

ASSIGNMENT INSTRUCTIONS

1. Assignment 04: **75 points w/ 5 E.C. points**
2. Due Date & Time: **11-04-2022 at 11:55 PM**

WHAT TO SUBMIT

1. Code
2. Assignment Report

HOW TO SUBMIT AND THE RULES TO FOLLOW

- Submit via Canvas, the Assignment Submission section
- Please refer to Assignment 01 for the Assignment Guidelines
- Please follow the Assignment Report Template
- Please follow the Course Policy on Student Conduct and Academic Honesty

PERFORMANCE TRACKER		
ASMT	GRADE	YOUR GRADE
CANVAS	05	
01	15	
02	100	
03	100	
MIDTERM EXAM	50	
04-PREPARATION	25	
04	75	
TOTAL	370	

A: 90-100% B: 80-89% C: 70-79% D: 60-69% F: 0-60%
 The course grader provides feedback to your assignments on Canvas.

ABOUT

- Please download: <http://csc340.ducta.net/Assignments/Assignment-04-Code.zip>
- This assignment's three main topics are:
 - **Linked List** which was a topic of CSC 220 or of a previous course not at SFSU. We reviewed and learned Data Structures.
 - **Recursive Function** which was also a topic of CSC 220 or of a previous course not at SFSU.
 - **Smart Pointers** which we cover in detail in this course.
 - Assignment 04-Preparation helped us study the C++ versions of Linked List (the Linked Bag) and of Recursive Function. The focus was on C++ syntax and advanced implementations.
 - More help and sample code will be provided. Please start this assignment early.
- All parts of this assignment are to be done in C++.

PART A – Linked Bag. 40 points

- Please change only files: `LinkedBag340.cpp` and `Include.h`, no other files.
- We are to implement 8 small additional functions and 2 helper functions to the Linked Bag.
- Our programs must produce **identical** output to the output in the 2 sample runs: `Asmt04_Run1.txt` and `Asmt04_Run2.txt`
 - Our Test 9's output must also be **identical** to the sample output excepts the random values.
 - Our Test 9's random values in our 2 sample runs' output must be **different**.

Descriptions of the 8 functions:

Please ask questions, if any, during the in-class discussions and demos for this assignment.

1. `removeSecondNode340` deletes the second node in the Linked Bag. **4 pts**
2. `addEnd340` inserts the new node at the end of the Linked Bag. **4 pts**
3. `getCurrentSize340Iterative` counts the number of nodes in the Linked Bag iteratively. **4 pts**
4. `getCurrentSize340Recursive` counts the number of nodes in the Linked Bag recursively. Use 1 helper function: `getCurrentSize340RecursiveHelper`. **4 pts**
5. **IMMEDIATE RECURSION:** `getCurrentSize340RecursiveNoHelper` counts the number of nodes in the Linked Bag recursively. This recursive function **does not** use any helper functions. **8 pts**
6. `getFrequencyOf340Recursive` recursively counts the number of times an entry appears in the Linked Bag. Use 1 helper function: `getFrequencyOf340RecursiveHelper`. **4 pts**
7. **IMMEDIATE RECURSION:** `getFrequencyOf340RecursiveNoHelper` recursively counts the number of times an entry appears in the Linked Bag. This recursive function **does not** use any helper functions. **8 pts**
8. `removeRandom340` removes a random entry from the Linked Bag. **4 pts**

PART B – Smart Pointers. 15 points

- For each of the following statements, please:
 - Explain the statement in 5 or more sentences. Please think Interviews. And
 - Create a new code experiment to demonstrate our understanding.
 - *Please remember to submit our code and document our experiment in our assignment report.*
- 1. Deleting the same memory twice: This error can happen when two pointers address the same dynamically allocated object. If `delete` is applied to one of the pointers, then the object's memory is returned to the Free store. If we subsequently delete the second pointer, then the Free-store may be corrupted.
- 2. Use smart pointers... Objects that must be allocated with `new`, but you like to have the same lifetime as other objects/variables on the Run-time stack. Objects assigned to smart pointers will be deleted when program exits that function or block.
- 3. Use smart pointers... Data members of classes, so when an object is deleted all the owned data is deleted as well (without any special code in the destructor).
- 4. Converting `unique_ptr` to `shared_ptr` is easy. Use `unique_ptr` first and convert `unique_ptr` to `shared_ptr` when needed.
- 5. Use `weak_ptr` for `shared_ptr` like pointers that can dangle.

PART C – Linked Bag, Smart Pointers Version. 20 points

- Create a Smart Pointers version of our PART A's Linked Bag:
 - 1. Please create a copy of our entire PART A solution and name it: **PartC_SmartPointers**.
 - 2. Then go through all the files, not just `LinkedBag340.cpp`, and use smart pointers properly where it is possible.
 - 3. In our assignment report, **list the file names and the line numbers in which we use smart pointers. For each smart pointer, explain in 5 or more sentences why it is a proper use.**
 - 4. This Smart Pointers version must work properly and produce identical output like that of our PART A version.
 - 5. In addition, please **update** and **add destructor(s)** so that the program displays more information (*in addition to the output required and described above*) when object(s) get destroyed.
 - 6. Please remember to submit our code of this part. Save the code under a folder named "**PartC_SmartPointers**" and include this folder in the assignment submission ZIP. *Please remember to document this part in the assignment report.*

PART D – Linked Bag, Creativity. 5 Extra Credit points

- Please create a copy of our entire PART C solution and name it: **PartD_IamCreative**
- This part is to show off our creative mind. Please implement a new function for Part C's LinkedBag. We need to add code to `LinkedBag340.cpp` and `Include.h` and write `PartD.cpp` to demonstrate how this new function works.
- **Requirements**, this function shall:
 - 1. Perform **one** meaningful task. Please use the first paragraph of at least 5 sentences in PART D to explain why it is a meaningful task.
 - 2. Modify the LinkedBag's content every time it runs.
 - 3. Use Smart Pointers in its parameter list, in its implementation, and as return value(s).
- Our graders expect higher quality in this part: creativity, a meaningful task, clean code, and clear documentation and report.

Happy coding and thank you!