Tatyana Vlaskin
Week 5

Problem 1:

In this problem will need to write a simple function that acts like a random number generator and looks like:

void rand_int(const int &min, const int &max, int &val)

This function will accept references to min and max and return val, which is a random number generated by the random number generator

We are allowed to reuse code from the previous assignments. This was straightforward problem because I already had code from last 2 assignments; there is not much that I can say for design of this problem. See implementations for more information.

The only thing that I say is that I used const in the function definition because I did not want the function to change the min and max values. If they are not defined as const, they can be potentially changed in the function calling. I still do not understand how that would be possible, but it does happen, so I defined them as const.

Also, just for completeness, I'll mention that when you pass a variable by value, the value gets copied. When you pass a variable by reference, the variable is stored in the address that was set aside for the variable during declaration/definition. Copying values takes more space; thus, this plays a significant role when values are huge.

Problem 2:

For this problem we need to write a simple function that accepts 2 references to strings and returns whether they have the same contents. As for the previous problem we are allowed to reuse code from last week, so its just a matter of defining a function that accepts 2 strings as references and slightly rearranging the code. See implementation for more information. I've just taken the following code from my last weeks problem and moved it to a function: void userInput(string& string1, string& string2);

```
string string1, string2;// strings declaration
cout << "Input string # 1: "; // console output
getline(cin, string1); // console input string 1
cout << endl;
cout << "Input string # 2: "; //console output
getline(cin, string2); //console input string 2
cout<<endl;
stringCompare(string1, string2);
```

Problem 3:

Understanding:

We need to write a program where the user inputs 3 integerst

Once integers are entered they are sorted from smaller to large value

Not required, but I am adding this to the program.

Check for valid entries. User will not be allowed to enter special characters and letters. Hower, user will be allowed to enter floating-point number, but they will be converted to interest.

Implementation:

On page 150 in our book, there is a swap function:

```
24 void swapValues(int& variable1, int& variable2)
25 {
26 int temp;
27 temp = variable1;
28 variable1 = variable2;
29 variable2 = temp;
30 }
```

I'll try to use it for this problem. I not sure that it will work, but it looks really promising.
Lets say that the user needs to enter only 2 numbers. Ill declare those values as x (first value) and y (second value).
The user enters 2 UNSORTED values and we need to sort them from smaller to larger.
Scenario 1: x < y nothing needs to be done because value 1 is already smaller than value 2, so they are sorted.
Scenario 2: x > y. In this case we need to swap x and y.
I'll introduce variable double temp and the following loop to swap x and y:

```
if (x > y){
temp= x;
x= y;
y= temp;
}
```

Thus, if value1 (x) > value2(y), after this loop, values will be swapped and sorted from smallest to largest. Ill put this code in a function: void Sort1(double &x, double &y);
I've tested it and it worked well- the code does what is expected.
The problem is that we have 3 variables, so we need to compare value 1, value 2 and value 3. We have 3 combinations that we need to compare and sort

1. Value1 and value2
2. Value 1 and value3
3. Value 2 and value 3

I'll just write one more sort function and call sort1 3 times. Something like this:

```
void sort (int &value1, int &value2, int &value3){
```

```
Sort1(value1, value2);
Sort1(value1, value3);
Sort1(value2, value3);
}
```

Problem 4:

Understanding:

I read the problem like 10 times. Everything was making sense and at the same time nothing was making any sense. I gave up and decided to read more about the Finonacci number. According to the http://www.mathsisfun.com/numbers/fibonacci-sequence.html

The Fibonacci Sequence is the series of numbers:

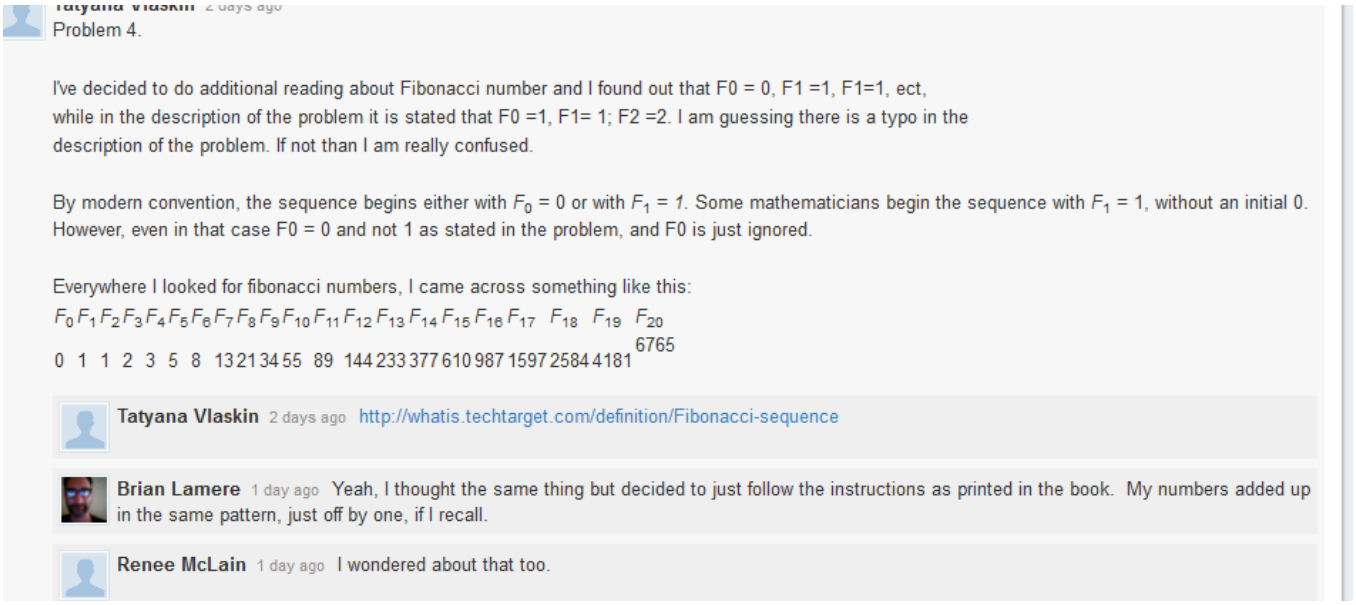
0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ...

The next number is found by adding up the two numbers before it.

The Rule is $\mathbf{x_n = x_{n-1} + x_{n-2}}$. I will definitely use this in my code. But instead of x, Ill say Fibonacci or something like that.

I found out that F0 = 0, F1 =1, F1=1, ect,

while in the description of the problem it is stated that F0 =1, F1= 1; F2 =2. I am guessing there is a typo in the description of the problem. If not than I am really confused. I've posted this question on the discussion board, lon Thursday, I have not gotten an answer from TA or instructor. I am attaching a snapshot:



Problem 4.

I've decided to do additional reading about Fibonacci number and I found out that F0 = 0, F1 =1, F1=1, ect, while in the description of the problem it is stated that F0 =1, F1= 1; F2 =2. I am guessing there is a typo in the description of the problem. If not than I am really confused.

By modern convention, the sequence begins either with $F_0 = 0$ or with $F_1 = 1$. Some mathematicians begin the sequence with $F_1 = 1$, without an initial 0. However, even in that case F0 = 0 and not 1 as stated in the problem, and F0 is just ignored.

Everywhere I looked for fibonacci numbers, I came across something like this:

$F_0\ F_1\ F_2\ F_3\ F_4\ F_5\ F_6\ F_7\ F_8\ F_9\ F_{10}\ F_{11}\ F_{12}\ F_{13}\ F_{14}\ F_{15}\ F_{16}\ F_{17}\ F_{18}\ F_{19}\ F_{20}$

0 1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987 1597 2584 4181 6765

Tatyana Vlaskin 2 days ago http://whatis.techtarget.com/definition/Fibonacci-sequence

Brian Lamere 1 day ago Yeah, I thought the same thing but decided to just follow the instructions as printed in the book. My numbers added up in the same pattern, just off by one, if I recall.

