FULL NAME_____

STUDENT ID_____

BLG 545E – DISCRETE OPTIMIZATION
MIDTERM EXAM – NOVEMBER 25, 2020
12:00-3:00 PM
100 POINTS TOTAL

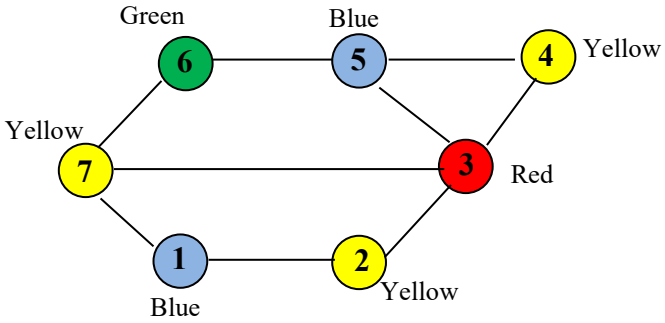
1. Please ***write*** your name in CAPITAL LETTERS at the top of your solution pages, as shown above.
2. Check that the exam has 5 pages (including this page) with a total of 4 problems.
3. Partial credit will be based upon your written intermediate results.
4. You must show your work on Problems 1-3 for credit. You must give explanations in Problem 4 for credit.
5. Simplify your final answer as much as possible (simplify fractions, etc.).
6. This is an open book, open notes exam.
7. You should have ample time to finish the exam and upload it.
8. No questions may be asked during the exam. If you are not sure about a problem, answer based on what you understand and state your assumptions.

GOOD LUCK!

Problem	Description	Point Value	Score
1	GCP/Simulated Annealing	30	
2	Navigation/SA	25	
3	Simulated Annealing Data	25	
4	Randomized Search	20	
Total		**100**	

<u>Problem 1 (30 points)</u> Graph Coloring Problem using Simulated Annealing

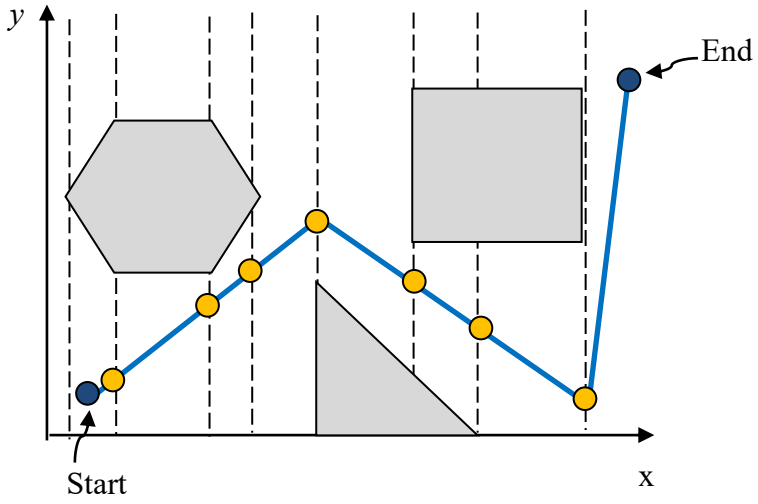
We can solve the graph coloring problem using simulated annealing. Given the graph below, start with the solution where nodes have been colored as shown using four colors (Blue, Yellow, Red, and Green). Show the first three steps of simulated annealing to obtain a better solution. Explain and show all of your work.



Problem 2 (25 points) Navigation/Simulated Annealing

In this problem, we are navigating a remote-controlled toy car around obstacles indicated by the gray-shaded geometric shapes in the graph below. We want to optimize the y-coordinates of the points at which the car's path intersects the vertical lines (which are drawn at the vertices of the obstacles), to create a path that goes from the blue node on the left to the blue node on the right.

Explain how you would solve this problem using simulated annealing.



Problem 3 (25 points) Simulated Annealing

Assume you are trying to maximize the objective function. You are given the following data for the simulated annealing algorithm.

Current Objective Function Value	Neighbor Objective Function Value	Current Temperature	Probability of Acceptance
75	65	25	
75	55	25	
75	65	50	
75	55	50	
65	75	25	
65	75	50	

a) For each line in the table, fill in the probability of the neighbor (s') being accepted (last column, highlighted in yellow). Make sure you write all your equations and steps, and explain the terms. Show all of your work.

b) What happens if the starting temperature is extremely high or low?

c) How is the starting temperature picked?

d) How is the final temperature chosen?

Problem 4 (20 points) Randomized Iterative Improvement

For each search space A and B given below, explain which randomized method (random steps or random restart) would work best (*f* is the evaluation function):