Sri Lanka Institute of Information Technology

Foundations of Algorithms – IE2072

Submitted by:

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Date of submission: 29 / 05 / 2021

Q1 –

Question 1

Given a string containing digits from 2-9 inclusive, return all possible letter combinations that the number could represent. Return the answer in any order.

A mapping of digit to letters (just like on the telephone buttons) is given below. Note that 1 does not map to any letters.

Example 1:

Input: digits = "23"

Output: ["ad","ae","af","bd","be","bf","cd","ce","cf"]

Example 2:

Input: digits = ""

Output: []

Example 3:

Input: digits = "2"

Output: ["a","b","c"]

Constraints:

- 0 <= digits.length <= 4
- digits[i] is a digit in the range ['2', '9'].

Q1 Source code :

Source code developed using C++ language

```
#include<iostream>

#include <bits/stdc++.h>

using namespace std;

#include<stdlib.h>

#include<vector>


//declaring functions

void vecprint(vector<string> &pp);

void create_combination(string num, vector<string>&result, string
pac[], int c, string l);

vector<string> comb(string num);



int main()
```

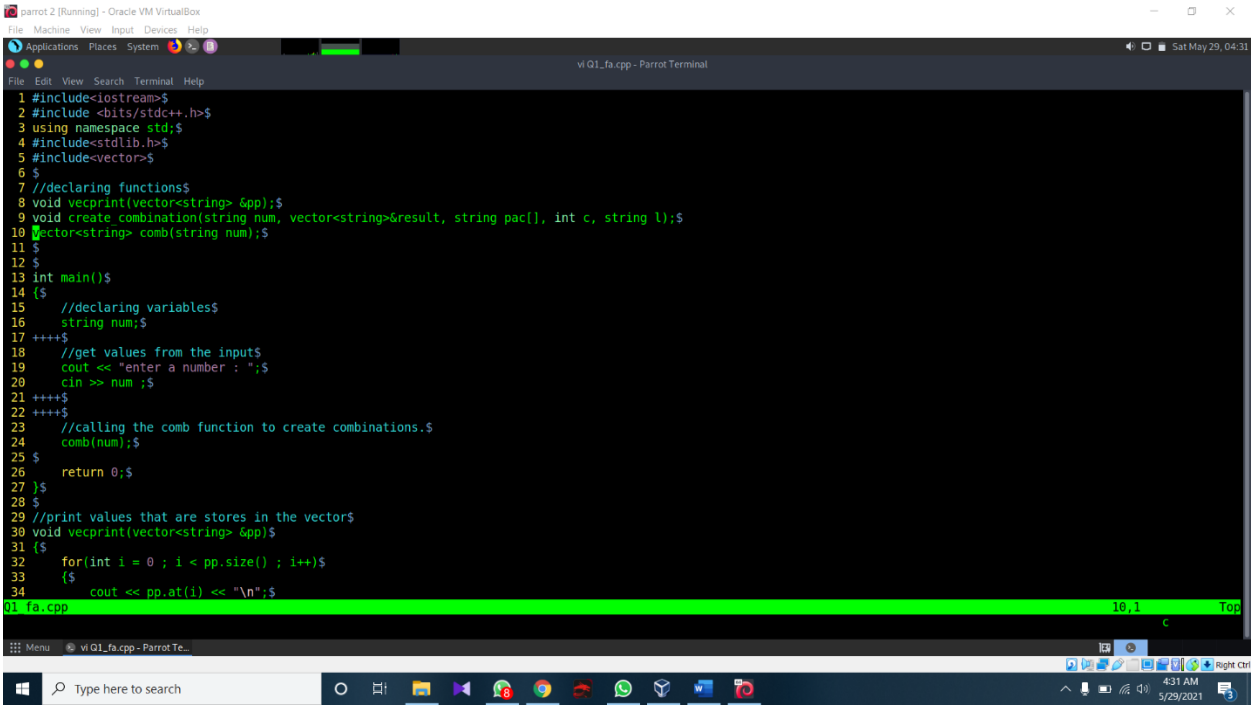
```
{
    //declaring variables
    string num;

    //get values from the input
    cout << "enter a number : ";
    cin >> num ;



    //calling the comb function to create combinations.
    comb(num);

    return 0;
}

//print values that are stores in the vector
void vecprint(vector<string> &pp)
{
    for(int i = 0 ; i < pp.size() ; i++)
    {
```

