PROBLEM SOLVING WITH C LABORATORY (UE19CS152)

MINI-PROJECT PHASE -2

PROJECT TITLE - PLAY FAIR CIPHER

Course Title: Problem Solving with C Laboratory		
Course code: UE19CS152		
Semester : II sem	Section:Q	Team Id:13
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SRN:PESIUG19CV008	Name:AMRITA J SINGH	

Description

In order to encrypt using the play fair cipher, a polybias square is drawn using a keyword. Firstly, the plain text is split into diagraph.

If two letters appear on same row, then replace each letter by the letter immediately to the right. If two letters appear on the same column, then replace the letter by the letter immediately below it. Otherwise, if two letters from the corners of a rectangle, then they are replaced by the corners present on the same row.

Encryption Technique
For the encryption process let us consider the following example:

Key: monarchy
Plaintext: instruments

The Playfair Cipher Encryption Algorithm:
The Algorithm consistes of 2 steps:
1.Generate the key Square(5×5):

- *The key square is a 5×5 grid of alphabets that acts as the key for encrypting the plaintext. Each of the 25 alphabets must be unique and one letter of the alphabet (usually J) is omitted from the table (as the table can hold only 25 alphabets). If the plaintext contains J, then it is replaced by I.*
- *The initial alphabets in the key square are the unique alphabets of the key in the order in which they appear followed by the remaining letters of the alphabet in order.*

1.For example:
The key is "**monarchy**" Thus the initial entires are **'m', 'o', 'n', 'a', 'r', 'c', 'h', 'y'** followed by remaining characters of **a-z(except 'j')** in that order.

M	O	N	A	R
C	H	Y	B	D
E	F	G	I	K
L	P	Q	S	T
U	V	W	X	Z

2.Algorithm to encrypt the plain text: *The plaintext is split into pairs of two letters (digraphs). If there is an odd number of letters, a Z is added to the last letter.*
For example:
PlainText: "instruments" **After Split:** 'in' 'st' 'ru' 'me' 'nt' 'sz'

Rules for Encryption:
•If both the letters are in the same column: *Take the letter below each one (going back to the top if at the bottom).*
For example:
Diagraph: "me" **Encrypted Text:** cl **Encryption:** m -> c e -> l

M	O	N	A	R
C	H	Y	B	D
E	F	G	I	K
L	P	Q	S	T
U	V	W	X	Z

If both the letters are in the same row: Take the letter to the right of each one (going back to the leftmost if at the rightmost position).**For example:**

•
Diagraph: "st" **Encrypted Text:** tl **Encryption:** s -> t t -> l

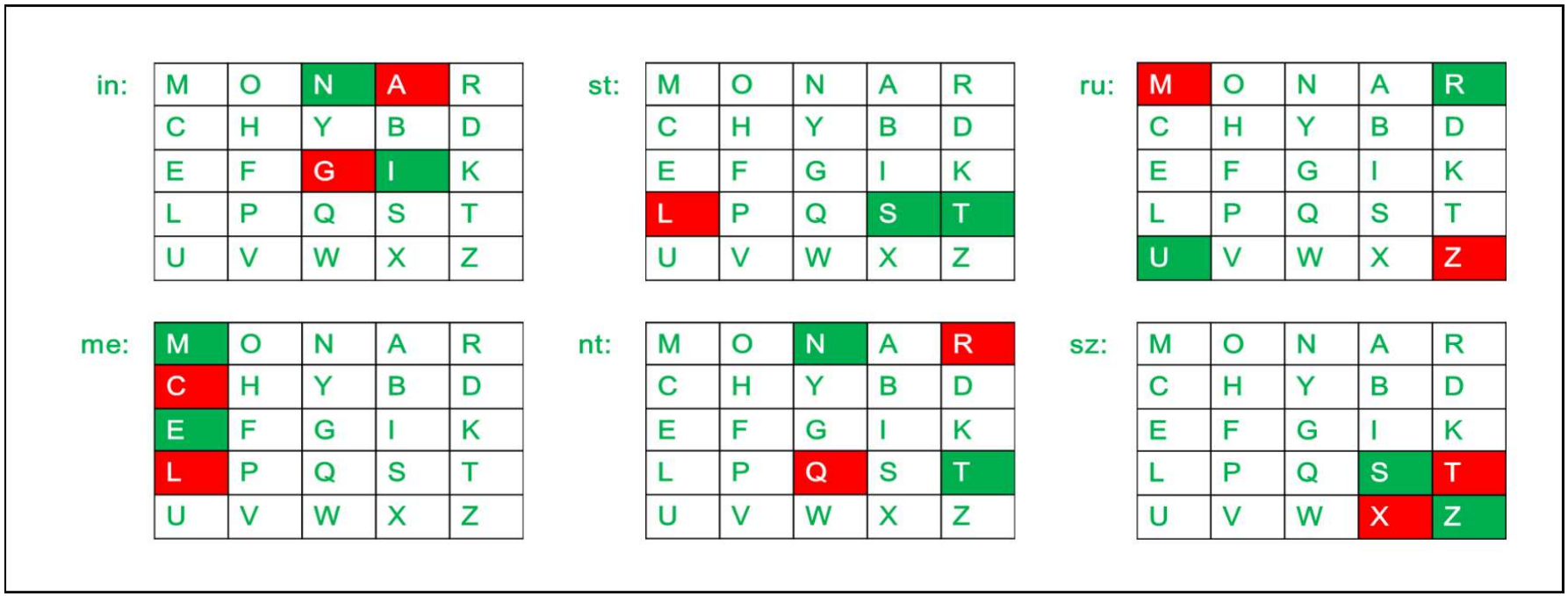
M	O	N	A	R
C	H	Y	B	D
E	F	G	I	K
L	P	Q	S	T
U	V	W	X	Z

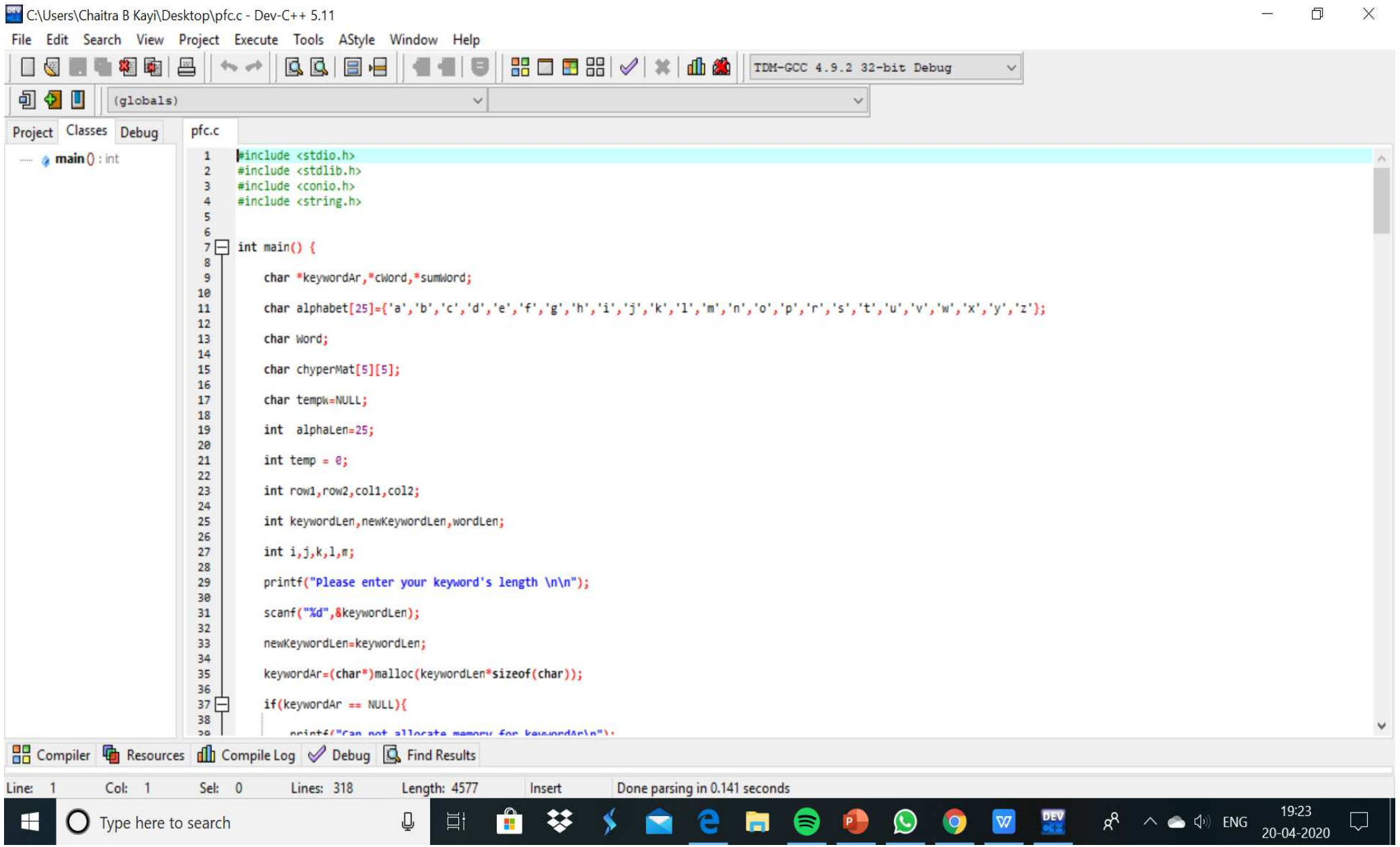
M	O	N	A	R
C	H	Y	B	D
E	F	G	I	K
L	P	Q	S	T
U	V	W	X	Z

