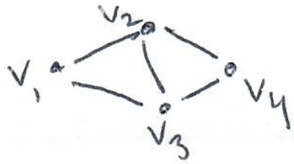
- Sign up for gradescope.com accounts
- You need an email address (create one; needs to be functional)
- I don't recommend giving your real name.
- " " " " any ID #.
- Do homework, write reports: ~~give~~ write on assignment your email addresses (gradescope)
- Add Math 441
- Please put solutions to different problems on different pages.
- Fill out "UBC Survey" give UBC ID, gradescope email.

This week: Applications of LP / Integer LP,
Project ideas, probably Friday or next Monday form groups
Friday Oct 6; or a bit later — first preliminary overview.

Sample project: exam scheduling
- Graph colouring: Graph $G = (V, E)$, vertices, edges,

V finite set,
edge = pair of vertices

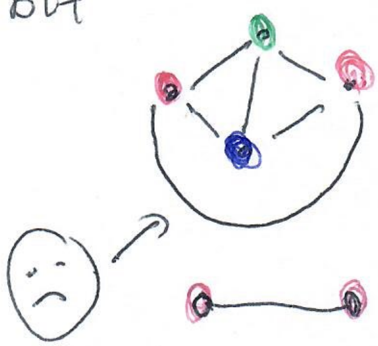


$V = \{v_1, v_2, v_3, v_4\}$, $E = \left\{ \begin{matrix} \{v_1, v_2\}, & \{v_2, v_3\} \\ \{v_3, v_1\}, & \{v_2, v_4\} \\ & \{v_3, v_4\} \end{matrix} \right\}$

Graph Colouring: We have k colours, given graph $G = (V, E)$. Can we assign colours $1, \dots, k$ to V s.t. no edge has the same colour?

red, green, blue
each edge has different coloured endpoints

but



we can't colour the vertizes with 3 colours with each edge of endpoints different colours

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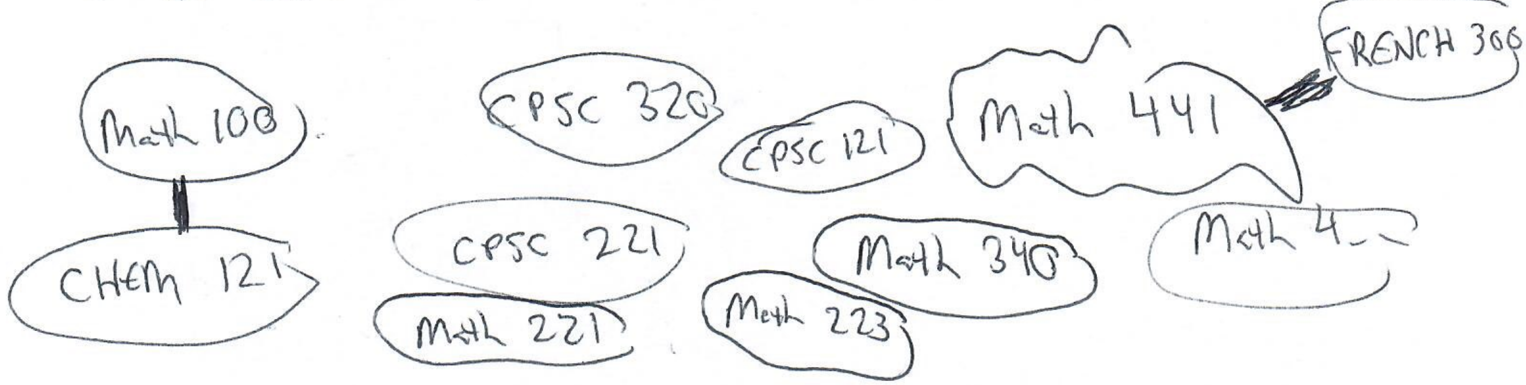
Application: Schedule exam for classes into exam periods without conflicts:

Graph: Vertizes, V, { set of classes }

e.g. at UBC: { Math 100, Math 101, Math 102, CPSC 320, ... }



join vertices that share students

Say we have 44 exam periods, say colour each course with its exam period.

Math 100, French 300 exam period 1 red

they share students, and same colour for endpoints — colour ⟷ exam period

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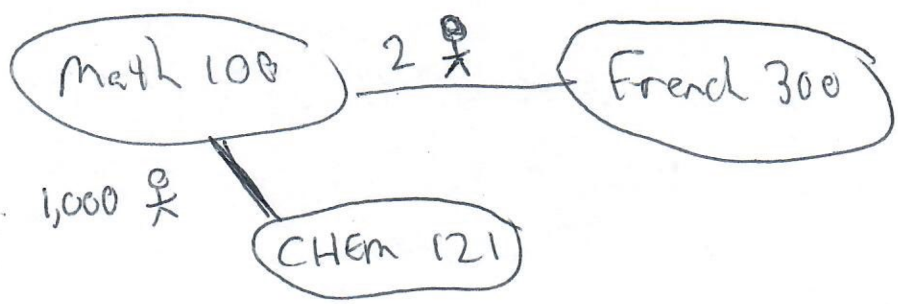
Asking for a "good colouring", meaning no edge has same two colours, ⇝ exam scheduling

Variant: Instead of no conflicts, allow some number of conflicts, or for each edge/conflict give a "weight"



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Any graph colouring, weighted or not ⟶ solved with ILP

Say $V = \{v_1, \ldots, v_n\}$, each $i<j$, $1 \le i < j \le n$

we have weight $w_{ij} = \begin{cases} 0 & \text{if there's no edge } i - j \\ 1 & \text{otherwise, or some positive weight} \end{cases}$

Say colors $1, \ldots, k$

$$x_{im} = \begin{cases} 1 & \text{if vertex } i \text{ is assigned colour } m \\ 0 & \text{otherwise} \end{cases}$$

Want $x_{i1} + x_{i2} + \cdots + x_{ik} = 1$ ...