
Specification for Assignment 3 of 4

Your submission **must be created using Microsoft Word, Google Docs, or LaTeX.**

Your submission **must be saved as a "pdf" document and have the name "a3.lastname.firstname.pdf"**

Do not compress your submission into a "zip" file.

Late assignments will not be accepted and will receive a mark of 0.

Submissions written by hand, compressed into an archive, or submitted in the wrong format (i.e., are not "pdf" documents) will receive a mark of 0.

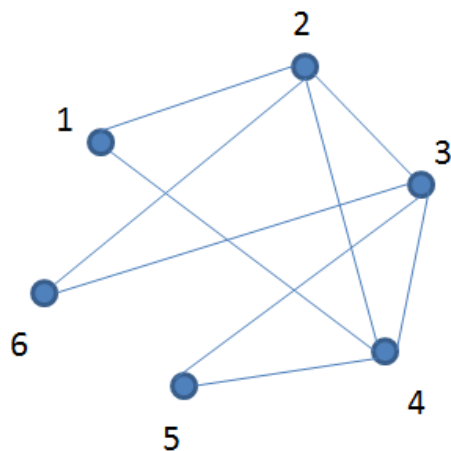
The due date for this assignment is March 4th, 2017, by 11:30pm.

1. Determine which of the following graphs is simple. If the graph is simple, draw an example and if not then explain (in English) what the problem is.
 - a. G has five vertices with the following degrees $\deg(v_1) = 1$; $\deg(v_2) = 5$; $\deg(v_3) = 2$; $\deg(v_4) = 4$; $\deg(v_5) = 2$.

Solution: The graph is not a simple graph because $\deg(v_2) = 5$. The graph has only five vertices and therefore, the maximum degree of a vertex is 4.

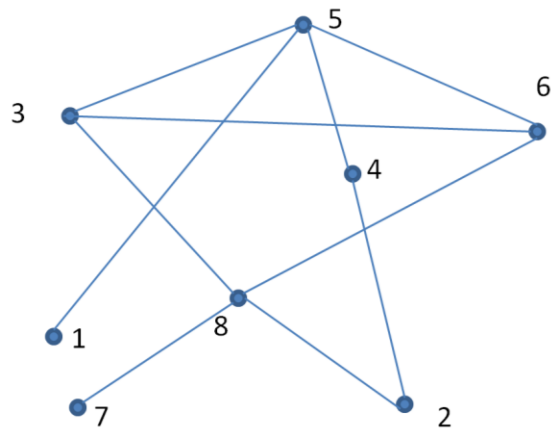
- b. G has six vertices with the following degrees $\deg(v_1) = 2$; $\deg(v_2) = 4$; $\deg(v_3) = 4$; $\deg(v_4) = 4$; $\deg(v_5) = 2$; $\deg(v_6) = 2$.

Solution: Yes the graph is simple. Example of possible solution:



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For questions 2-7 all refer to the undirected graph specified below:



2. If the graph above is denoted G where $G = (V, E)$, what are the values of V and E ?

$$V = \{1, 2, 3, 4, 5, 6, 7, 8\}$$

$$E = \{ \{1, 5\}, \{2, 4\}, \{2, 8\}, \{3, 5\}, \{3, 6\}, \{3, 8\}, \{4, 5\}, \{5, 6\}, \{6, 8\}, \{7, 8\} \}$$

3. Provide an adjacency matrix representation of this graph.

	1	2	3	4	5	6	7	8
1	0	0	0	0	1	0	0	0
2	0	0	0	1	0	0	0	1
3	0	0	0	0	1	1	0	1
4	0	1	0	0	1	0	0	0
5	1	0	1	1	0	1	0	0
6	0	0	1	0	1	0	0	1
7	0	0	0	0	0	0	0	1
8	0	1	1	0	0	1	1	0

4. Provide an adjacency list representation of this graph.

1: 5
 2: 4, 8
 3: 5, 6, 8
 4: 2, 5
 5: 1, 3, 4, 6
 6: 3, 5, 8
 7: 8
 8: 2, 3, 6, 7

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5. Transform this undirected graph into a directed graph G' by changing each undirected edge into a directed edge that moves away from vertex 1. Provide the values of V' and E' such that $G' = (V', E')$ and please note that there is more than one correct solution to this question.

$$V' = \{1, 2, 3, 4, 5, 6, 7, 8\}$$

$$E' = \{ (1, 5), (5, 3), (5, 4), (5, 6), (3, 6), (3, 8), (4, 2), (6, 8), (2, 8), (8, 7) \}$$

6. Provide a subgraph G'' of the graph above that is an element of the set K_n . Specify this graph by listing the elements of both V'' and E'' such that $G'' = (V'', E'')$ and then provide an adjacency matrix representation of this graph as well.

