest = 16, k = 7 at pos4.
smallest = 16, k = 7 at pos2.
smallest = 7, k = 7 at pos3.
52
smallest = 7, k = 52 at pos4.
smallest = 7, k = 52 at pos2.
smallest = 7, k = 52 at pos3.
-1
smallest = 7, k = -1 at pos4.
The smallest number is 7
Press any key to continue . . .
```

To:
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