Renee McLain 1 day ago I wondered about that too.

I've also found information that by modern convention, the sequence begins either with $F_0 = 0$ or with $F_1 = 1$. Some mathematicians begin the sequence with $F_1 = 1$, without an initial 0. However, even in that case F0 = 0 and not 1 as stated in the problem, and F0 is just ignored.

Because I think that this assignment has a type, I decided to use this table to test my program.

It is taken from: http://en.wikipedia.org/wiki/Fibonacci_number

List of Fibonacci numbers [edit]

The first 21 Fibonacci numbers F_n for n = 0, 1, 2, ..., 20 are:[16]

F_0	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9	F_{10}	F_{11}	F_{12}	F_{13}	F_{14}	F_{15}	F_{16}	F_{17}	F_{18}	F_{19}	F_{20}
0	1	1	2	3	5	8	13	21	34	55	89	144	233	377	610	987	1597	2584	4181	6765

PLEASE NOTE IN MY SOLUTION TO THIS PROBLEM F0 = 0 and not 1.

From the definition of the Fibonacci number, we have out reqursive property:

fibonacci(n-1) + fibonacci(n-2);

PROBLEM 5:

We need to write a program that inputs number of rows and lets us know how many pins are there in the pyramid.

Trying to find a pattern:

Number of rows	**Total # of Pins in Triangle**	**Trying to find a pattern**	**Formula**	**Spaces before pins** **(I need this to display the triangle on the screen)**
1	1	1	Base case	0
2	3	1+2	CountPins(2) = 2 + CountPins(1)	1
3	6	1+2+3	CountPins(3) = 3 + CountPins(2)	2
4	10	1+2+3+4	CountPins(4) = 4 + CountPins(3)	3
5	15	1+2+3+4+5	CountPins(5) = 5 + CountPins(4)	4
6	21	1+2+3+4+5+6	CountPins(6) = 6 + CountPins(5)	5
countPins(rows) = rows + CountPins(rows-1)				**spaces = rows - 1**

So basically to calculate total number of pins in the triangle, I simply add the row number to the already existing pins. This is how we figured out the general formula. Now let us look at the simplification of one of the cases: 4 rows.
Next part of the code in my program is not required, but when I saw solution for this program that Frank L Brasington posted on discussion board, I'll decided to understand his code and incorporate it in my code to completeness of this program in case I will use this report to study for the test.

Problem 6:

We need to design a program which will let the user to enter principle balance, interest rate and number of years that they are planning to keep the money in the band and output the amount of money that will be in the bank at the end.

Trying to find a pattern:

Year	**Amount of money in the bank** **Lets say interest rate is 10%**	**Trying to find pattern**	**Formula**
0	1000 $	1000	Base case
1	1100 $	1000 + 0.1 *1000	Amount(1) = Amount(0) + Amount (0) * (IR/100)
2	1210 $	1100 + 0.1*1100	Amount(2) = Amount(1) + Amount (1) * (IR/100)
3	1331	1210 + 0.1 *1210	Amount(3) = Amount(2) + Amount (2) * (IR/100)
4	1464.1	1331 +0.1 *1331	Amount(4) = Amount(3) + Amount (3) * (IR/100)
Amount(years) = Amount(years-1) + Amount (year-1) * (IR/100)			

Thus our recursive function will use to following property to calculate the balance in the bank at the end of each year:

Amount(years) = Amount(years-1) + Amount (year-1) * (IR/100)