•**If neither of the above rules is true**: Form a rectangle with the two letters and take the letters on the horizontal opposite corner of the rectangle.
For example:
Diagraph: "nt" **Encrypted Text:** rq **Encryption:** n -> r t -> q

For example:
Plain Text: "instrumentsz" **Encrypted Text:** gatlmzclrqtx **Encryption:**

i -> g n -> a s -> t t -> l r -> m u -> z m -> c e -> l n -> r t -> q s -> t z -> x




C:\Users\Chaitra B Kayi\Desktop\pfc.c - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
TDM-GCC 4.9.2 32-bit Debug
(globals)
Project Classes Debug
main () : int
pfc.c
#include <stdio.h>
#include <stdlib.h>
#include <conio.h>
#include <string.h>
int main() {
char *keywordAr,*cWord,*sumWord;
char alphabet[25]={'a','b','c','d','e','f','g','h','i','j','k','l','m','n','o','p','r','s','t','u','v','w','x','y','z'};
char Word;
char chyperMat[5][5];
char tempW=NULL;
int alphaLen=25;
int temp = 0;
int row1,row2,col1,col2;
int keywordLen,newKeywordLen,wordLen;
int i,j,k,l,m;
printf("Please enter your keyword's length \n\n");
scanf("%d",&keywordLen);
newKeywordLen=keywordLen;
keywordAr=(char*)malloc(keywordLen*sizeof(char));
if(keywordAr == NULL){
Compiler Resources Compile Log Debug Find Results
Line: 1 Col: 1 Sel: 0 Lines: 318 Length: 4577 Insert Done parsing in 0.141 seconds
Type here to search
ENG
19:23
20-04-2020

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TDM-GCC 4.9.2 32-bit Debug

(globals)

Project Classes Debug

main () : int

pfc.c

```
37      if(keywordAr == NULL){
38
39          printf("Can not allocate memory for keywordAr\n");
40
41          return -1;
42
43      }
44
45      printf("Please enter your keyword (with lowercase letters) \n\n");
46
47      scanf("%s",keywordAr);
48
49      //Making '0' in alphabet array's some positions for given key word's letter
50
51      for(i=0;i<keywordLen;i++){
52
53          for(j=0;j<25;j++){
54
55              if(keywordAr[i] == alphabet[j]){
56
57                  alphabet[j]='0';
58
59              }
60
61          }
62      }
63      //Assign all '0' elements in alphabet to end of alphabet array
64      for(i=0;i<25;i++){
65
66          if(alphabet[i] =='0' && alphabet[i+1] != '0'){
67
68
69              for(j=i;j<24;j++){
70
71                  alphabet[j]=alphabet[j+1];
72
73              }
74              alphaLen--;
```

Compiler Resources Compile Log Debug Find Results

Line: 2 Col: 1 Sel: 0 Lines: 318 Length: 4577 Insert Done parsing in 0.141 seconds

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TDM-GCC 4.9.2 32-bit Debug

(globals)

Project Classes Debug

main() : int

pfc.c

```
76          }else if (alphabet[i] =='0' && alphabet[i+1] == '0'){
77
78              for(j=i;j<24;j++){
79
80                  alphabet[j]=alphabet[j+1];
81
82              }
83              alphaLen--;
84              i--;
85          }
86
87
88      }
89
90      //Check for same letters in keyword
91
92      for(i=0;i<keywordLen-1;i++){
93
94          for(j=i+1;j<keywordLen;j++){
95
96              if(keywordAr[i] == keywordAr[j]){
97
98                  keywordAr[j] = '0' ;
99
100
101             }
102
103         }
104
105     }
106
107     for(i=0;i<keywordLen;i++){
108
109         if(keywordAr[i] == '0' && keywordAr[i+1]!= '0'){
110
111             for(j=i;j<keywordLen;j++){
112
113                 keywordAr[j]=keywordAr[j+1];
```

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(globals)

Project Classes Debug

main () : int

pfc.c

```
109         if(keywordAr[i] == '0' && keywordAr[i+1]!= '0'){
110
111             for(j=i;j<keywordLen;j++){
112
113                 keywordAr[j]=keywordAr[j+1];
114
115             }
116             newKeywordLen--;
117         }
118         else if(keywordAr[i] == '0' && keywordAr[i+1] == '0'){
119
120             for(j=i;j<keywordLen;j++){
121
122                 keywordAr[j]=keywordAr[j+1];
123
124             }
125             newKeywordLen--;
126             i--;
127
128         }
129
130
131     }
132
133     k=0;
134     l=0;
135
136     //Preparing Cryption Matrix
137
138     for(i=0;i<5;i++){
139
140         for(j=0;j<5;j++){
141
142             if(k<newKeywordLen){
143
144                 chyperMat[i][j]=keywordAr[k];
145                 k++;
146
147             }else{
```

