Final exam for CSc 4520/6520 SPRING 2020

Take-home part, to be submitted by April 30th 10pm on iCollege in typed electronic format of pdf and word.

Your work must be your own!

Honor Code Statement:

"I will not commit any act of academic dishonesty while completing this assignment. I am fully aware that any of my own personal actions while attempting this assignment that are interpreted as academic dishonesty, will be treated as such. I understand that if I am held accountable for an act of academic dishonesty that I will receive a grade of "0" (zero) for this assignment and the incident will be reported to the Dean of Students Office."

FIRST NAME _____ LAST NAME _____

#1. Answer the following questions, provide explanations to your answers:

(1) Graph G has 8 pairwise adjacent vertices. Minimum proper coloring of G uses at least 8 colors

Yes No Impossible to say

(2) Checking, if two given vertices i and j of a graph G are adjacent is faster using adjacency lists than using adjacency matrix

Yes No Don’t know

(3) Every tree is a bipartite graph Yes No Don’t know

#2. Answer with explanations.

Graph G with 10 vertices has 4 pair-wise nonadjacent vertices. Minimum **vertex cover** of G has

a) at least 4 vertices Yes No Don't know

because_____

b) at most 6 vertices Yes No Don't know

because_____

#3.
Suppose you have a *maximization* problem and an algorithm A, that has an approximation ratio of 4.
When run on some input I, A produced a solution with cost 12.
What can you say about the true (optimal) answer OPT? Explain your chosen answer(s).

- OP T ≥ 3

- OP T ≤ 3

- OP T ≥ 12

- OP T ≤ 12

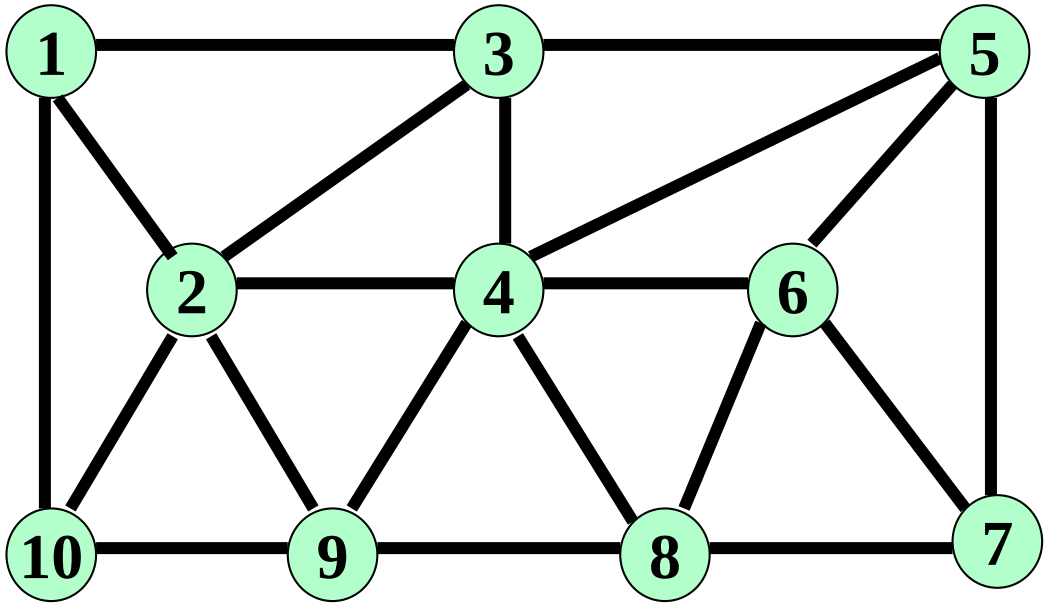
- OP T ≥ 48

- OP T ≤ 48

#4. Follow greedy coloring algorithm for the following graph.
You can add more colors to the palette if needed.

Palette

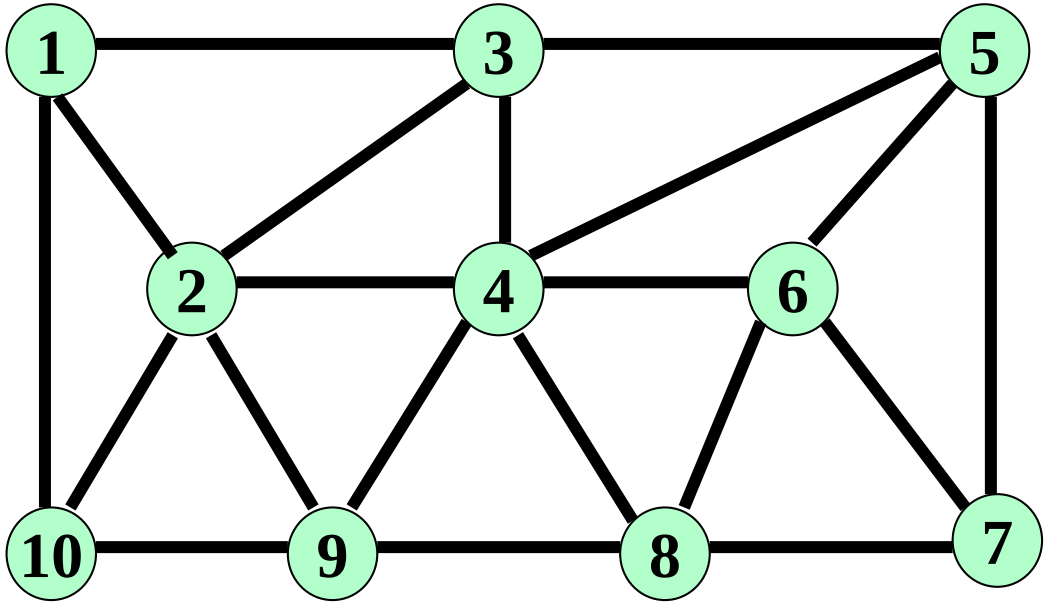
Colors:	a	b	c	d
v1				
v2				
v3				
v4				
v5				
v6				
v7				
v8				
v9				
v10				



On the graph itself – indicate for each vertex its resulting color.

On the palette – if vertex cannot be colored in a certain color, shade that square [same as in our slides]

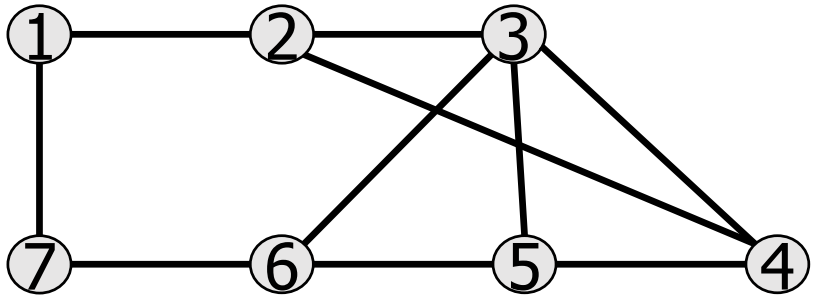
#5. Find Maximal Independent Set of this graph by LUBY's algorithm. Explain your steps.



Output: MIS is _____

#6. Do branch-and-bound technique to generate all maximal independent sets (=leaves).
Left child should be graph G_1 = G – vertex. Right child: G_2 = G – N(vertex). Do two levels – see next page.

G



G_1

G_2

#6. contd.

G_{11} G_{12} G_{21} G_{22}