Any of the following would constitute a correct answer!

$$K_3 @ \quad V'' = \{3, 5, 6\} \quad E'' = \{\{3, 5\}, \{5, 6\}, \{3, 6\}\}$$

$$K_3 @ \quad V'' = \{3, 6, 8\} \quad E'' = \{\{3, 6\}, \{6, 8\}, \{3, 8\}\}$$

$$K_2 @ \quad V'' = \{1, 5\} \quad E'' = \{\{3, 6\}, \{6, 8\}, \{3, 8\}\}$$

$$K_2 @ \quad V'' = \{1, 5\} \quad E'' = \{\{1, 5\}\}$$

$$K_2 @ \quad V'' = \{2, 4\} \quad E'' = \{\{2, 4\}\}$$

$$K_2 @ \quad V'' = \{2, 8\} \quad E'' = \{\{2, 8\}\}$$

$$K_2 @ \quad V'' = \{3, 5\} \quad E'' = \{\{3, 5\}\}$$

$$K_2 @ \quad V'' = \{3, 6\} \quad E'' = \{\{3, 6\}\}$$

$$K_2 @ \quad V'' = \{3, 8\} \quad E'' = \{\{3, 8\}\}$$

$$K_2 @ \quad V'' = \{4, 5\} \quad E'' = \{\{4, 5\}\}$$

$$K_2 @ \quad V'' = \{5, 6\} \quad E'' = \{\{5, 6\}\}$$

$$K_2 @ \quad V'' = \{6, 8\} \quad E'' = \{\{6, 8\}\}$$

$$K_2 @ \quad V'' = \{7, 8\} \quad E'' = \{\{7, 8\}\}$$

$$K_1 @ \quad V'' = \{1\} \quad E'' = \emptyset$$

$$K_1 @ \quad V'' = \{2\} \quad E'' = \emptyset$$

$$K_1 @ \quad V'' = \{3\} \quad E'' = \emptyset$$

$$K_1 @ \quad V'' = \{4\} \quad E'' = \emptyset$$

$$K_1 @ \quad V'' = \{5\} \quad E'' = \emptyset$$

$$K_1 @ \quad V'' = \{6\} \quad E'' = \emptyset$$

$$K_1 @ \quad V'' = \{7\} \quad E'' = \emptyset$$

$$K_1 @ \quad V'' = \{8\} \quad E'' = \emptyset$$

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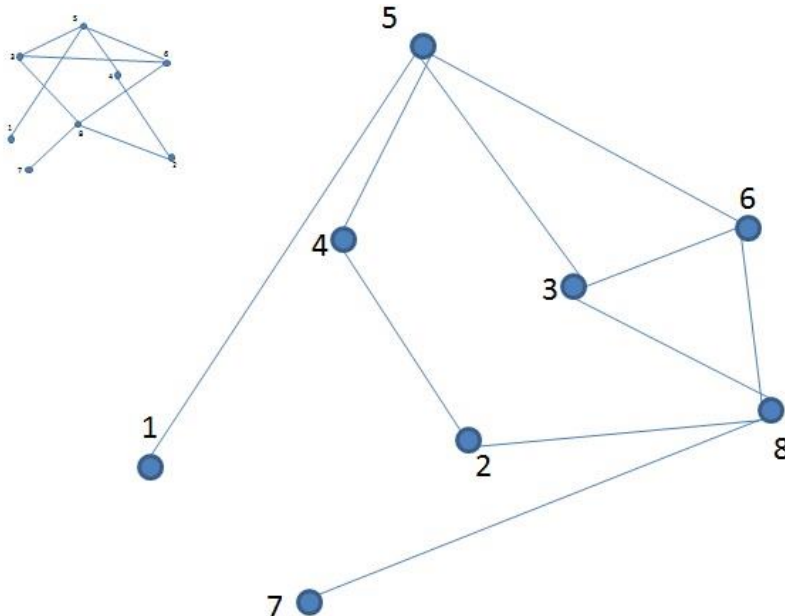
7. Consider the smallest set of edges E''' that needs to be added to the graph above such that the graph $(V, E \cup E''')$ contains W_6 . Provide an exhaustive list of the elements of E''' and specify the cardinality of E''' .

Solution:

$$E''' = \{\{3, 4\}, \{2, 3\}\}$$

$$|E'''| = 2$$

Isomorphic graph that shows which two edges are missing: (NOT necessary to get full marks, here to illustrate the solution)



Questions 8-9 all refer to the undirected graph specified below:

