HW10 Problem Set

CS-3020

Assignment
Deitel & Deitel Exercises 17.7, 18.10

HW10-1: (Deitel & Deitel Exercise 17.7)

17.7 *(Telephone-Number Word Generator)* Standard telephone keypads contain the digits zero through nine. The numbers two through nine each have three letters associated with them (Fig. 17.16). Many people find it difficult to memorize phone numbers, so they use the correspondence between digits and letters to develop seven-letter words that correspond to their phone numbers. For example, a person whose telephone number is 686-2377 might use the correspondence indicated in Fig. 17.16 to develop the seven-letter word "NUMBERS." Every seven-letter word corresponds to exactly one seven-digit telephone number. A restaurant wishing to increase its takeout business could surely do so with the number 825-3688 (i.e., "TAKEOUT").

Every seven-letter phone number corresponds to many different seven-letter words. Unfortunately, most of these words represent unrecognizable juxtapositions of letters. It's possible, however, that the owner of a barbershop would be pleased to know that the shop's telephone number, 424-7288, corresponds to "HAIRCUT." The owner of a liquor store would no doubt be delighted to find that the store's number, 233-7226, corresponds to "BEERCAN." A veterinarian with the phone number 738-2273 would be pleased to know that the number corresponds to the letters "PETCARE." An automotive dealership would be pleased to know that its phone number, 639-2277, corresponds to "NEWCARS."

Digit	Letter	Digit	Letter
2	A B C	6	M N O
3	D E F	7	P R S
4	G H I	8	T U V
5	J K L	9	W X Y Z

Fig. 17.16 | Letters that correspond to the numbers on a telephone keypad .

Write a GUI program that, given a seven-digit number, uses a `StreamWriter` object to write to a file every possible seven-letter word combination corresponding to that number. There are 2,187 (3^7) such combinations. Avoid phone numbers with the digits 0 and 1.

NOTE: The '7' key maps to the letters P,Q,R,S. The claim that there are 3^7 combinations is wrong and is not even consistent with the mapping shown in Fig 17.16. Keep this in mind when testing your code.

HW10 Problem Set

CS-3020

HW10-2: (Deitel & Deitel Exercise 18.10)

18.10 *(Quicksort)* The recursive sorting technique called quicksort uses the following basic algorithm for a one-dimensional array of values:

a) *Partitioning Step*: Take the first element of the unsorted array and determine its final location in the sorted array (i.e., all values to the left of the element in the array are less than the element, and all values to the right of the element in the array are greater than the element—we show how to do this below). We now have one element in its proper location and two unsorted subarrays.

b) *Recursive Step*: Perform *Step a* on each unsorted subarray.

Each time *Step a* is performed on a subarray, another element is placed in its final location in the sorted array, and two unsorted subarrays are created. When a subarray consists of one element, that element is in its final location (because a one-element array is already sorted).

The basic algorithm seems simple enough, but how do we determine the final position of the first element of each subarray? As an example, consider the following set of values (the element in bold is the partitioning element—it will be placed in its final location in the sorted array):

37 2 6 4 89 8 10 12 68 45

a) Starting from the rightmost element of the array, compare each element with **37** until an element less than **37** is found, then swap **37** and that element. The first element less than **37** is 12, so **37** and 12 are swapped. The new array is

12 2 6 4 89 8 10 *37* 68 45

Element 12 is in italics to indicate that it was just swapped with **37**.

b) Starting from the left of the array, but beginning with the element after 12, compare each element with **37** until an element greater than **37** is found—then swap **37** and that element. The first element greater than **37** is 89, so **37** and 89 are swapped. The new array is

12 2 6 4 *37* 8 10 *89* 68 45

c) Starting from the right, but beginning with the element before 89, compare each element with **37** until an element less than **37** is found—then swap **37** and that element. The first element less than **37** is 10, so **37** and 10 are swapped. The new array is

12 2 6 4 *10* 8 *37* 89 68 45

d) Starting from the left, but beginning with the element after 10, compare each element with **37** until an element greater than **37** is found—then swap **37** and that element. There are no more elements greater than **37**, so when we compare **37** with itself, we know that **37** has been placed in its final location of the sorted array. Every value to the left of **37** is smaller than it, and every value to the right of **37** is larger than it.

Once the partition has been applied on the previous array, there are two unsorted subarrays. The subarray with values less than 37 contains 12, 2, 6, 4, 10 and 8. The subarray with values greater than 37 contains 89, 68 and 45. The sort continues recursively, with both subarrays being partitioned in the same manner as the original array.

Based on the preceding discussion, write recursive method `QuickSortHelper` to sort a one-dimensional integer array. The method should receive as arguments a starting index and an ending index in the original array being sorted.

HW10 Problem Set

CS-3020

Grading Rubric

Each problem is worth 10 pts (score will be recorded as a percentage of that amount)

10% Properly submitted
10% Properly named
20% Adequate comments
10% Runs
20% Produces correct output
30% Effort evidenced by the submitted work