

THE UNIVERSITY OF BRITISH COLUMBIA  
CPSC 320 2016WT2: WEEKLY QUIZZES

Full Name: \_\_\_\_\_

Exam ID: \_\_\_\_\_

Signature: \_\_\_\_\_

UBC Student #: \_\_\_\_\_

**Important notes about this examination**

1. You have 25 minutes to complete this quiz.
2. **Answer all questions in PEN and write CLEARLY and LEGIBLY.**
3. You are allowed to bring up to (the equivalent of) a 3-inch 3-ring binder of notes and 3 textbooks, and nothing else. Justify all you answers.
4. Use the back of the pages for your notes, or if you need extra space for the answer to any question.
5. Good luck!

**Student Conduct during Examinations**

1. Each examination candidate must be prepared to produce, upon the request of the invigilator or examiner, his or her UBCcard for identification.
2. Examination candidates are not permitted to ask questions of the examiners or invigilators, except in cases of supposed errors or ambiguities in examination questions, illegible or missing material, or the like.
3. No examination candidate shall be permitted to enter the examination room after the expiration of one-half hour from the scheduled starting time, or to leave during the first half hour of the examination. Should the examination run forty-five (45) minutes or less, no examination candidate shall be permitted to enter the examination room once the examination has begun.
4. Examination candidates must conduct themselves honestly and in accordance with established rules for a given examination, which will be articulated by the examiner or invigilator prior to the examination commencing. Should dishonest behaviour be observed by the examiner(s) or invigilator(s), pleas of accident or forgetfulness shall not be received.
5. Examination candidates suspected of any of the following, or any other similar practices, may be immediately dismissed from the examination by the examiner/invigilator, and may be subject to disciplinary action:
  - i. speaking or communicating with other examination candidates, unless otherwise authorized;
  - ii. purposely exposing written papers to the view of other examination candidates or imaging devices;
  - iii. purposely viewing the written papers of other examination candidates;
  - iv. using or having visible at the place of writing any books, papers or other memory aid devices other than those authorized by the examiner(s); and,
  - v. using or operating electronic devices including but not limited to telephones, calculators, computers, or similar devices other than those authorized by the examiner(s)—(electronic devices other than those authorized by the examiner(s) must be completely powered down if present at the place of writing).
6. Examination candidates must not destroy or damage any examination material, must hand in all examination papers, and must not take any examination material from the examination room without permission of the examiner or invigilator.
7. Notwithstanding the above, for any mode of examination that does not fall into the traditional, paper-based method, examination candidates shall adhere to any special rules for conduct as established and articulated by the examiner.
8. Examination candidates must follow any additional examination rules or directions communicated by the examiner(s) or invigilator(s).

**Please do not write in this space:**

Quiz Number: \_\_\_\_\_

Tutorial Section: \_\_\_\_\_



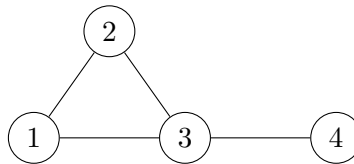
## Coloring graphs with lots of colors

February 7, 2017

We are given a graph  $G = (V, E)$ . We want to color each vertex with one of  $k$  colors so that two end points of any edge in  $E$  receive different colors. This is called a *vertex  $k$ -coloring* of the graph.

Recall that the *degree* of a vertex  $v \in V$  is the number of edges incident on  $v$ . Let  $\Delta$  be the *maximum degree* in the graph.

*Example:*



The maximum degree  $\Delta$  in this graph is 3 and the graph has a 3-coloring and a 4-coloring, but does not have a 2-coloring.

### 1 Greedy coloring with lots of colors

1. For any value of  $\Delta$ , describe a graph with the maximum degree  $\Delta$  that can be colored by two colors.

See the next page!

2. Design a greedy algorithm that will color vertices of  $G$  with at most  $\Delta + 1$  colors. Explain why it works correctly.