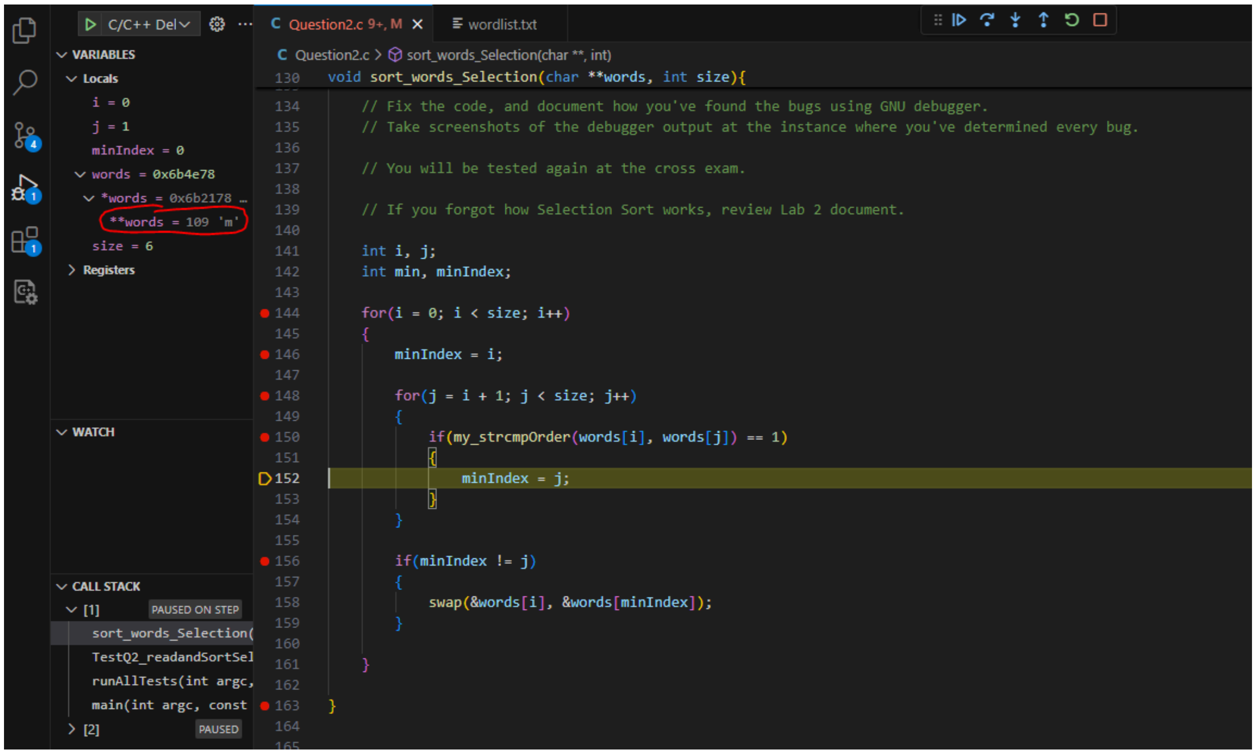
Lab3 Question 2 Debugging Report | xuej41 | 400515671

Bug #1 – Line 150: words[i] should be changed to words[minIndex]

The issue with using words[i] in the inner loop is that it fails to keep track of the smallest element found so far in the unsorted part of the array. In Selection Sort, we need to locate the minimum element in each pass and swap it with the element at the current position, i. To do this, we use minIndex to store the index of the smallest element found as we iterate.

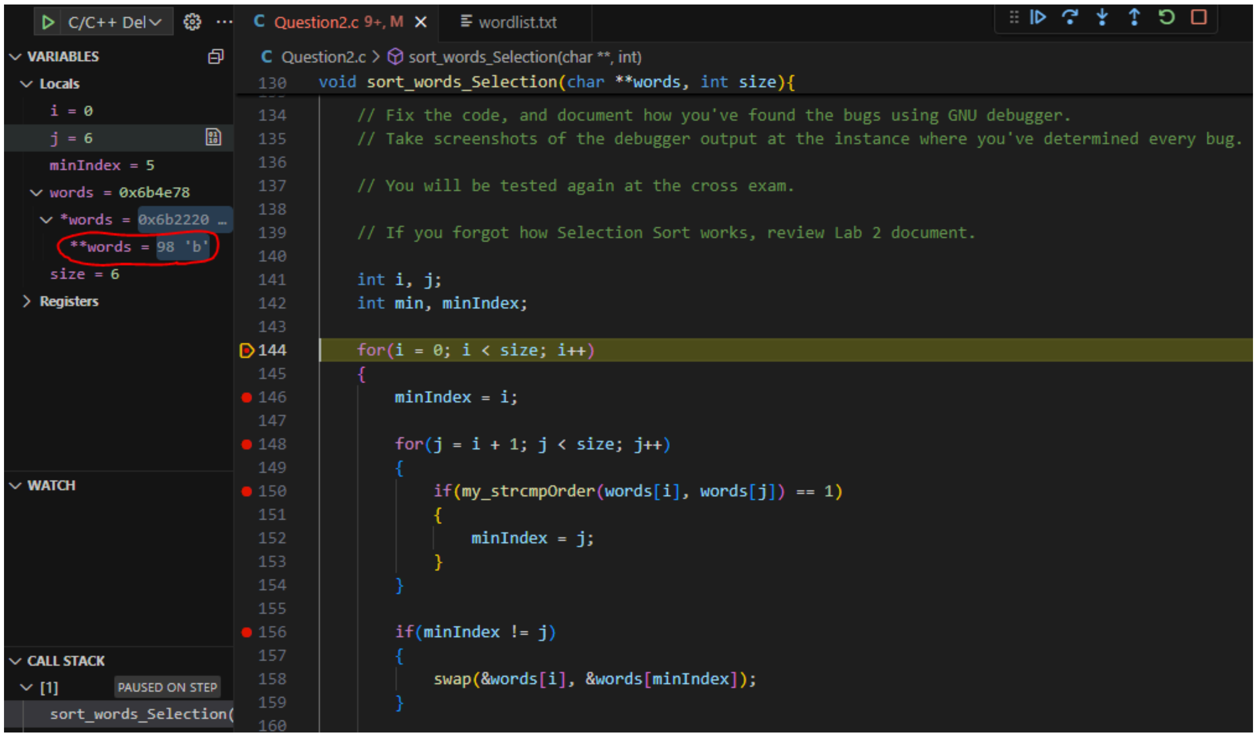
Watch what “m” in milan is replaced by:



```
i = 0
j = 1
minIndex = 0
words = 0x6b4e78
  *words = 0x6b2178 …
    **words = 109 'm'
size = 6
```

```
sort_words_Selection(
TestQ2_readandSortSel
runAllTests(int argc,
main(int argc, const
```

```
130  void sort_words_Selection(char **words, int size){
134      // Fix the code, and document how you've found the bugs using GNU debugger.
135      // Take screenshots of the debugger output at the instance where you've determined every bug.
136
137      // You will be tested again at the cross exam.
138
139      // If you forgot how Selection Sort works, review Lab 2 document.
140
141      int i, j;
142      int min, minIndex;
143
144      for(i = 0; i < size; i++)
145      {
146          minIndex = i;
147
148          for(j = i + 1; j < size; j++)
149          {
150              if(my_strcmpOrder(words[i], words[j]) == 1)
151              {
152                  minIndex = j;
153              }
154          }
155
156          if(minIndex != j)
157          {
158              swap(&words[i], &words[minIndex]);
159          }
160
161      }
162
163  }
164
```



```
VARIABLES
  Locals
    i = 0
    j = 6
    minIndex = 5
    words = 0x6b4e78
      *words = 0x6b2220 …
        **words = 98 'b'
    size = 6
  Registers
WATCH
CALL STACK
  [1]
    sort_words_Selection(
```

```c
130 void sort_words_Selection(char **words, int size){
134     // Fix the code, and document how you've found the bugs using GNU debugger.
135     // Take screenshots of the debugger output at the instance where you've determined every bug.
136 
137     // You will be tested again at the cross exam.
138 
139     // If you forgot how Selection Sort works, review Lab 2 document.
140 
141     int i, j;
142     int min, minIndex;
143 
144     for(i = 0; i < size; i++)
145     {
146         minIndex = i;
147 
148         for(j = i + 1; j < size; j++)
149         {
150             if(my_strcmpOrder(words[i], words[j]) == 1)
151             {
152                 minIndex = j;
153             }
154         }
155 
156         if(minIndex != j)
157         {
158             swap(&words[i], &words[minIndex]);
159         }
160 
```

As you can see, “m” in milan is replaced by “b” in banana, when it should have been replaced by “a” in apple. This is because using words[i] in the comparison would instead mean we’re always comparing with the element at i, rather than the current smallest element, which prevents the algorithm from correctly identifying the minimum.

By comparing words[minIndex] with words[j], minIndex will point to the smallest word seen so far, and update whenever it finds a smaller element.