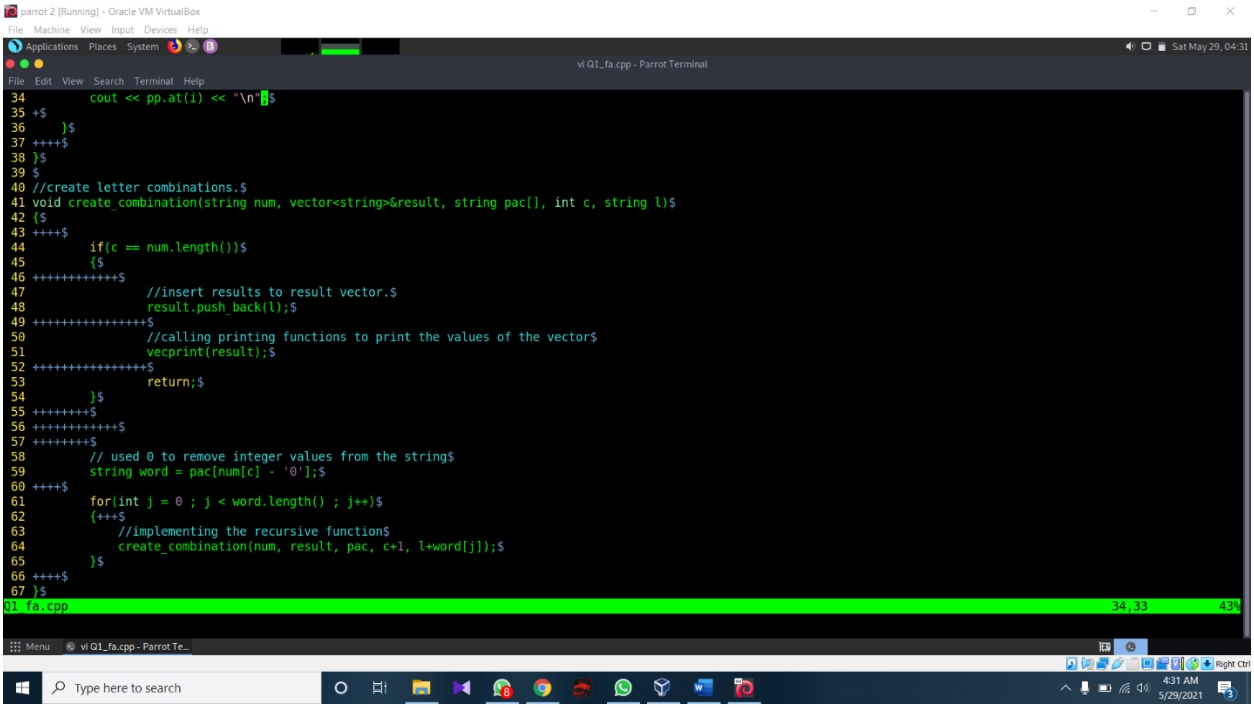
```
        cout << pp.at(i) << "\n";


    }


}


//create letter combinations.

void create_combination(string num, vector<string>&result, string
pac[], int c, string l)

{


        if(c == num.length())

        {


                //insert results to result vector.

                result.push_back(l);


                //calling printing functions to print the values of the vector

                vecprint(result);
```

```
            return;
        }



        // used 0 to remove integer values from the string
        string word = pac[num[c] - '0'];

        for(int j = 0 ; j < word.length() ; j++)
        {
            //implementing the recursive function
            create_combination(num, result, pac, c+1, l+word[j]);
        }

}

vector<string> comb(string num)
{
    //declaring a vector variable
     vector<string>result;
```

```
    //map data to a string array
    string pace[10] =
{"","","abc","def","ghi","jkl","mno","pqrs","tuv","wxyz"};


    //check the length of the number is 0 or not.
    if(num.length()==0)
    {
        return result;
    }

    create_combination(num, result, pace, 0,"");
    return result;



}
```

