24-780 Engineering Computation
Problem Set 10

You need to create a ZIP file (It may appear as a compressed folder in Windows) and submit the ZIP file via the 24-780 Canvas. The file name of the ZIP file must be:

PS10-YourAndrewID.zip

For example, if your Andrew account is *hummingbird@andrew.cmu.edu*, the file name must be:

PS10-hummingbird.zip

If your ZIP file does not comply with this naming rule, you will automatically lose 5% credit from this assignment. If we are not able to identify who submitted the file, you will lose another 5% credit. If we finally are not able to connect you and the submitted ZIP file, you will receive 0 point for this assignment. Therefore, please make sure you strictly adhere to this naming rule before submitting a file.

The ZIP file needs to be submitted to the 24-780 Canvas. If you find a mistake in the previous submission, you can re-submit the ZIP file with no penalty as long as it is before the submission deadline.

Notice that the grade will be given to the final submission only. If you submit multiple files, the earlier version will be discarded. Therefore, if you re-submit a ZIP file, the ZIP file MUST include all the required files. Also, if your final version is submitted after the submission deadline, late-submission policy will be applied no matter how early your earlier version was submitted.

Make sure you upload your Zip file to the correct location. If you did not upload your assignment to the correct location, you will lose 5%.

The ZIP file needs to include:

- C++ source file of your program (ps10.cpp)

Submission Due: Please see Canvas

START EARLY!

Unless you are already a good programmer, there is no way to finish the assignment overnight.

PS10 Bowling Score Calculator (ps10.cpp)

The goal of the bowling game is to knock down all ten pins with your ball. One game consists of ten frames, and the bowler can throw a ball up to twice to knock down all the pins. In the last (10th) frame, the bowler is allowed to throw up to three shots if the bowler knocks down all ten pins within the first two attempt of the frame. Therefore, in a single game, the bowler may throw 21 shots maximum.

If the bowler fails to knock down all pins in the frame, the score earned from the frame is the number of pins that falls down.

If the bowler knocks down all ten pins in the first attempt of the frame (called strike), the bowler does not throw the second shot of the frame, and the score earned from the frame is 10 plus number of pins from the next two shots. For example, if the bowler knocks all the pins in the first attempt of the first frame, and 8 pins and 1 pin in the two shots of the second frame, the total score earned in the first frame is 19. Or, if the bowler knocks all the pins in the first attempt of the first and the second frame and knocks 9 pins in the first attempt of the third frame, total score earned in the first frame is 29. If the bowler gets three strikes in a row, the score earned for the first strike is 30.

If the bowler fails to knock down all ten pins in the first attempt, but knocks down the remaining pins in the second attempt of the frame (called spare), the total score earned from the frame is 10 plus number of pins from the next one shot. For example, if the bowler knocks 9 pins and 1 pin in the first and the second shot of the first frame respectively, and gets a strike (10 pins in the first attempt) in the second frame, total score earned from the first frame is 20.

If the bowler gets a strike in the first shot of the 10th frame, the bowler is allowed to shoot twice more in the same frame. Or if the bowler gets a spare in the first two attempt of the 10th frame, the bowler is allowed to shoot once more in the same frame. The total score earned in the 10th frame is equal to the total pins that the bowler knocks down in the frame. (The maximum is 30 pins when the bowler gets three strikes in a row in the 10th frame). Even when the bowler gets a strike in the third shot of the 10th frame, or a spare in the second and the third shots of the 10th frame, there is no 11th frame.

Total score from the game is the total of the scores from all ten frames.

Write a program that takes one string from the console window and calculates the bowling score from the string. When you start your program, <u>do not print anything</u>, and take one line of string as input from the console window.

The format of the string is as follows:

'0' to '9'	Number of pins knocked down
'X' or 'x'	Strike
'/'	Spare
'-'	Same as '0'
' ' (Space)	Same as '0'

The input string must be always at least 21 letters long. If it is shorter than 21 letters, your program must print an error message. If it is longer than 21 letters, your program should ignore letters beyond 22nd letter. Also, if the input string includes any other character other than listed above, your program should print an error and terminate. Your program does NOT have to check for other errors like saying more than 10 pins are knocked in one frame.

Each two letters indicate how the bowler knocked the pins in the each frame except that the last three of the 21 letters indicate how the bowler knocked the pins in the 10th frame.

For example:

X X X X X X X X X XXX

means perfect game and the score is 300. Or,

9/9/9/9/9/9/9/9/9/9/9

means the bowler had 9+1 pins in each frame, and the last extra shot of the 10th frame was 9. Or,

9-9-9-9-9-9-9-9-9-9--

should be calculated as 90. You can also use the scores in the above photo, too for verification. If you need more test cases you can go bowling with friends.

Your program must recognize "91" and "9/" the same. ('/' must be considered as 10 minus previous pins.)

If the input is correct, the output must be only one number (between one to three digits). Do not add any extra characters such as space or tabs, i.e., the printf format must be just "%d\n". For example, your console window must look like:

```
9/90X X 9/X X X 9/XX8      <- Input
224                        <- Output
```

If the input string is too short, print **"Too Short\n"**, or if the input includes a character that cannot be recognized as a bowling score, print **"Wrong Character\n"**.

Your program must terminate after showing the score for the game. <u>Do not wait for the key stroke.</u>

Your program will be graded based on how many accurate calculations your program gives for our test cases.

Suggested steps (you don't have to follow if you come up with easier steps):

(1) Write a program that takes a single line from the console. Use TextString class and use Fgets member function to take input from stdin. You can use any version of TextString class. Show an error and terminate if the string is too short, including unrecognizable character.

(2) Interpret 21 letters to 21 integers. For example, turn:

"9/72X-X-8-919/9/9-XX6"

into an array of integers:

9, 1, 7, 2, 10, 0, 10, 0, 8, 0, 9, 1, 9, 1, 9, 1, 9, 0, 10, 10, 6

(3) Write a function int ScoreFromFrame(const int pinsKnocked[21],int frameNo); (Hint: You may want to write calculations for1-9th frames, and 10th frame separately. And maybe you want to write separate calculation for the strike in the 9th frame.)

(4) Sum up ScoreFromFrame(pinsKnocked,i) for i=0 to 9 (or i=1 to10 depending on how you write your ScoreFromFrame), and then print.