Recursive function look somewhat like this:

```
double amount( double &principle, double rate, double years )
{
    principle = principle + (principle* (rate/ 100));
        if(years > 0.0) // if there are still years left
        {
            principle =  amount( principle, rate, (years-1.0)); // call of the function
        }
```

```
return principle; // once years <=0, total amount is calculated.
    }
```

Problem 7
PROJECT:
UNDERSTANDING:

1. User 1 enters a word
2. If word entered by user 1 is valid, word is stored in a variable and user 2 is asked to guess a word
3. If word entered by user 1 is not valid , user 1 get a message that entry is invalid and they are prompted to reenter a word
4. Once the word is valid and stored as a variable:
5. User 2 is notified how many guesses they have
6. Word that is entered by user one is presented to the user 2 as '-' . Each '-' represents a letter in the word
7. User 2 is asked to guess a word one letter at a time
8. If the user guesses a letter, program shows the user 2 what of the word has been guessed so far. At this step, I will also change the list of possible letters to reflect the user's newest correct guess. If the letter was guessed correctly, '-' character will be replaced with the correct letter.
9. If the user makes incorrect guess, the user is notified that they made incorrect guess and number of misses is counter. I think I'll have two variable misses and guesses and during implementation decide what exactly I will do with them
10. If the user makes a guess that is correct but is the repeated guess of the same character, the user is notified that the letter was already guessed. I think in this case I will not consider this as an incorrect guess, but I might change my plan.
11. We need to check if the guess is a valid letter, I have no idea what is means. I interpretation will be that is the user inters a letter that is in the word, it is a valid letter. However if the user enters a letter that is not in the word or number, or special character, the user 2 will be notified that the guess made is wrong.
12. If the user guesses a word congratulation message is displayed.
13. If the user runs out of guesses, the user is notified that they lost, what the secret word was and what letters were missing from their guesses.
14. At the end of the game the user is asked if they want to repeat the game one more time.

DESING:

1. Ask 1st user for a word
2. Check if the word is valid. Ill try to write a function. Do something like this.

```
for(unsigned int i =0; i < word.length(); i++)
{
    if (word.at(i) == ' ' || !isalpha(word [i]))
   cin.clear();  // reset cin
   cin. ignore();// varible declaration to discard bad entry
   cout << "\nINVALID ENTRY. Try again. ";
   }
```

3. If the user makes valid entry, store it in the variable and ask the 2nd user to guess the game.
4. Declare variables: we need to keep track of misses, guesses, exposed letters
5. Exposed letters will be incremented each time the letter is correctly guessed. This is critical.
6. Initialize: guesses = 3; This is a programmers choice. I decided that user can make only 3 INCORRECT guesses. Please note that I am counting only INCORRECT GUESSES.

7. Initialize string, lets call it display. This string will keep track of letter entered by user 2
8. At this point, we will initialize string display = word;
9. Next step will be to replace all charactesr in the string word with '-'. I saw this code in the book

```
for (int i = 0; i < display.length(); i++)
    display [i] = '-';
```

10. Next step possibly if stament is (guesses > 0) or possibly while(exposed < word.length() && guesses > 0)

. Until exposed count is less than word. Length., continue this loop.
In this loop we need to let the user know how many guesses they have left.
How many missed they already made
Ask the user to enter a letter
Do cin to let the user enter a letter

11. Once the guess if made, we need to figure out if the guess if correct and if the guess is the duplicate (possibly 2 bool statement (goodguess= false, duplicate = false)
12. For each entry the user 2 makes, we need to loop through the entry: for(int i=0; i < word.length(); i++) and compare the entry to the word: if(response == word[i])
13. For duplicate do something like this:
    if (display [i] == word [i]) . Let the user know that entry is duplicate, change bool to false

14. If the entry is not duplicate: do else stamen: display[i] = word [i];
    a. Count exposed++;
    b. Set the bool goodGuess =true; // guess was good, so we change bool to good
15. if (!goodGuess)
16. {
17. misses++; // increment misses
18. guesses--;// decrementing guesses
19. // let the user know that the letter is not in the word
20. If there word is guessed : diplay congratulations message
21. If (guesses <=0) the user, ran out of guesses, let the user know that they lost, display the word and let them know which characters they have not guesses. I have no idea at this point how to display the characters that were missed
22. Do while loop to ask the player if they want to play one more time.

