Practical Lab Session: Week 5

For this practical lab session, please first ensure you have viewed the **Week 5** video sessions **5.1** and **5.2**. Within these sessions, you should attempt the development exercises presented as **Challenges** during this lab session. Please ensure you complete the set of challenges prior to the next lab session and upload screenshots of your results to the Progress Management section on Blackboard as directed.

Session 5.1 Challenge: Measuring Algorithm Performance

- Create a new class called `SumAnalysis` in a new file called *SumAnalysis.java* within your **Analysis** project.
- In the `main()` method of the new class, measure and record the execution time in nanoseconds for each the `SumIntegers` class methods `sum_A()`, `sum_B()` and `sum_C()` for parameter values 1, 10, 100, 1000, 10000, 100000 and 1000000
- Print the results of the execution time measurements in a table and observe the rate of increase for each.
- Estimate the growth rate function for each of `sum_A()`, `sum_B()` and `sum_C()`.

Note: an example of the output from the program is provided in the video session.

Session 5.2 Challenge: Prove the Time Complexity of the LinkedBag Add and Remove Operations

Note: This challenge requires that you have implemented the `LinkedBag` class from Section 3.2

- Add a new class called `BagComplexityTest` to the **Bag** project in a new file called *BagComplexityTest.java*.
- The `main()` method of `BagComplexityTest` should create a new `LinkedBag` object and generate ***N*** random integers < ***N**10**, storing each in the bag as it is generated.
- For each integer generated, measure the time taken in nanoseconds to store the element in the bag and obtain the total time taken to add the elements.
- Now generate a further set of ***N*** random integers in the same range and attempt to remove an element of that value from the bag, again calculating the total time to remove.
- Repeat for values of ***N*** of 10, 100, 1000, 10000 and 100000 elements and report for each value of ***N***, the bag size, the total time to add, the average time to add, the total time to remove and the average time to remove.

Note: an example of the output from the program is provided in the video session.