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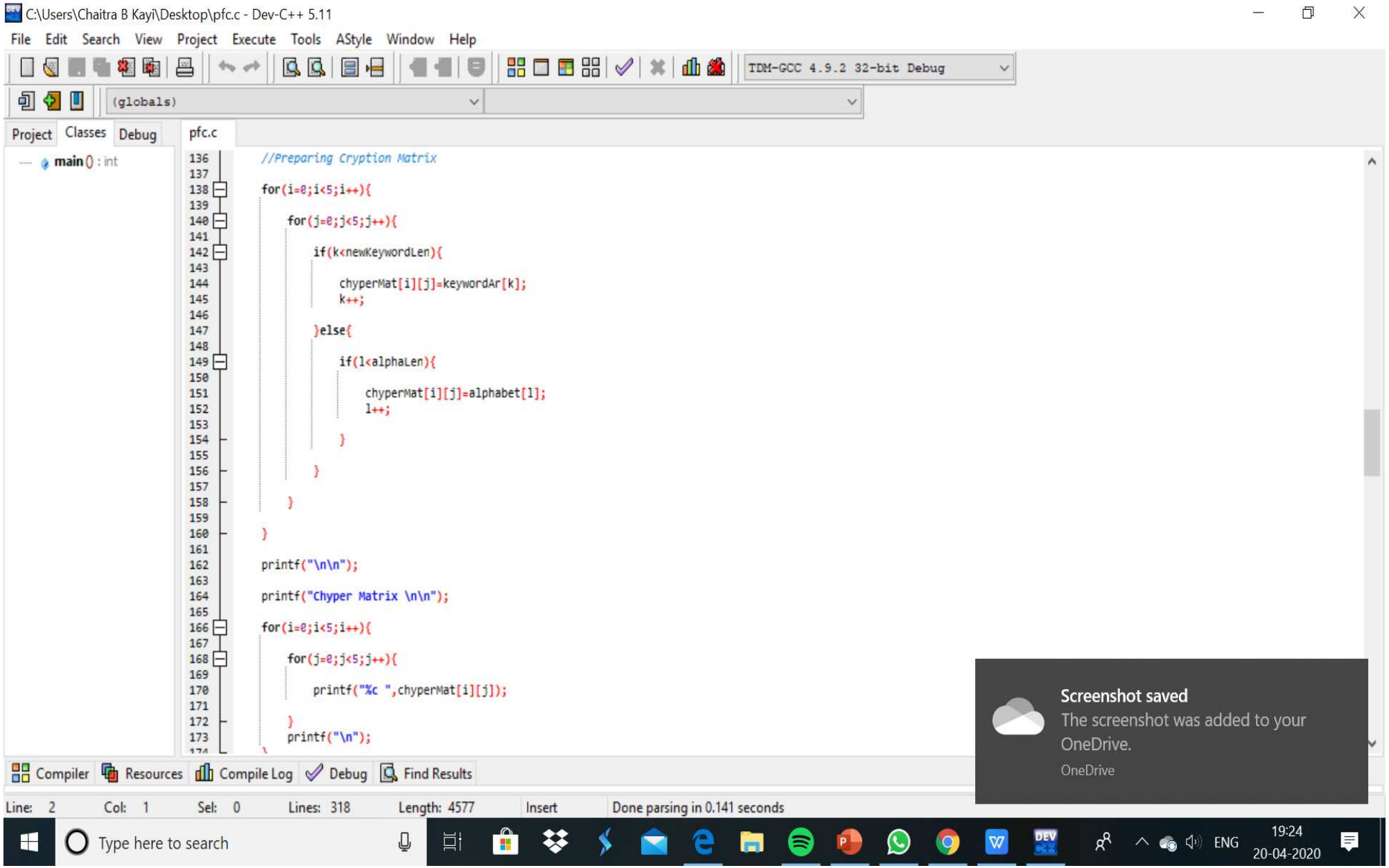
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File Edit Search View Project Execute Tools AStyle Window Help
TDM-GCC 4.9.2 32-bit Debug
(globals)
Project Classes Debug
main() : int
pfc.c
//Preparing Cryption Matrix
for(i=0;i<5;i++){
for(j=0;j<5;j++){
if(k<newKeywordLen){
chyperMat[i][j]=keywordAr[k];
k++;
}else{
if(l<alphaLen){
chyperMat[i][j]=alphabet[l];
l++;
}
}
}
}
printf("\n\n");
printf("Chyper Matrix \n\n");
for(i=0;i<5;i++){
for(j=0;j<5;j++){
printf("%c ",chyperMat[i][j]);
}
printf("\n");
Compiler Resources Compile Log Debug Find Results
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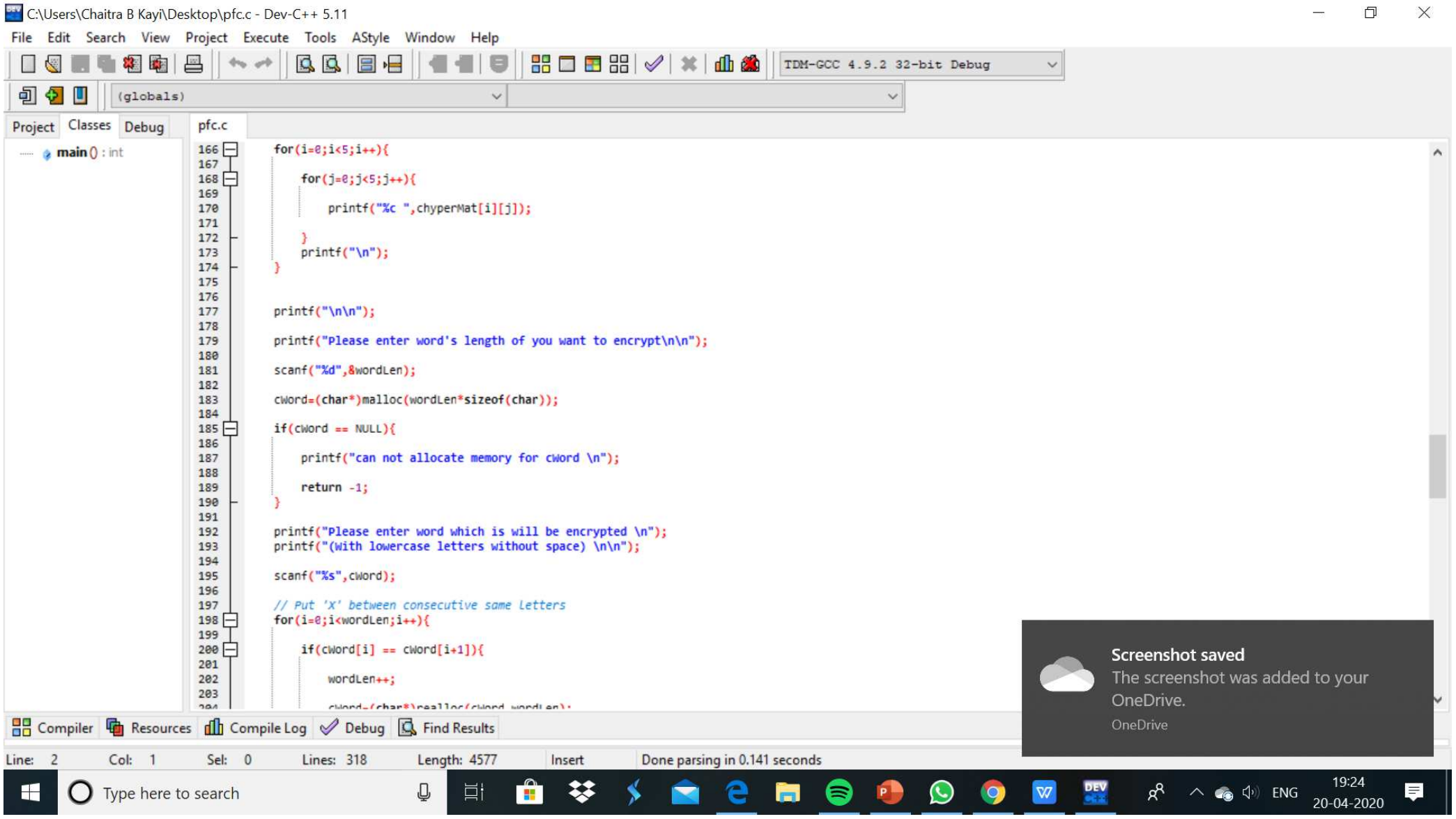
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TDM-GCC 4.9.2 32-bit Debug
(globals)
Project Classes Debug
main () : int
pfc.c
for(i=0;i<5;i++){
for(j=0;j<5;j++){
printf("%c ",chyperMat[i][j]);
}
printf("\n");
}
printf("\n\n");
printf("Please enter word's length of you want to encrypt\n\n");
scanf("%d",&wordLen);
cWord=(char*)malloc(wordLen*sizeof(char));
if(cWord == NULL){
printf("can not allocate memory for cWord \n");
return -1;
}
printf("Please enter word which is will be encrypted \n");
printf("(With lowercase letters without space) \n\n");
scanf("%s",cWord);
// Put 'X' between consecutive same letters
for(i=0;i<wordLen;i++){
if(cWord[i] == cWord[i+1]){
wordLen++;
Compiler Resources Compile Log Debug Find Results
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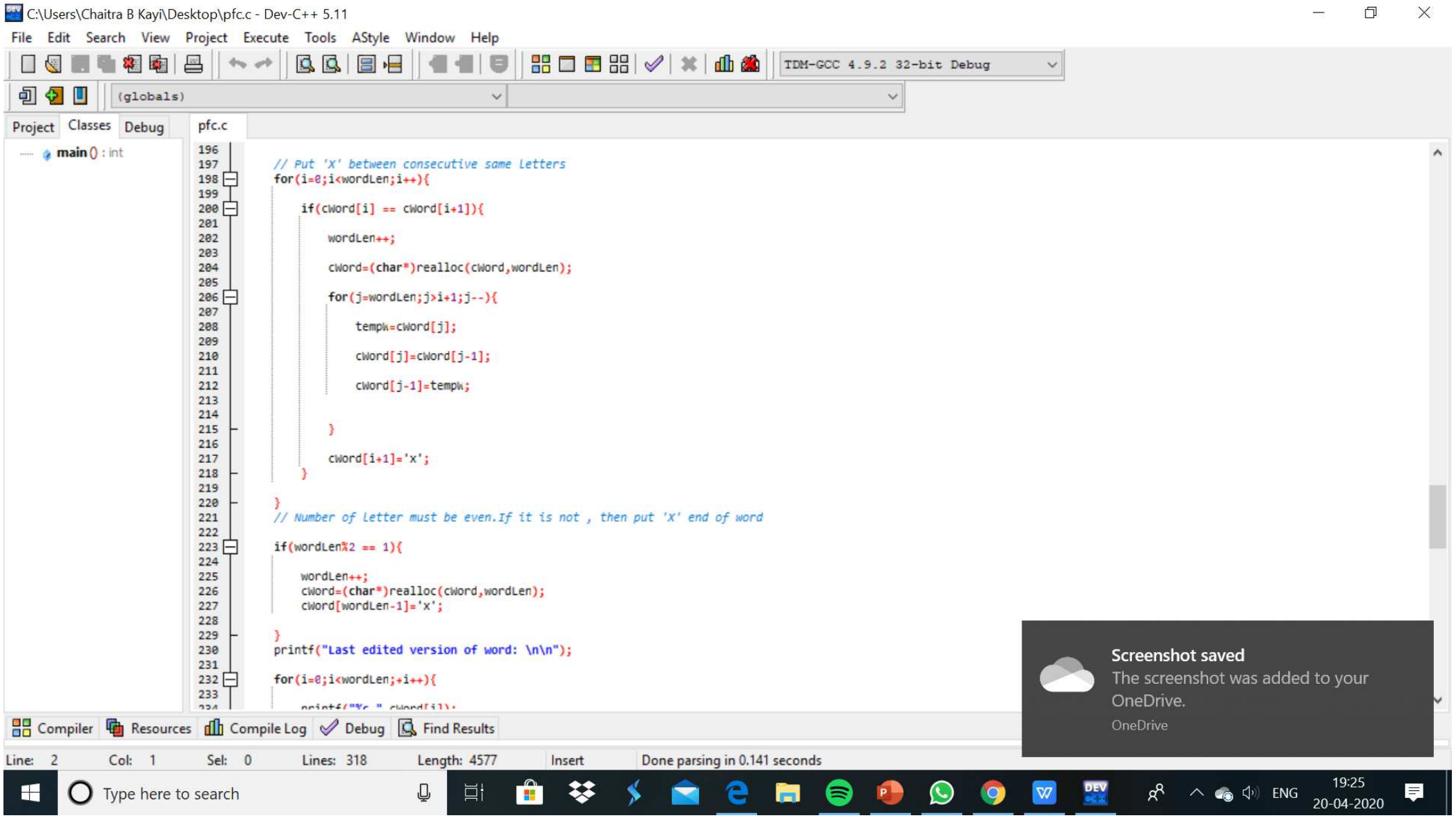
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TDM-GCC 4.9.2 32-bit Debug
(globals)
Project Classes Debug
main () : int
pfc.c
196 // Put 'X' between consecutive same letters
197 for(i=0;i<wordLen;i++){
198 if(cWord[i] == cWord[i+1]){
199 wordLen++;
200 cWord=(char*)realloc(cWord,wordLen);
201 for(j=wordLen;j>i+1;j--){
202 tempW=cWord[j];
203 cWord[j]=cWord[j-1];
204 cWord[j-1]=tempW;
205 }
206 cWord[i+1]='x';
207 }
208 }
209 // Number of letter must be even.If it is not , then put 'X' end of word
210 if(wordLen%2 == 1){
211 wordLen++;
212 cWord=(char*)realloc(cWord,wordLen);
213 cWord[wordLen-1]='x';
214 }
215 printf("Last edited version of word: \n\n");
216 for(i=0;i<wordLen;+i++){
Compiler Resources Compile Log Debug Find Results
Line: 2 Col: 1 Sel: 0 Lines: 318 Length: 4577 Insert Done parsing in 0.141 seconds
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TDM-GCC 4.9.2 32-bit Debug