TESTING

testing	Input (tested conditions)	Expected output	Pass/Fail
User #1 input	Character	Invalid entry, asks to reenter #	pass
User # 1 input	number	Invalid entry, asks to reenter #	pass
User #1 input	Word has space	Asks user # 2 to guess a number	Pass
User # 2	Guess the letter	The letter replaces '-' in the word	pass
User #2	Letter is not	User is notified that	Pass

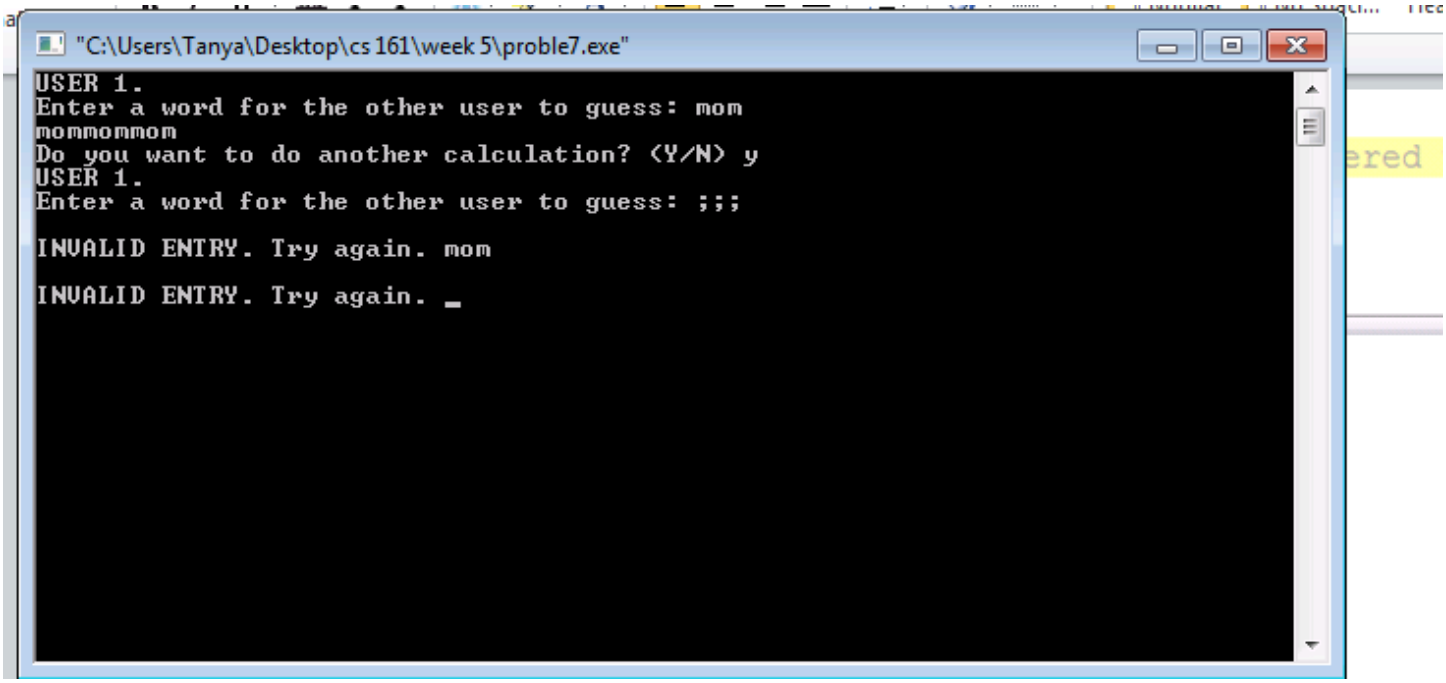
	guesses	the letter is not in the word	
User #2	Letter is not guesses	Guesses – Misses ++	Pass
User #	Letter that was guesses already, entered one more time	Lets the user know that letter was already guesses	Pass
Use 2	Letter that was guesses already, entered one more time	Guesses and misses, stay the same	Pass
User 2	User runs out of guesses and does not guess the word	User is notified that they lost	Pass
User 2	User runs out of guesses and does not guess the word	Secret word if displayed to the user	Pass
User 2	User runs out of guesses and does not guess the word	Letter that were not guessed are displayed to the user	Pass ☺☺☺
User 2	User guesses the work	Congratulations message is displayed	Pass
User 2	Runs out of guesses	Asks the user if they want to play again. If they say yes, game starts over	Pass
User 2	Runs out of guesses	Asks the user if they want to play again. If they say no, exits the screen	Pass

