

國立中山大學

NATIONAL SUN YAT-SEN UNIVERSITY

離散數學 (一)

MATH 203: Discrete Mathematics I

第二次期中考

November 24, 2020

Midterm 2

姓名 Name : _____

學號 Student ID # : _____

Lecturer: Jephian Lin 林晉宏

Contents: cover page,
5 pages of questions,
score page at the end

To be answered: on the test paper

Duration: **110 minutes**

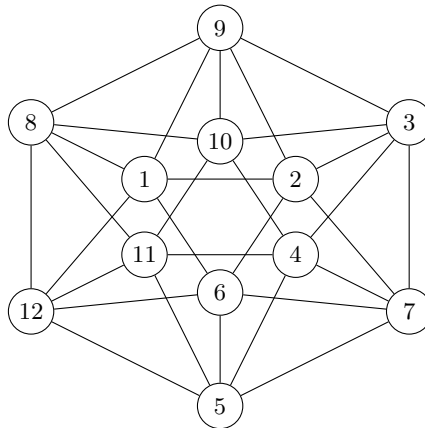
Total points: **20 points** + 2 extra points

Do not open this packet until instructed to do so.

Instructions:

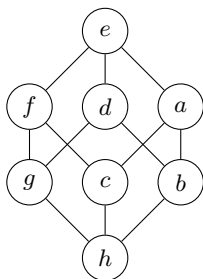
- Enter your **Name** and **Student ID #** before you start.
- Using the calculator is not allowed (and not necessary) for this exam.
- Any work necessary to arrive at an answer must be shown on the examination paper. Marks will not be given for final answers that are not supported by appropriate work.
- Clearly indicate your final answer to each question either by **underlining it or circling it**. If multiple answers are shown then no marks will be awarded.
- 可用中文或英文作答

1. Let G be the graph below. Answer the following questions and **provide your reasons**. [Hint: This graph is composed of the vertices and the edges of an icosahedron (正二十面體).]



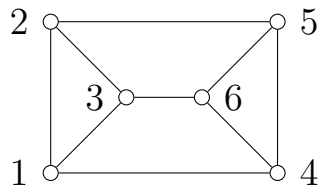
- (a) [1pt] Is there an Eulerian circuit on G ?
- (b) [1pt] Is there a Hamiltonian cycle on G ?
- (c) [1pt] Is G planar?
- (d) [1pt] Is G a bipartite graph?
- (e) [1pt] Is G 4-colorable?

2. Let (X, R) be the poset with the Hasse diagram below. Answer the following questions and **provide your reasons**.



- (a) [1pt] Is there a chain cover of (X, R) of size 2?
- (b) [1pt] Is there an antichain cover of (X, R) of size 5?
- (c) [1pt] Find a linear extension of (X, R) .
- (d) [1pt] Find a total order on $\{a, \dots, h\}$ that is not a linear extension of (X, R) .
- (e) [1pt] Is (X, R) an interval poset?

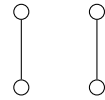
3. [5pt] Determine whether the graph below is a comparability graph or not and **provide your reasons**.



4. [5pt] Let (X, R) be a poset. Recall that

$$D(x) = \{y \in X : y \preceq x \text{ in } R, y \neq x\}$$

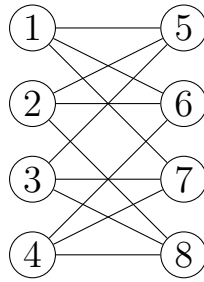
for any $x \in X$ and $\mathbf{2} + \mathbf{2}$ is the poset whose Hasse diagram is as below.



Show that the following statements are equivalent:

- (a) (X, R) contains $\mathbf{2} + \mathbf{2}$ as a subposet.
- (b) There are two elements $x_1, x_2 \in X$ such that $D(x_1) \setminus D(x_2) \neq \emptyset$ and $D(x_2) \setminus D(x_1) \neq \emptyset$.

5. [extra 2pt] Let G be the graph below. Find an order of the vertices (e.g., $8, 7, \dots, 1$) such that the greedy coloring algorithm using this order needs 4 colors.



[END]

Page	Points	Score
1	5	
2	5	
3	5	
4	5	
5	2	
Total	20 (+2)	