(globals)

Project Classes Debug

main () : int

pfc.c

```
229     }
230     printf("Last edited version of word: \n\n");
231
232     for(i=0;i<wordLen;+i++){
233
234         printf("%c ",cWord[i]);
235
236     }
237
238     printf("\n\n");
239
240     sumWord=(char*)malloc(wordLen*sizeof(char));
241
242     if(sumWord == NULL){
243
244         printf("can not allocate memory for sumWord ");
245         return -1;
246
247     }
248
249     //Cryption Process
250
251     for(i=0;i<wordLen;i++){
252
253         for(j=0;j<5;j++){
254
255             for(m=0;m<5;m++){
256
257                 if(chyperMat[j][m] == cWord[i]){
258
259                     row1 = j;
260                     col1 = m;
261
262                 }
263                 else if(chyperMat[j][m] == cWord[i+1]){
264
265                     row2= j;
266                     col2= m;
```

Compiler Resources Compile Log Debug Find Results

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TDM-GCC 4.9.2 32-bit Debug

(globals)

Project Classes Debug

main() : int

pfc.c

```
250
251     for(i=0;i<wordLen;i++){
252
253         for(j=0;j<5;j++){
254
255             for(m=0;m<5;m++){
256
257                 if(chyperMat[j][m] == cWord[i]){
258
259                     row1 = j;
260                     col1 = m;
261
262                 }
263                 else if(chyperMat[j][m] == cWord[i+1]){
264
265                     row2= j;
266                     col2= m;
267
268                 }
269
270             }
271
272         }
273
274         //If cryptionWord's consecutive letters in  in same row
275
276         if(row1==row2){
277
278             sumWord[i]=chyperMat[row1][(col1+1)%5];
279
280             sumWord[i+1]=chyperMat[row1][(col2+1)%5];
281
282         }
283         //If cryptionWord's consecutive letters in  in same coloumn
284         else if(col1==col2){
285
286             sumWord[i]=chyperMat[(row1+1)%5][col1];
287
288             sumWord[i+1]=chyperMat[(row2+1)%5][col1];
```

Compiler Resources Compile Log Debug Find Results

ine: 2 Col: 1 Sel: 0 Lines: 318 Length: 4577 Insert Done parsing in 0.141 seconds

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TDM-GCC 4.9.2 32-bit Debug

(globals)

Project Classes Debug

main () : int

pfc.c

```
281
282         }
283         //If cryptionWord's consecutive letters in  in same coloumn
284         else if(col1==col2){
285
286             sumWord[i]=chyperMat[(row1+1)%5][col1];
287
288             sumWord[i+1]=chyperMat[(row2+1)%5][col1];
289
290         }
291         else{
292
293             sumWord[i]=chyperMat[row1][col2];
294
295             sumWord[i+1]=chyperMat[row2][col1];
296
297         }
298
299         i++;
300
301     }
302
303
304
305
306     printf("CRYPTED WORD: \n\n");
307
308     for(i=0;i<wordLen;i++){
309         printf("%c ",sumWord[i]);
310     }
311
312     free(sumWord);
313     free(cWord);
314     free(keywordAr);
315
316
317     return 0;
318 }
```

