Project 2 - Report (Phase 2)

Due May 20 by 11pm **Points** 180 **Submitting** on paper **Available** after Apr 24 at 12am

CS 165 - Project 2 - Testing Solution Quality (Phase 2)

180 points

Project 2 involves testing various bin packing algorithms experimentally to determine the quality of the solutions they produce. The specific bin-packing algorithms you should implement are the following five algorithms (please see the course notes for details on these algorithms):

1. Next Fit (NF)
2. First Fit (FF)
3. Best Fit (BF)
4. First Fit Decreasing (FFD)
5. Best Fit Decreasing (BFD)

For Phase 2 of Project 2, you will need to submit your report on the performance of each of the above algorithms, electronically to Gradescope using the course Gradescope link.

You need to test each algorithm on lists of items of length n, as n grows, where the n items in the lists are floating point numbers between 0.0 and 0.7 generated uniformly at random in this range. Each algorithm is defined to operate with bins of size 1.0. The goal of these experiments is to determine an estimate for the waste, W(A), for each of the above bin-packing algorithms, A, as a function of n, as n grows, where W(A) is defined as follows:

- The **waste**, W(A), of a bin-packing algorithm, A, for any given list of items, is the number of bins used by the algorithm A minus the total size (i.e., the sum) of all the items in the list.

You should test multiple random sequences for each length n, and have n grow, and then plot the results on a **log-log scale (https://en.wikipedia.org/wiki/Log%E2%80%93log_plot)** to see if there is a line that fits the data. If so, you should then determine the slope

of that line, so as to provide experimental evidence for estimating W(A) as a function of n, and you should give that function in your report, for each algorithm, A.

Produce a report write-up that explains the algorithms you implemented, and reports your findings, including the waste performance you observed in your experiments. Your report will be graded based on the following rubric:

- 90 points. Correct English grammar and spelling
- 15 points. Plotting the waste for the NF algorithm on a log-log plot and determining the slope of an asymptotic best-fit line to determine its waste experimentally as a function of n.
- 15 points. Plotting the waste for the FF algorithm on a log-log plot and determining the slope of an asymptotic best-fit line to determine its waste experimentally as a function of n.
- 15 points. Plotting the waste for the BF algorithm on a log-log plot and determining the slope of an asymptotic best-fit line to determine its waste experimentally as a function of n.
- 15 points. Plotting the waste for the FFD algorithm on a log-log plot and determining the slope of an asymptotic best-fit line to determine its waste experimentally as a function of n.
- 15 points. Plotting the waste for the BFD algorithm on a log-log plot and determining the slope of an asymptotic best-fit line to determine its waste experimentally as a function of n.
- 15 points. Identifying the algorithm you think is best. Explain why you think this algorithm produces the least amount of waste of all the algorithms you studied.

Turn in your written report as a PDF file via **GradeScope.**