Image of source code




parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places System
Sat May 29, 04:31
vi Q1_fa.cpp - Parrot Terminal
File Edit View Search Terminal Help
cout << pp.at(i) << "\n";$
}$
}$
//create letter combinations.$
void create_combination(string num, vector<string>&result, string pac[], int c, string l)$
{$
if(c == num.length())$
{$
//insert results to result vector.$
result.push_back(l);$
//calling printing functions to print the values of the vector$
vecprint(result);$
return;$
}$
// used 0 to remove integer values from the string$
string word = pac[num[c] - '0'];$
for(int j = 0 ; j < word.length() ; j++)$
{$
//implementing the recursive function$
create_combination(num, result, pac, c+1, l+word[j]);$
}$
}$
Q1_fa.cpp 34,33 43%
Menu
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4:31 AM
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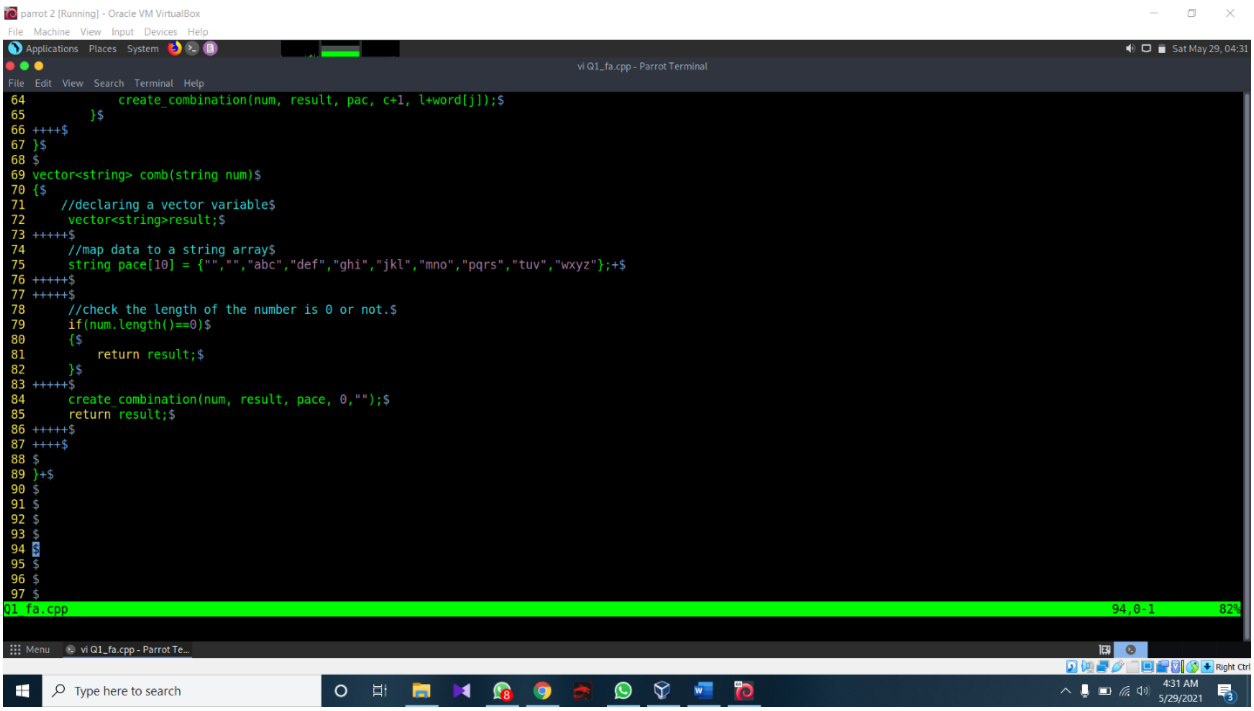
parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places System
Sat May 29, 04:31
vi Q1_fa.cpp - Parrot Terminal
File Edit View Search Terminal Help
create_combination(num, result, pac, c+1, l+word[j]);$
}$
}$
vector<string> comb(string num)$
{$
//declaring a vector variable$
vector<string>result;$
//map data to a string array$
string pace[10] = {"","","abc","def","ghi","jkl","mno","pqrs","tuv","wxyz"};$
//check the length of the number is 0 or not.$
if(num.length()==0)$
{$
return result;$
}$
create_combination(num, result, pace, 0,"");$
return result;$
}$
Q1_fa.cpp 94,0-1 82%
Menu
vi Q1_fa.cpp - Parrot Te...
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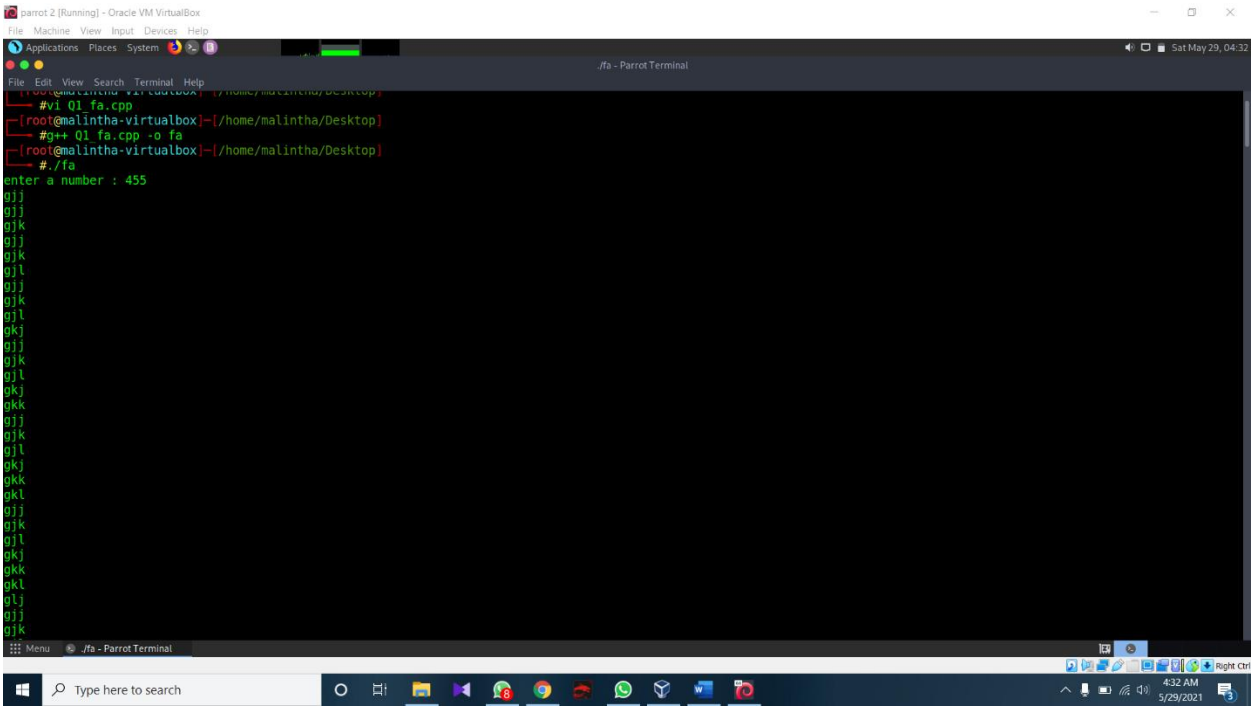
Output of Q1


parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places System
Sat May 29, 04:32
./fa - Parrot Terminal
File Edit View Search Terminal Help
#vi Q1_fa.cpp
[root@malintha-virtualbox]-[/home/malintha/Desktop]
#g++ Q1_fa.cpp -o fa
[root@malintha-virtualbox]-[/home/malintha/Desktop]
#./fa
enter a number : 455
gjj
gjj
gjk
gjj
gjk
gjl
gjj
gjk
gjl
gkj
gjj
gjk
gjl
gkj
gkk
gjj
gjk
gjl
gkj
gkk
gkl
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gjk
gjl
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gkk
gkl
glj
gjj
gjk
Menu
./fa - Parrot Terminal
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5/29/2021

Question 2

Given an input string (s) and a pattern (p), implement regular expression matching with support for '.' and '*' where:

- • '.' Matches any single character.
- • '*' Matches zero or more of the preceding element.