Compiler Resources Compile Log Debug Find Results

Line: 2 Col: 1 Sel: 0 Lines: 318 Length: 4577 Insert Done parsing in 0.141 seconds

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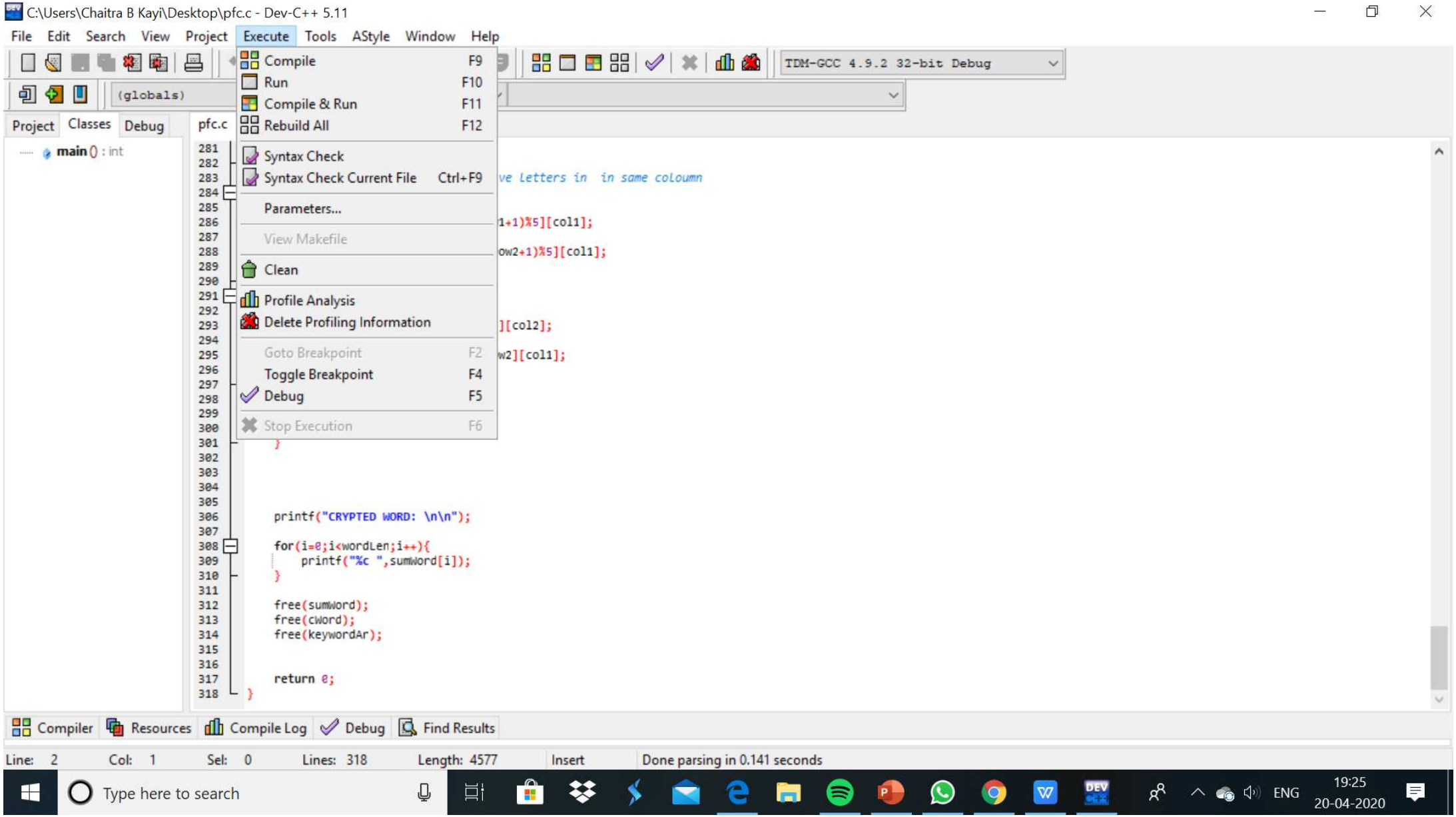
C:\Users\Chaitra B Kayi\Desktop\pfc.c - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
Compile F9
Run F10
Compile & Run F11
Rebuild All F12
Syntax Check
Syntax Check Current File Ctrl+F9
Parameters...
View Makefile
Clean
Profile Analysis
Delete Profiling Information
Goto Breakpoint F2
Toggle Breakpoint F4
Debug F5
Stop Execution F6
TDM-GCC 4.9.2 32-bit Debug
(globals)
Project Classes Debug
pfc.c
main() : int
printf("CRYPTED WORD: \n\n");
for(i=0;i<wordLen;i++){
printf("%c ",sumWord[i]);
free(sumWord);
free(cWord);
free(keywordAr);
return 0;
Compiler Resources Compile Log Debug Find Results
Line: 2 Col: 1 Sel: 0 Lines: 318 Length: 4577 Insert Done parsing in 0.141 seconds
Type here to search
ENG
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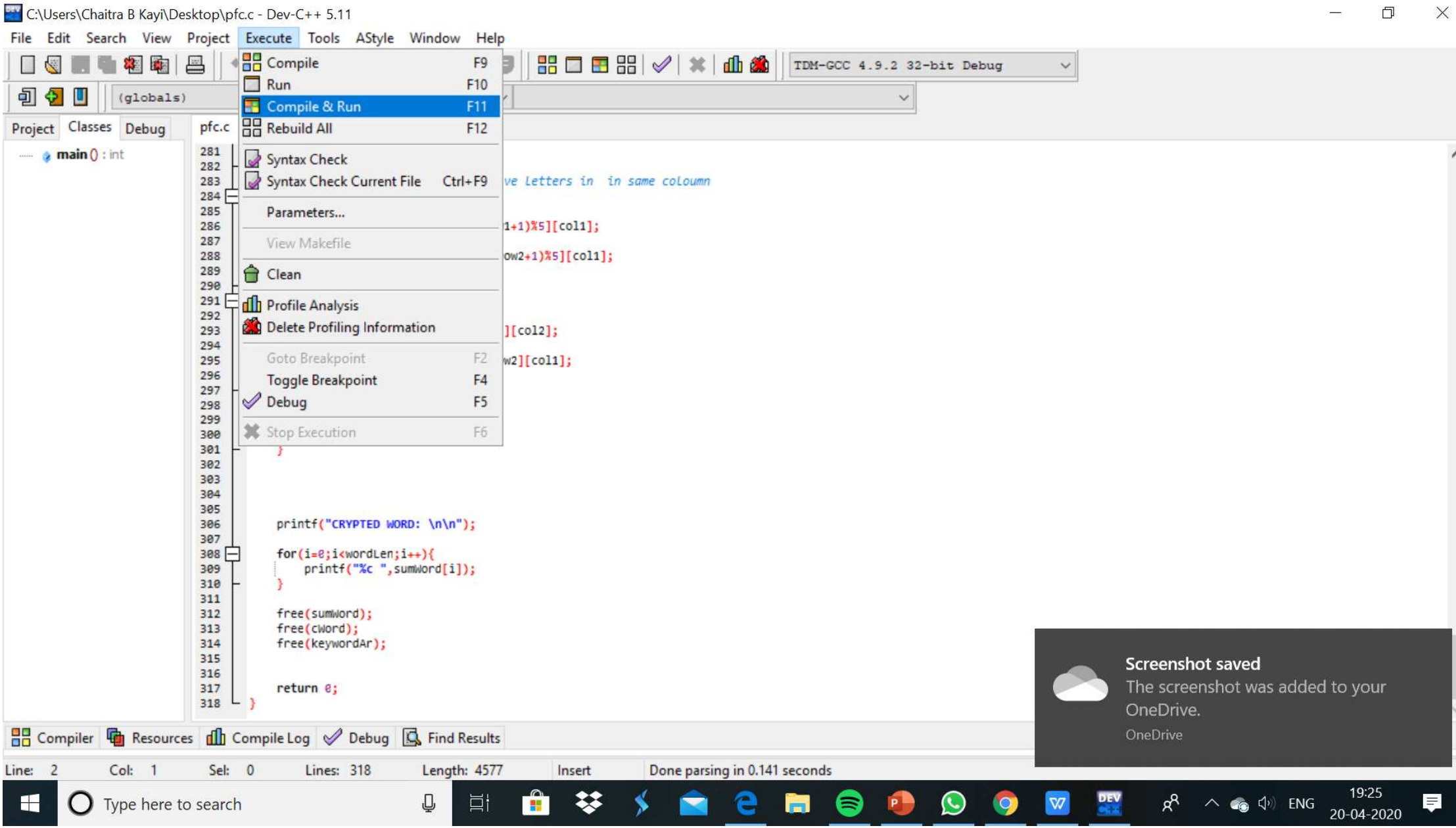
C:\Users\Chaitra B Kayi\Desktop\pfc.c - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
Compile F9
Run F10
Compile & Run F11
Rebuild All F12
Syntax Check
Syntax Check Current File Ctrl+F9
Parameters...
View Makefile
Clean
Profile Analysis
Delete Profiling Information
Goto Breakpoint F2
Toggle Breakpoint F4
Debug F5
Stop Execution F6
TDM-GCC 4.9.2 32-bit Debug
(globals)
Project Classes Debug
main() : int
pfc.c
ve letters in in same coloumn
1+1)%5][col1];
ow2+1)%5][col1];
][col2];
w2][col1];
printf("CRYPTED WORD: \n\n");
for(i=0;i<wordLen;i++){
printf("%c ",sumWord[i]);
}
free(sumWord);
free(cWord);