REFLECTION:

This project was hard. I spent a lot of time on it. My initial problem was that I was not able to design a function that determines if the user 1 entered a word that is valid. First function that I came up with looked somewhat like that:

```
void getword()
{
    string word;
    cin >> word;
    for(unsigned int i =0; i < word.length(); i++) // equivalent to while (true)
    {
        //if (my_str.at(i) == ' ' || my_str.at(i) =!isalpha
        //string word; // variable declaration
       //cin >> word; // console input lets the use enter a number
        if (word.at(i) == ' ' || !isalpha(word [i]))
        //if(cin.fail()) // if cin is bad time or cin is a negative value.
        {  // if the user enters string, character.
        cin.clear();  // reset cin
        string garbage; // varible declaration to discard bad entry
        getline(cin, garbage); // ignore rest of line
        //console output. let the use know that entry is invalid
        cout << "\nINVALID ENTRY. Try again. ";
        }
    else // if the users input is valid, entered value is returned.
    {
                cout << word;
    }
```

The problem is represented in the output:



As you can see, if valid word was entered, the program was accepting it, but looping it multiple times depending on how many letters where there in a word. So when word “mom” was entered it was stored as mommommom.

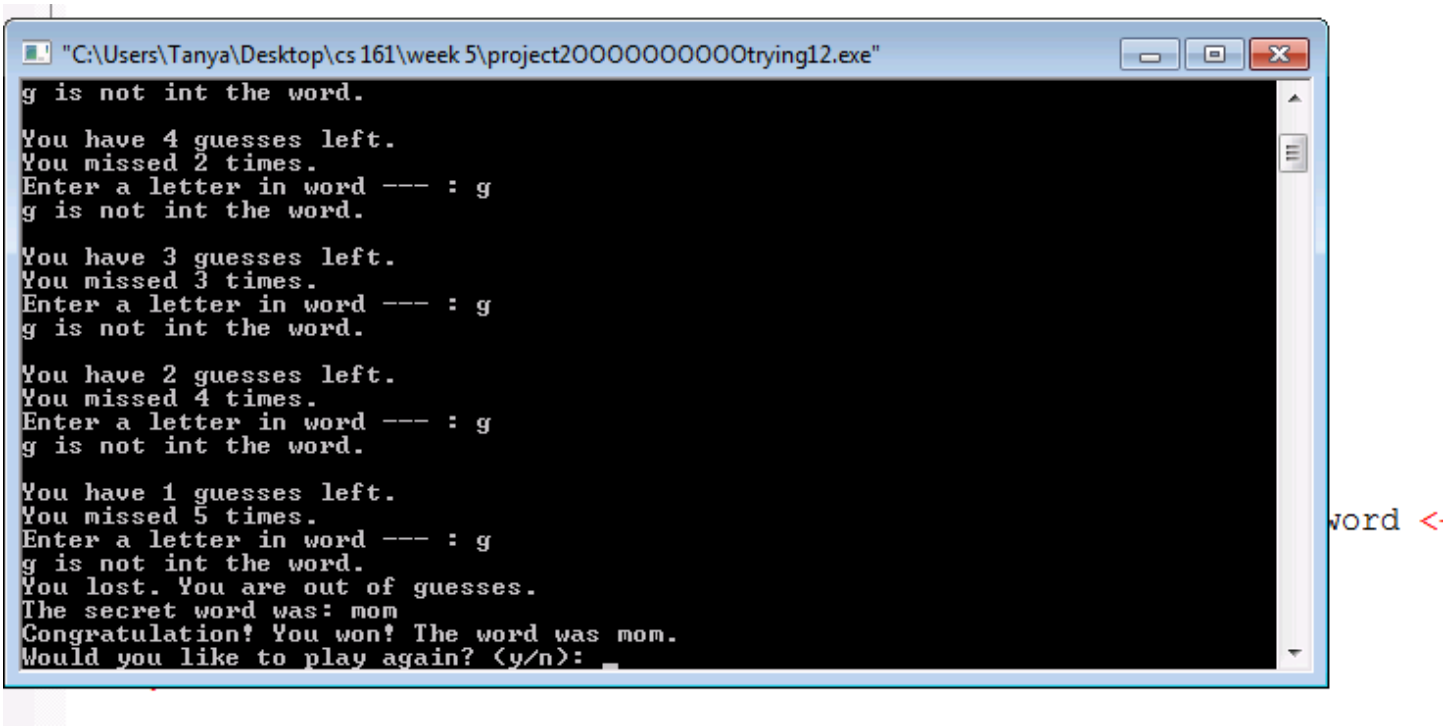
Another problem was that when invalid character was entered first, the program was letting me know that input is invalid. However, when I tried to enter valid word after that, the word was marked as invalid anyways.

I gave up and decided to look at the discussion board. And luckily I came across this;

```
// function to check that user 1 entered valid word
bool validWord(const string word)
{
   for (int i = 0; i < word.length(); i++)// loop through the word
     {
      // checks if every single character is a letter
      if (isalpha(word.at(i)) == 0)
         return false;
   }
   return true;
}
```