The matching should cover the entire input string (not partial).

Example 1:

Input: s = "aa", p = "a"

Output: false

Explanation: "a" does not match the entire string "aa".

Example 2:

Input: s = "aa", p = "a*"

Output: true

Explanation: '*' means zero or more of the preceding element, 'a'. Therefore, by repeating 'a' once, it becomes "aa".

Example 3:

Input: s = "ab", p = ".*"

Output: true

Explanation: ".*" means "zero or more (*) of any character (.)".

Example 4:

Input: s = "aab", p = "c*a*b"

Output: true

Explanation: c can be repeated 0 times, a can be repeated 1 time. Therefore, it matches "aab".

Example 5:

Input: s = "mississippi", p = "mis*is*p*."

Output: false

Constraints:

- 0 <= s.length <= 20
- 0 <= p.length <= 30
- s contains only lowercase English letters.
- p contains only lowercase English letters, '.', and '*'.
- It is guaranteed for each appearance of the character '*', there will be a previous valid character to match.

Q2 Source code

```
#include <stdio.h>

#include<iostream>

#include<string.h>

using namespace std;


//declaring the function
```

```
bool checker(string s, string p);

bool checkchars(string s);

bool checkpattn(string p);


int main()

{

    //declaring variables

    string s,p;


    //inserting inputs for string and pattern.

    cout << "please enter the string : ";

    cin >> s;


    cout << "enter the pattern : ";

    cin >> p;


    // validating the user inputs by callin checkchars and checkpattn functions.

    if(checkchars(s) == 1 || checkpattn(p) == 1 || p[0] == '*' || s.length() < 0 || s.length() > 20 || p.length() < 0 || p.length() > 30)

    {
```

```
        cout << "invalid input";


            return -1;
    }



    else
    {
        //calling the checker function to check wheather the number is match for the pattern
        if(checker(s,p) == 0)
        {
            cout << "False \n";
        }


        else
        if(checker(s,p) == 1)
        {
            cout << "True \n";
```

```
        }



    }

        return 0;
}


//check the pattern matches the string
bool checker(string s, string p)
{
    if((p.size() > 1) && p[1] == '*')
    {
        //check recursive function is true
        if(checker(s,p.substr(2)))
        {

            return true;
```

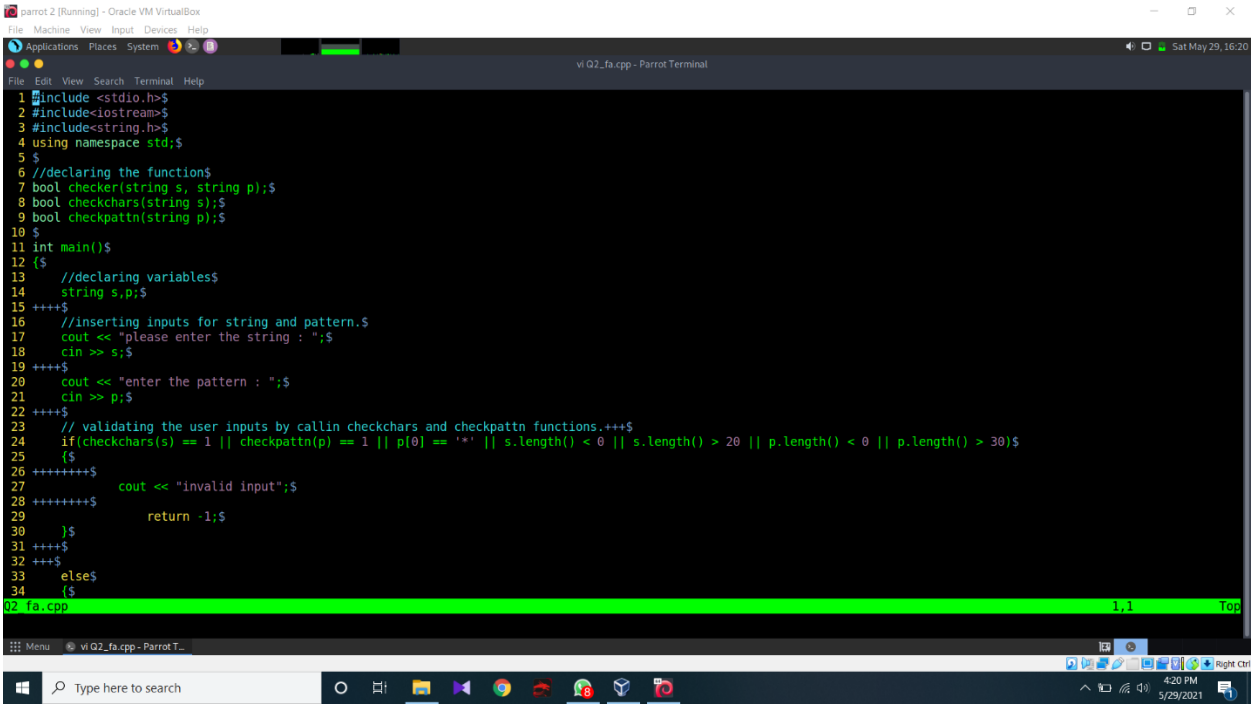
```
    }

    if((p[0] == '.'||p[0] == s[0]) && s.length() > 0)
    {
        //implementing recursive function
        return checker(s.substr(1),p);
    }

    return false;


}


if(p.size() == 0)
{

    return s.size() == 0;
```

```
}


else
{
    if((p[0] == '.' || p[0] == s[0]) && s.size() > 0)
    {
        //substr - use to remove the check character of the string.
        //example : s = abb - s.substr(1) = bb
        //implementing the recursive function
        return checker(s.substr(1),p.substr(1));
    }

    return false;


}
```

```
}


//check all the character are in lowecase in the strings
bool checkchars(string s)
{
    for(int i = 0 ; i < s.length() ; i++)
    {
       if(s[i] < 97 || s[i] > 122)
       {
           return true;
       }


    }
}

//check all the character are in loewrcase in pattern
bool checkpattn(string p)
{
```

```
    for (int i = 0 ; i < p.length() ; i++)
    {
        if (isupper(p[i]) || isdigit(p[i]))
        {
            return true;
        }

    }

}
```