free(keywordAr);
return 0;
}
Compiler Resources Compile Log Debug Find Results
Line: 2 Col: 1 Sel: 0 Lines: 318 Length: 4577 Insert Done parsing in 0.141 seconds
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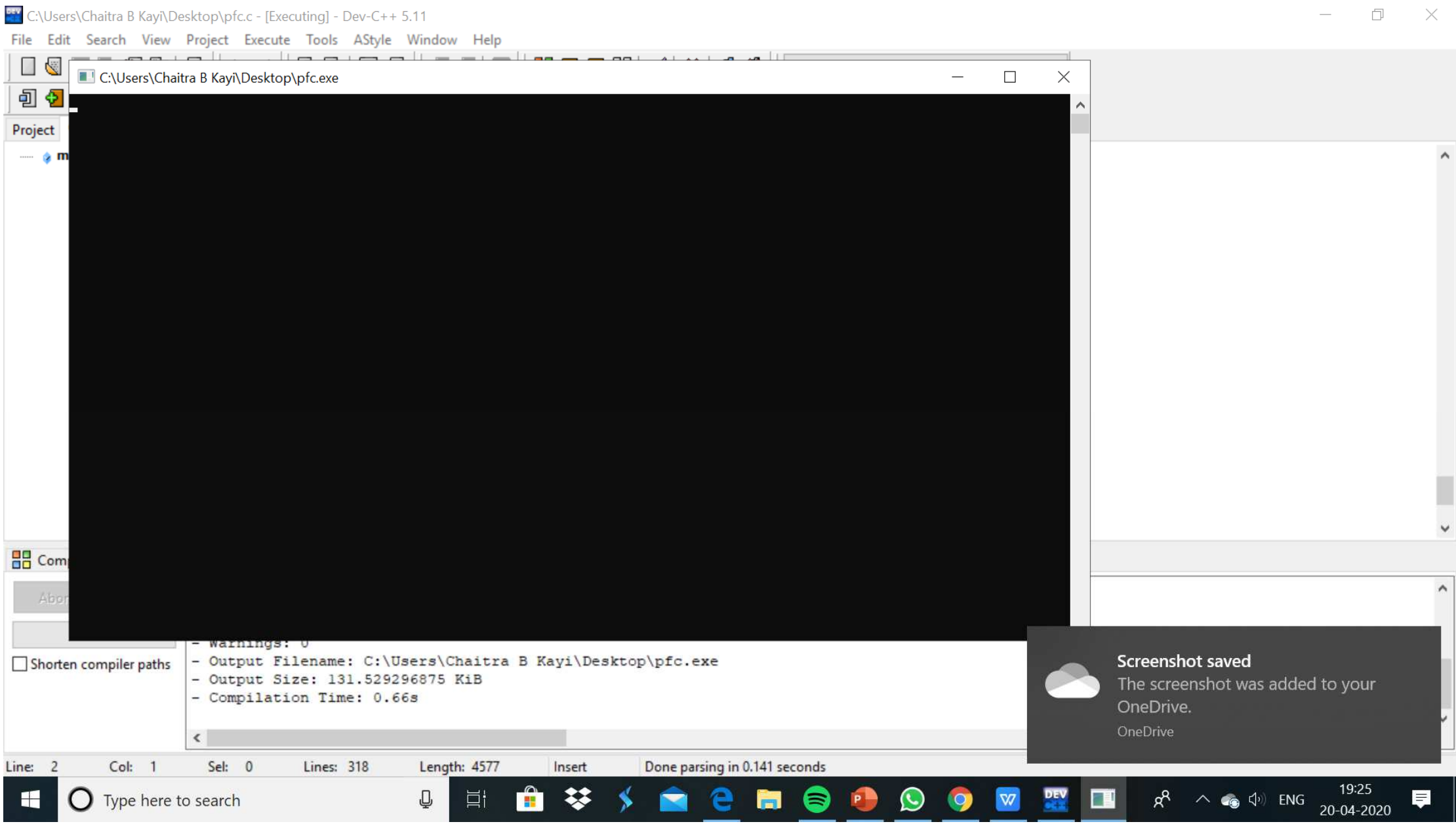
C:\Users\Chaitra B Kayi\Desktop\pfc.c - [Executing] - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
C:\Users\Chaitra B Kayi\Desktop\pfc.exe
Project
Shorten compiler paths
- Warnings: 0
- Output Filename: C:\Users\Chaitra B Kayi\Desktop\pfc.exe
- Output Size: 131.529296875 KiB
- Compilation Time: 0.66s
Line: 2 Col: 1 Sel: 0 Lines: 318 Length: 4577 Insert Done parsing in 0.141 seconds
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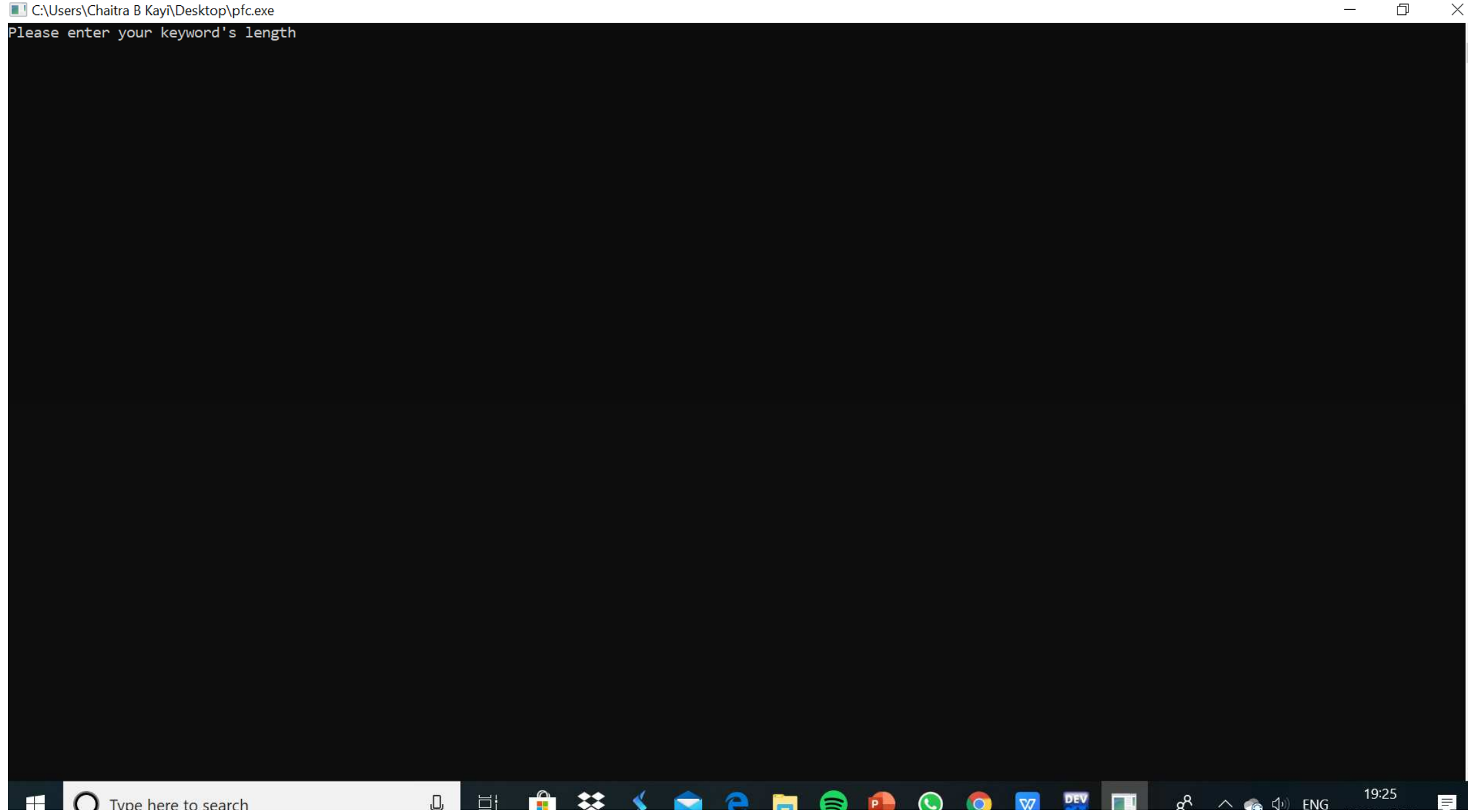
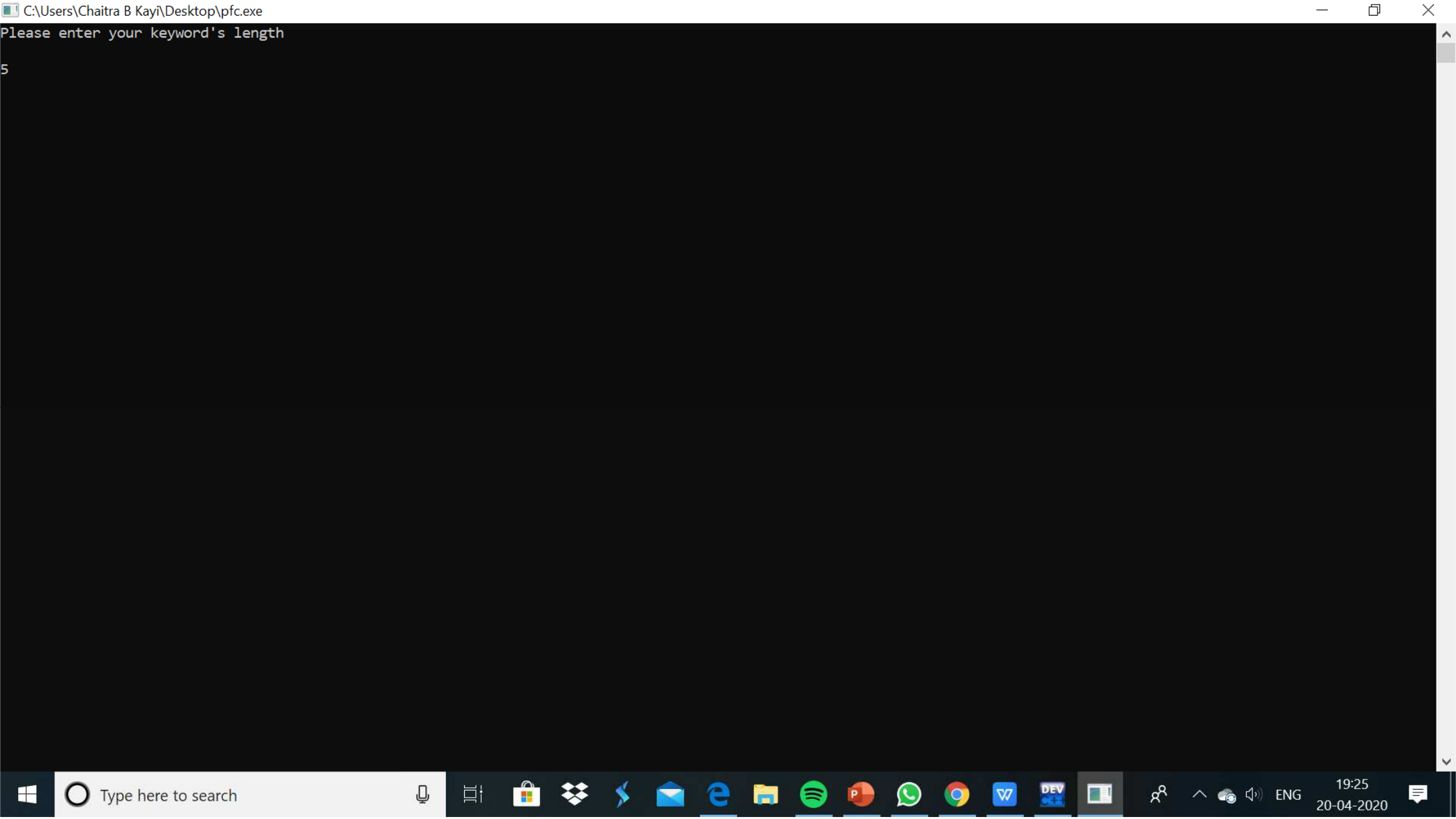
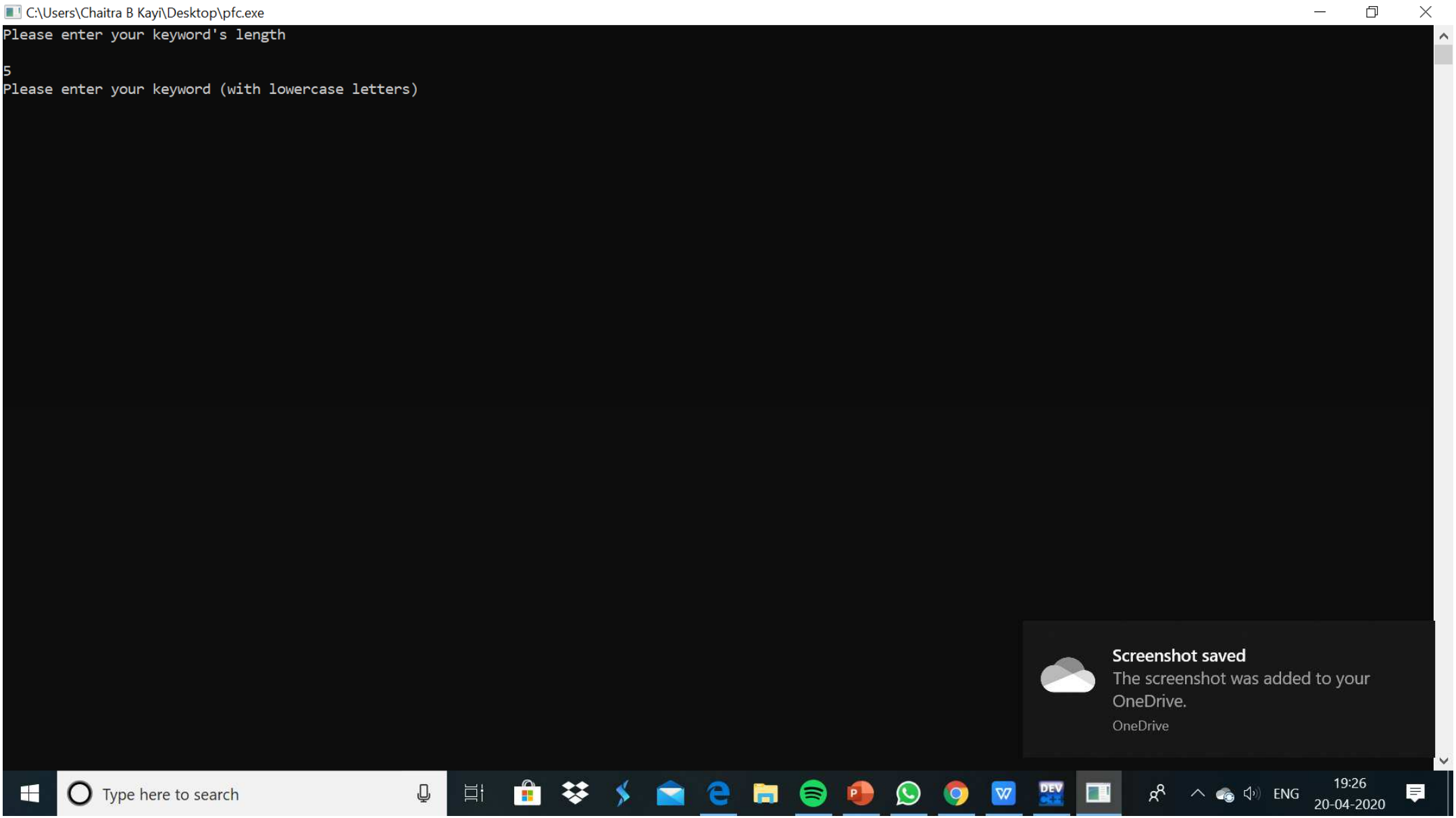