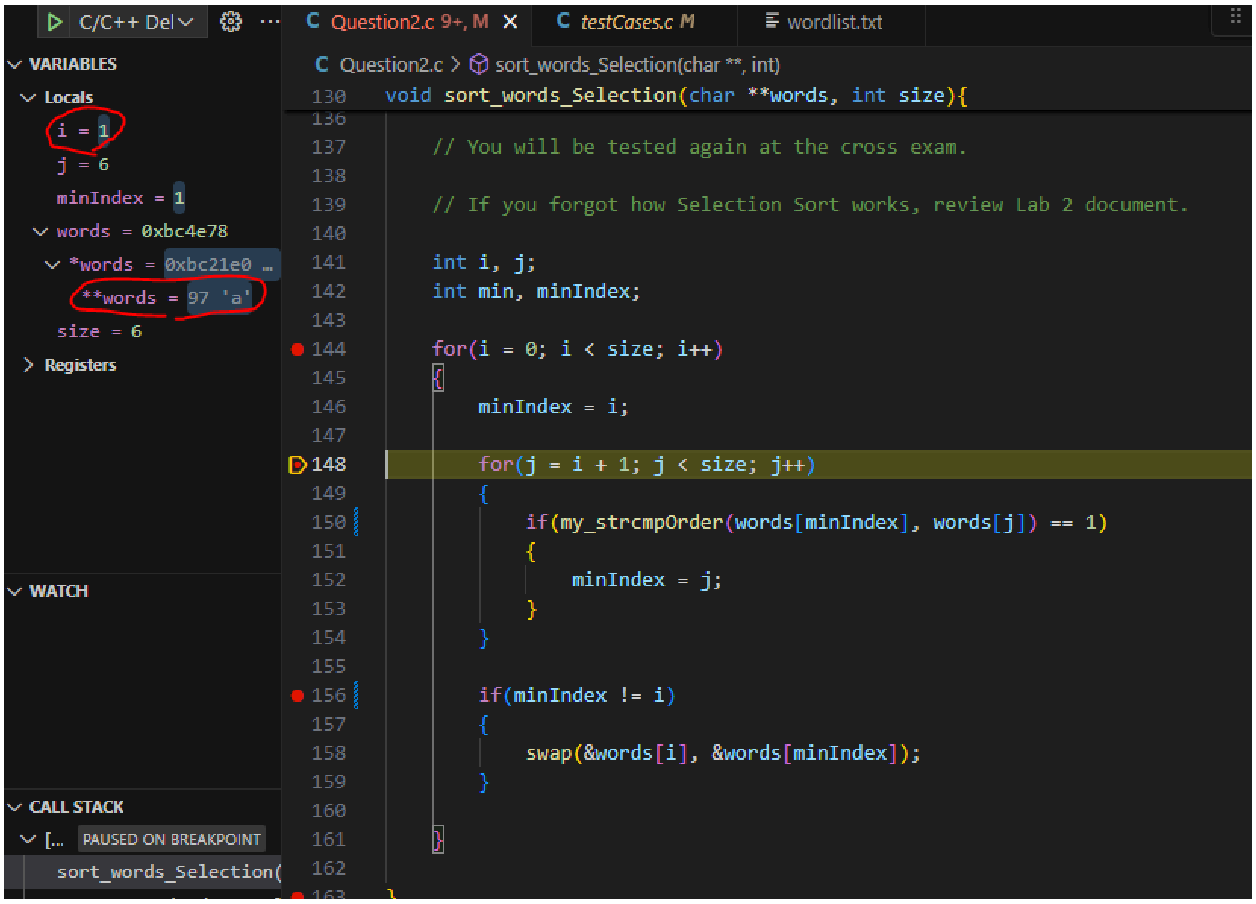
Bug #2 – Line 156: minIndex != j should be changed to minIndex != i

The condition if(minIndex != j) is incorrect because it does not properly check whether a swap is needed. The variable minIndex holds the index of the smallest element found during the inner loop. By the end of the inner loop, we need to check whether this smallest element’s index, minIndex, is different from i, not j, because i is the position we are looking to fill with the smallest value.

Having minIndex != j instead will mean that when the code gets to that line, j = size (as it was incremented to that size in the loop), so having minIndex != size will mess up the logic of the algorithm.

Changing the condition to if (minIndex != i) makes sure to only perform the swap if the smallest element is not already in the correct place.

After implementing these changes, you can see that the algorithm is running correctly. After 1 pass of the sorting algorithm (i = 1), “m” in milan has been correctly replaced by “a” in apple.



```
i = 1
j = 6
minIndex = 1
words = 0xbc4e78
*words = 0xbc21e0 …
**words = 97 'a'
size = 6
```

```
void sort_words_Selection(char **words, int size){

    // You will be tested again at the cross exam.

    // If you forgot how Selection Sort works, review Lab 2 document.

    int i, j;
    int min, minIndex;

    for(i = 0; i < size; i++)
    {
        minIndex = i;

        for(j = i + 1; j < size; j++)
        {
            if(my_strcmpOrder(words[minIndex], words[j]) == 1)
            {
                minIndex = j;
            }
        }

        if(minIndex != i)
        {
            swap(&words[i], &words[minIndex]);
        }

    }
```