Image of source code


parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places System
Sat May 29, 16:20
vi Q2_fa.cpp - Parrot Terminal
File Edit View Search Terminal Help
#include <stdio.h>$
#include<iostream>$
#include<string.h>$
using namespace std;$
$
//declaring the function$
bool checker(string s, string p);$
bool checkchars(string s);$
bool checkpattn(string p);$
$
int main()$
{$
//declaring variables$
string s,p;$
++++$
//inserting inputs for string and pattern.$
cout << "please enter the string : ";$
cin >> s;$
++++$
cout << "enter the pattern : ";$
cin >> p;$
++++$
// validating the user inputs by callin checkchars and checkpattn functions.+++$
if(checkchars(s) == 1 || checkpattn(p) == 1 || p[0] == '*' || s.length() < 0 || s.length() > 20 || p.length() < 0 || p.length() > 30)$
{$
++++++++$
cout << "invalid input";$
++++++++$
return -1;$
}$
++++$
+++$
else$
{$
Q2_fa.cpp 1,1 Top
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vi Q2_fa.cpp - Parrot T...
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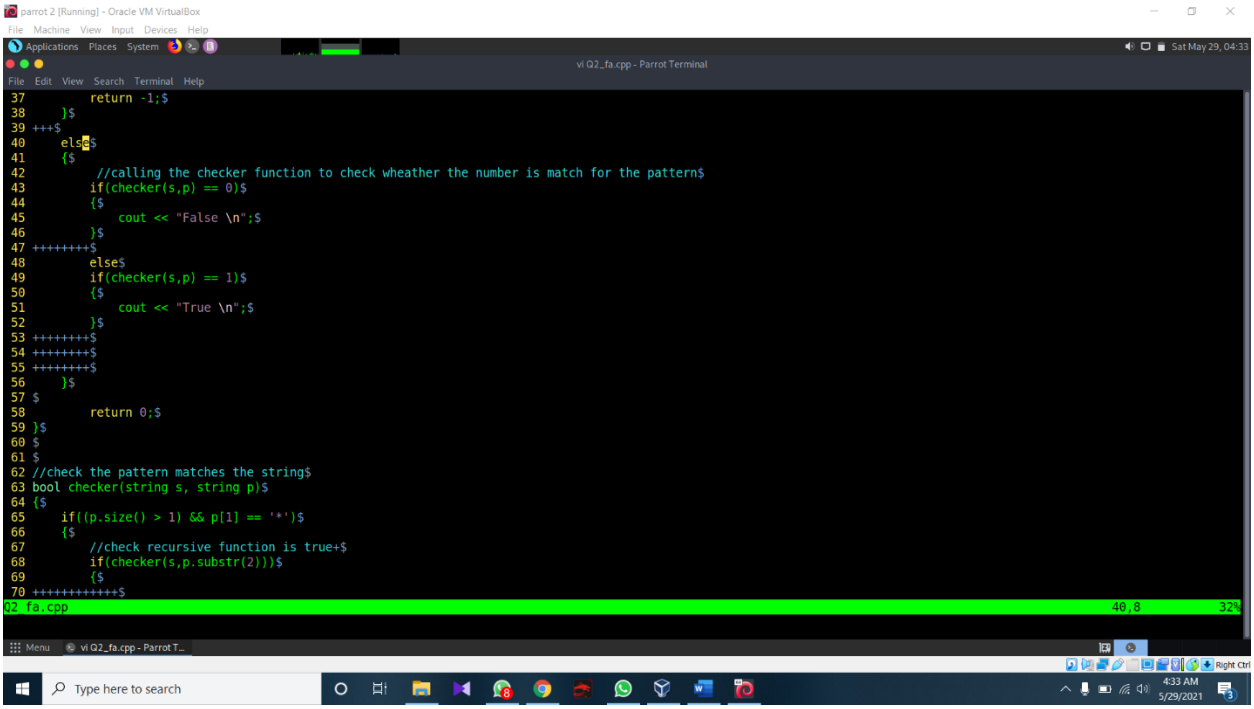
parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places System
Sat May 29, 04:33
vi Q2_fa.cpp - Parrot Terminal
File Edit View Search Terminal Help
return -1;$
}$
+++$
else$
{$
//calling the checker function to check wheather the number is match for the pattern$
if(checker(s,p) == 0)$
{$
cout << "False \n";$
}$
++++++++$
else$
if(checker(s,p) == 1)$
{$
cout << "True \n";$
}$
++++++++$
++++++++$
++++++++$
}$
$
return 0;$
}$
$
$
//check the pattern matches the string$
bool checker(string s, string p)$
{$
if((p.size() > 1) && p[1] == '*')$
{$
//check recursive function is true+$
if(checker(s,p.substr(2)))$
{$
++++++++++++$
Q2_fa.cpp 40,8 32%
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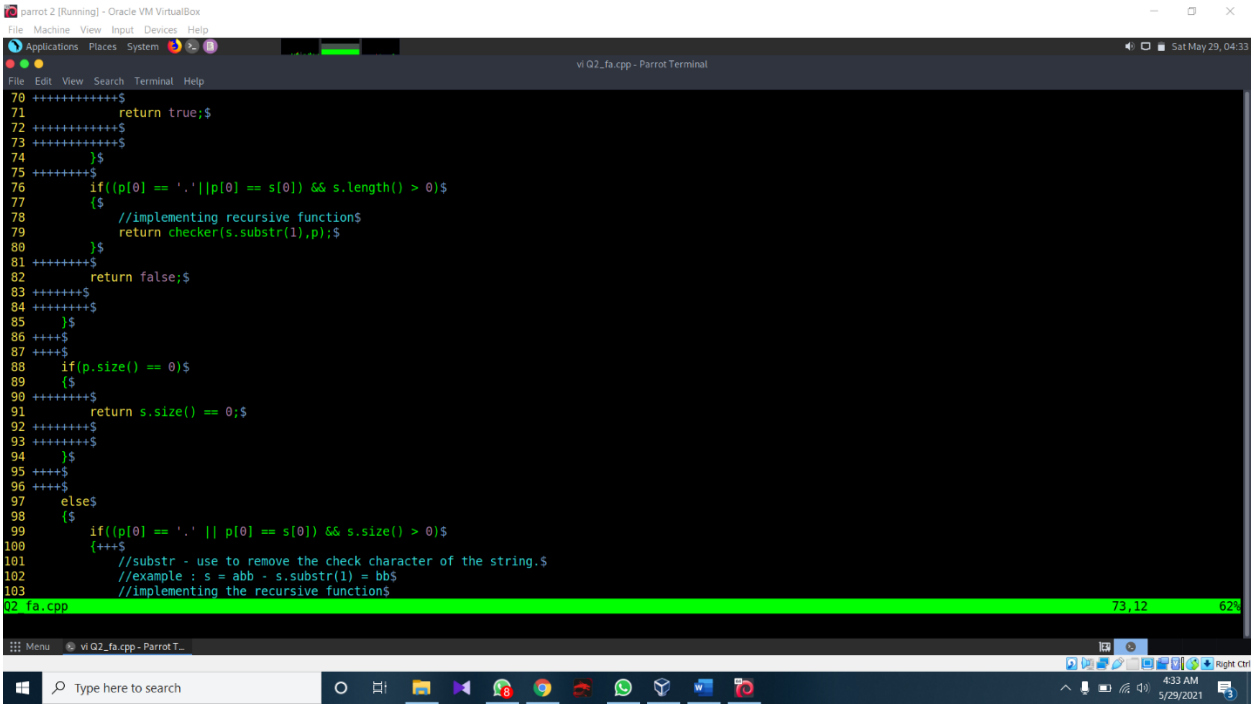
parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