C:\Users\Chaitra B Kayi\Desktop\pfc.exe
Please enter your keyword's length
Type here to search
ENG
19:25


C:\Users\Chaitra B Kayi\Desktop\pfc.exe
Please enter your keyword's length
5
Type here to search
ENG
19:25
20-04-2020


C:\Users\Chaitra B Kayi\Desktop\pfc.exe
Please enter your keyword's length
5
Please enter your keyword (with lowercase letters)
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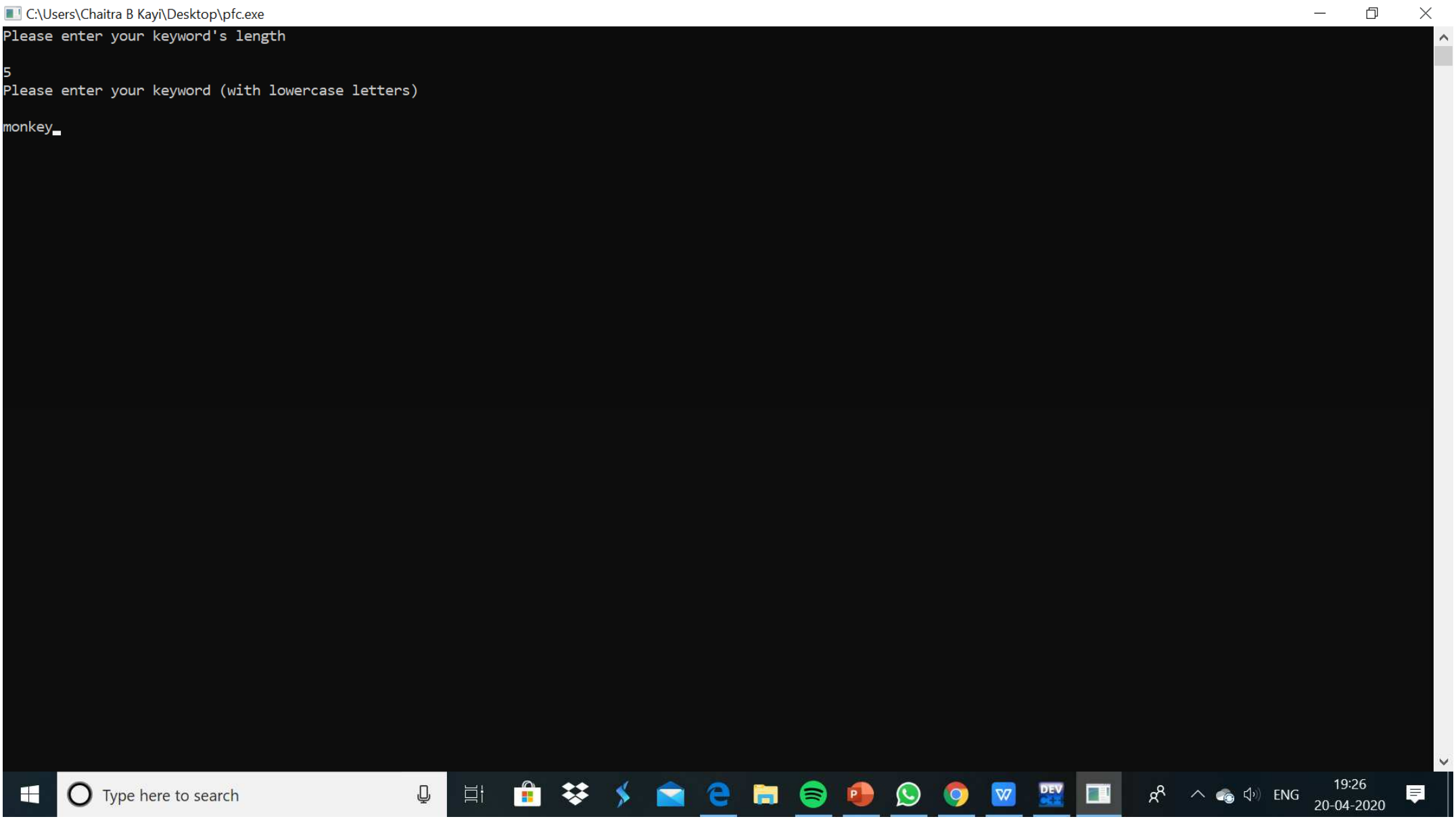
C:\Users\Chaitra B Kayi\Desktop\pfc.exe
Please enter your keyword's length
5
Please enter your keyword (with lowercase letters)
monkey
Type here to search
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C:\Users\Chaitra B Kayi\Desktop\pfc.exe

```
Please enter your keyword's length

5
Please enter your keyword (with lowercase letters)

monkey


Chyper Matrix

m o n k e
a b c d f
g h i j l
p r s t u
v w x y z


Please enter word's length of you want to encrypt
```

C:\Users\Chaitra B Kayi\Desktop\pfc.exe

```
Please enter your keyword's length

5
Please enter your keyword (with lowercase letters)

monkey


Chyper Matrix

m o n k e
a b c d f
g h i j l
p r s t u
v w x y z


Please enter word's length of you want to encrypt

5
Please enter word which is will be encrypted
(With lowercase letters without space)
```

C:\Users\Chaitra B Kayi\Desktop\pfc.exe

```
Please enter your keyword's length

5
Please enter your keyword (with lowercase letters)

monkey


Chyper Matrix

m o n k e
a b c d f
g h i j l
p r s t u
v w x y z


Please enter word's length of you want to encrypt

5
Please enter word which is will be encrypted
(With lowercase letters without space)

games
```

C:\Users\Chaitra B Kayi\Desktop\pfc.exe

```
Please enter your keyword's length

5
Please enter your keyword (with lowercase letters)

monkey


Chyper Matrix

m o n k e
a b c d f
g h i j l
p r s t u
v w x y z


Please enter word's length of you want to encrypt

5
Please enter word which is will be encrypted
(With lowercase letters without space)

games
Last edited version of word:

g a m e s x

CRYPTED WORD:

p g o m x n
--------------------------------
Process exited after 83.38 seconds with return value 0
Press any key to continue . . .
```

THANK YOU