CMSC-3140 Analysis of Algorithms
Fall 2024
Group Assignment 3
Due – Thursday, December 5, 2024, at 11:59pm EST

Submit your program and report to the right D2L Dropbox named "Assignment 3 Dropbox" by the due date and time. This assignment will be graded out of 60 points, 25 points for your programs and 35 points for your report, 10 points for your solution designs and 25 points for your solution evaluations.

You are to create a graph class and implement two algorithms attempting to find the maximum independent set of a graph. One, a brute force approach, will find the maximum independent set and its independence number of a graph. A more efficient approach, an approximation algorithm taking a greedy approach, will find a good (not necessarily best) answer. In addition to implementing the two algorithms, you are to compare results and submit a paper on your findings. You report must have two main sections: The design section and The evaluation section. The design section should include details of the design of both algorithms/programs. The evaluation section should include items such as: How close does the approximation algorithm usually come to finding the maximum independent set? How often does the approximation algorithm find the maximum? How fast (or slow) does each algorithm run? Time your program with graphs of different sizes and include a table of results. Stop testing when the program takes over 24 hours to run. Use the system clock to automate the process of timing the running time of the program.

Ideas for both algorithms will be discussed in class. Ask questions if you do not understand either one. Be sure to check EVERY possible combination with the brute force approach. Make sure you are running the two algorithms on the SAME graph each time.

Notes:

- Name your source files graph.h, graph.cpp, and main.cpp.
- This is not to be an interactive program. Set constant sizes for the number of vertices per graph and edge density, and experiment with changing these numbers.
- Of particular interest is the number of vertices per graph. This is what the running times of the algorithms will be based on.
- Your paper should include tables of data, in particular the times the algorithms take to run with different sized graphs (numbers of vertices), and the results (sizes of the answers). Your paper should be at least 5 full pages in length.

Remember, questions are encouraged.