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Sat May 29, 04:33
vi Q2_fa.cpp - Parrot Terminal
File Edit View Search Terminal Help
70 ++++++++++++$
71 return true;$
72 ++++++++++++$
73 ++++++++++++$
74 }$
75 ++++++++$
76 if((p[0] == '.'||p[0] == s[0]) && s.length() > 0)$
77 {$
78 //implementing recursive function$
79 return checker(s.substr(1),p);$
80 }$
81 ++++++++$
82 return false;$
83 +++++++$
84 ++++++++$
85 }$
86 ++++$
87 ++++$
88 if(p.size() == 0)$
89 {$
90 ++++++++$
91 return s.size() == 0;$
92 ++++++++$
93 ++++++++$
94 }$
95 ++++$
96 ++++$
97 else$
98 {$
99 if((p[0] == '.' || p[0] == s[0]) && s.size() > 0)$
100 {+++$
101 //substr - use to remove the check character of the string.$
102 //example : s = abb - s.substr(1) = bb$
103 //implementing the recursive function$
Q2_fa.cpp 73,12 62%
Menu
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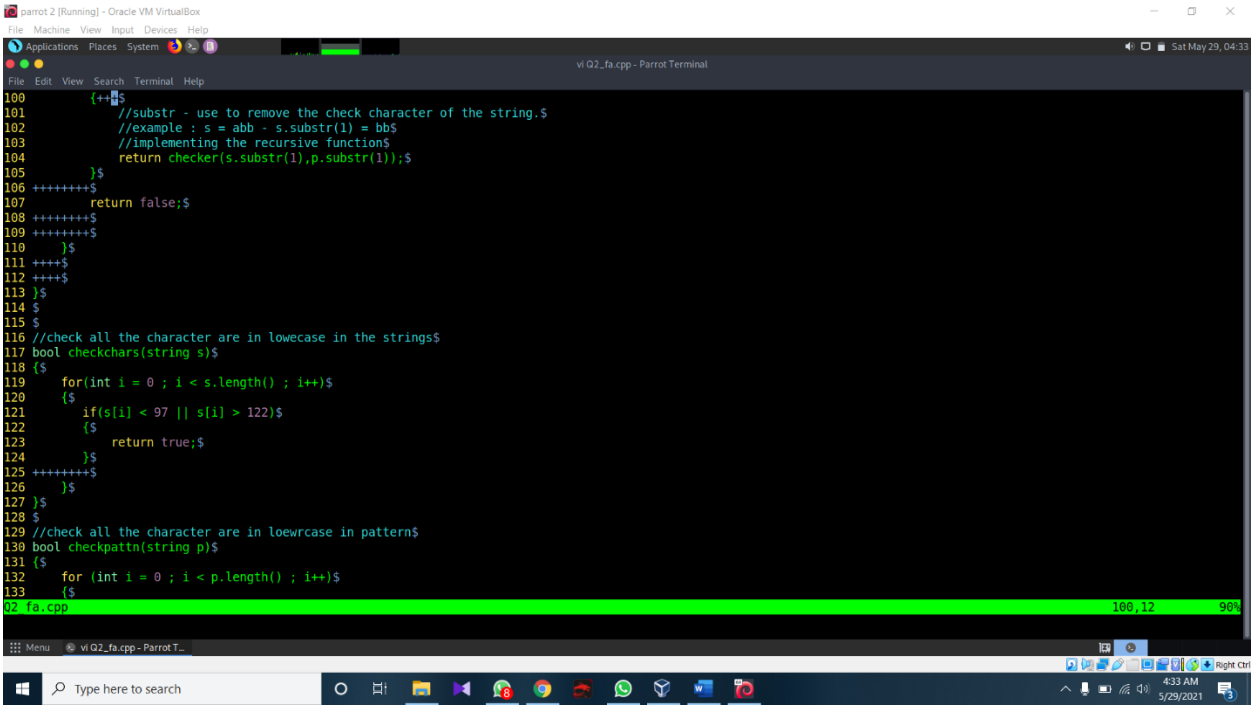
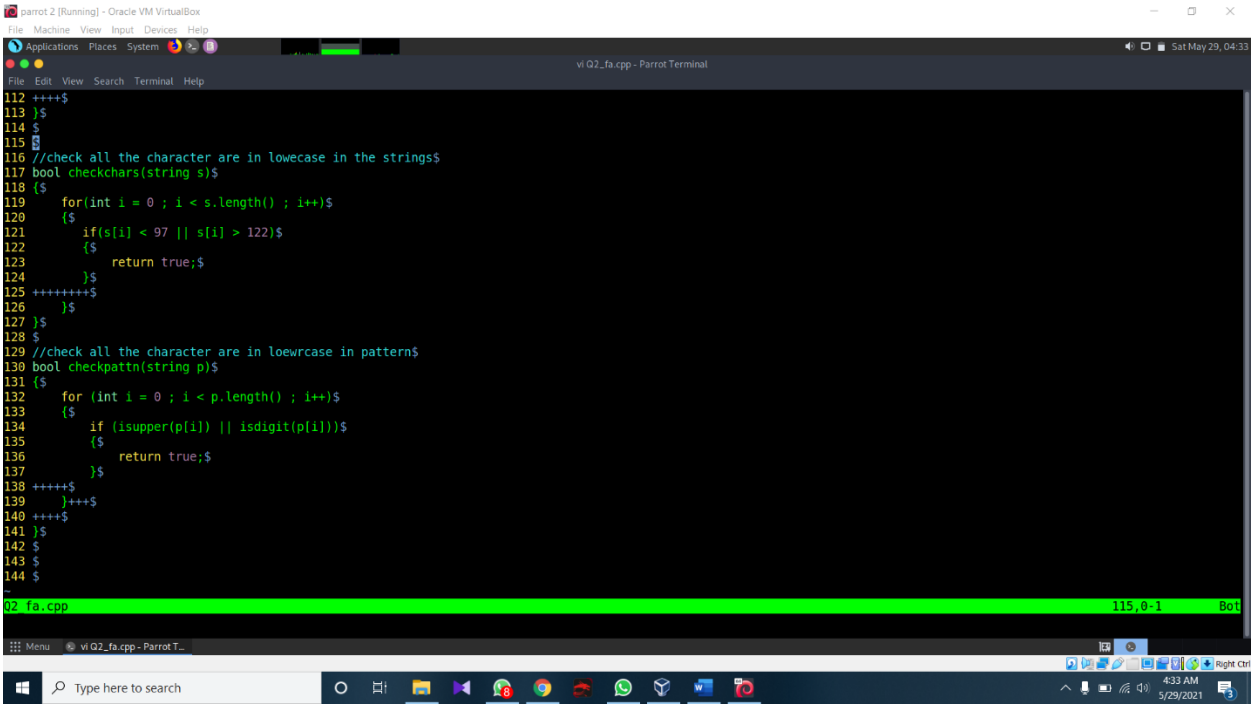
5/29/2021


parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places System
Sat May 29, 04:33
vi Q2_fa.cpp - Parrot Terminal
File Edit View Search Terminal Help
100 {++$
101 //substr - use to remove the check character of the string.$
102 //example : s = abb - s.substr(1) = bb$
103 //implementing the recursive function$
104 return checker(s.substr(1),p.substr(1));$
105 }$
106 ++++++++$
107 return false;$
108 ++++++++$
109 ++++++++$
110 }$
111 ++++$
112 ++++$
113 }$
114 $
115 $
116 //check all the character are in lowecase in the strings$
117 bool checkchars(string s)$
118 {$
119 for(int i = 0 ; i < s.length() ; i++)$
120 {$
121 if(s[i] < 97 || s[i] > 122)$
122 {$
123 return true;$
124 }$
125 ++++++++$
126 }$
127 }$
128 $
129 //check all the character are in loewrcase in pattern$
130 bool checkpattn(string p)$
131 {$
132 for (int i = 0 ; i < p.length() ; i++)$
133 {$
Q2_fa.cpp 100,12 90%
Menu
vi Q2_fa.cpp - Parrot T...
Right Ctrl
Type here to search
4:33 AM
5/29/2021


parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places System
Sat May 29, 04:33
vi Q2_fa.cpp - Parrot Terminal
File Edit View Search Terminal Help
112 ++++$
113 }$
114 $
115 $
116 //check all the character are in lowecase in the strings$
117 bool checkchars(string s)$
118 {$
119 for(int i = 0 ; i < s.length() ; i++)$
120 {$
121 if(s[i] < 97 || s[i] > 122)$
122 {$
123 return true;$
124 }$
125 ++++++++$
126 }$
127 }$
128 $
129 //check all the character are in loewrcase in pattern$
130 bool checkpattn(string p)$
131 {$
132 for (int i = 0 ; i < p.length() ; i++)$
133 {$
134 if (isupper(p[i]) || isdigit(p[i]))$
135 {$
136 return true;$
137 }$
138 +++++$
139 }+++$
140 ++++$
141 }$
142 $
143 $
144 $
Q2 fa.cpp 115,0-1 Bot
Menu vi Q2_fa.cpp - Parrot T...
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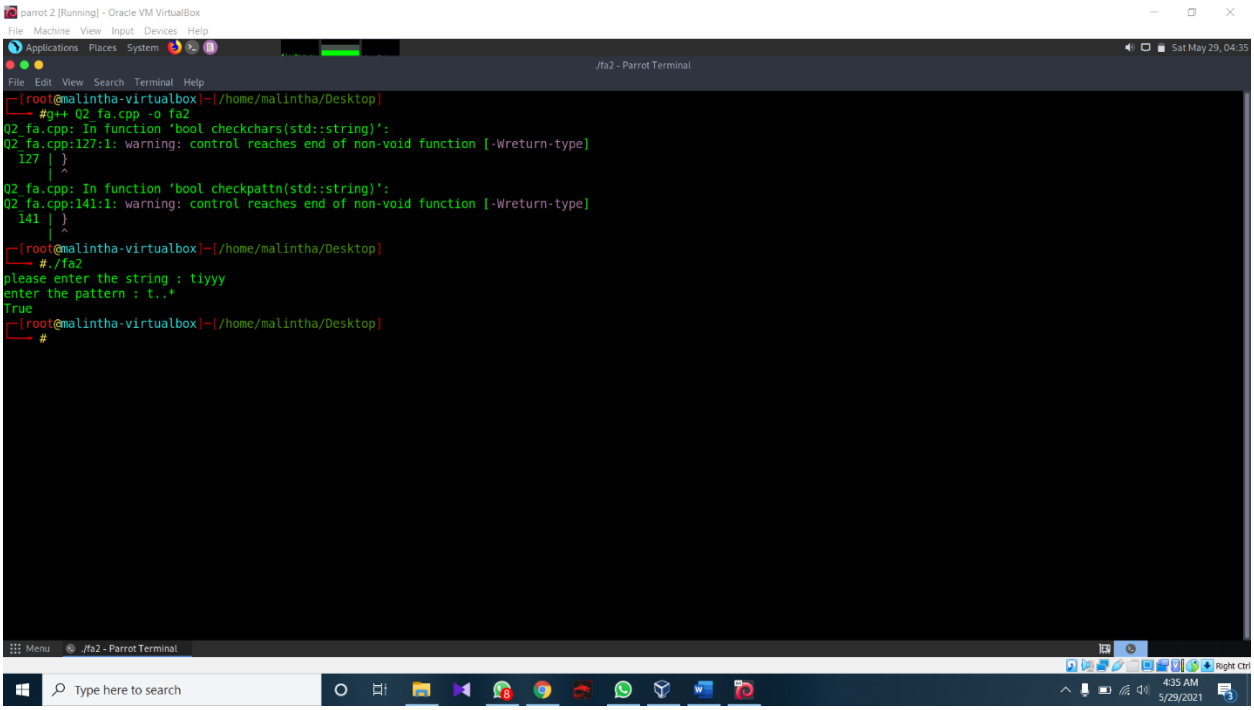
Output of Q2


parrot 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places System
Sat May 29, 04:35
./fa2 - Parrot Terminal
File Edit View Search Terminal Help
┌─[root@malintha-virtualbox]─[/home/malintha/Desktop]
└──╼ #g++ Q2_fa.cpp -o fa2
Q2_fa.cpp: In function 'bool checkchars(std::string)':
Q2_fa.cpp:127:1: warning: control reaches end of non-void function [-Wreturn-type]
127 | }
| ^
Q2_fa.cpp: In function 'bool checkpattn(std::string)':
Q2_fa.cpp:141:1: warning: control reaches end of non-void function [-Wreturn-type]
141 | }
| ^
┌─[root@malintha-virtualbox]─[/home/malintha/Desktop]
└──╼ #./fa2
please enter the string : tiyyy
enter the pattern : t..*
True
┌─[root@malintha-virtualbox]─[/home/malintha/Desktop]
└──╼ #
Menu ./fa2 - Parrot Terminal
Type here to search
4:35 AM
5/29/2021