This function fixed my problem.

Next major problem that I am still trying to fix and I doubt that Ill be able to is that when user runs out of guesses, for some reason both “congratulation” and “you lost” message are displayed.



If does not make any sense because I am using the following code to determine which message to display:

```
if (exposed < word.length() && guesses <= 0)
{
    cout << "You lost. You are out of guesses."<< endl;
    cout << "The secret word was: " << word;
   // break;
}
 //} while (!compareGuess(display, word));
// if the word is quessed, the user is notified that the\
else //if(exposed = word.length()&& guesses > 0)
{
cout << endl << "Congratulation! You won! The word was " << word << "." << endl;
return misses;
return guesses;// not sure if i need this
    //guessesLeft =false; // my code
}
```

So if guesses <=0 only a failure message should be displayed. At this point I gave up and started adding more comments. At the end I compiled the program, tested it one more time and it works now. I get only “You lost message” when I run out of guess. I really have no idea how I fixed the problem. The only possible explanation I have is that it was fixed long time ago, but I was just pressing run instead of built/run and it kept running old version with the bug.

Finally I am almost at the end. I still have no idea how to display letter that were not guesses.

Looking at my code, I think that if I try to do something like this:

```
for (int k=0; k<word.length(); k++){
                    if (display [k] != word [k])
                    {
                            cout << display[k] << ", ";
                    }}}
```

This should work. Basically if there is a mismatch between display word and secret word, I should be able to display letters that were not guesses. When I tried to run this, I was getting ‘-‘instead of letters. So instead of cout << display[k] << ", ";,

I decided to cout << word[k] << ", "; and…..

It worked.

I am really sorry for such messy report. Unfortunately, I do not have time to reread it.