CSE 211: Discrete Mathematics **(Due: 15/12/19)**

Homework #3

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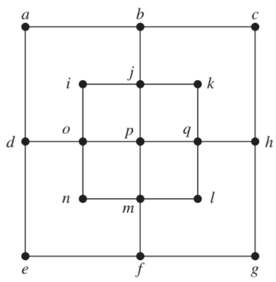
Course Policy: Read all the instructions below carefully before you start working on the assignment, and before you make a submission.

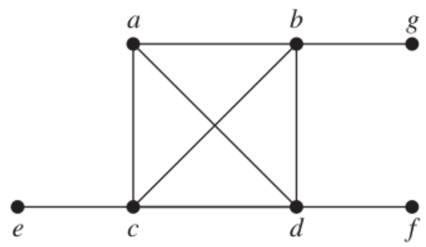
- It is not a group homework. Do not share your answers to anyone in any circumstance. Any cheating means at least -100 for both sides.
- Do not take any information from Internet.
- No late homework will be accepted.
- For any questions about the homework, send an email to gizemsungu@gtu.edu.tr
- Submit your homework into Assignments/Homework3 directory of the CoCalc project CSE211-2019-2020.

Problem 1: Hamilton Circuits (10+10+10=30 points)

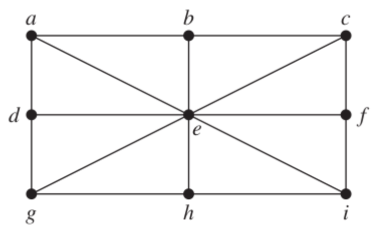
Determine whether there is a Hamilton circuit for each given graph (See Figure 1a, Figure 1b, Figure 1c). If the graph has a Hamilton circuit, show the path with its vertices which gives a Hamilton circuit. If it does not, explain why no Hamilton circuit exists.



(a) The graph G_1



(b) The graph G_2



(c) The graph G_3

Figure 1: The graphs to find Hamilton circuits for Problem 1

(a) ***(Solution)***

To be a hamilton circuit you must start and stop at the same node and you can not pass at vertex more than once

assume that we start pafter goinglike p j k q l m n o i there is no way without passing j again to visit all vetices even you first copmlete semi square after that complete the out of small square you have to pass the same vertex again

(b) ***(Solution)***

we can not say there is a hamilton circuit because if you start from e,g or f you cannot

(c) ***(Solution)***

$e \rightarrow h \rightarrow i \rightarrow f \rightarrow c \rightarrow b \rightarrow a \rightarrow d \rightarrow g \rightarrow e$

Problem 2: Graph Isomorphism (10+10+10=30 points)

Determine whether each pair of graphs (see Figure 2, Figure 3, Figure 4) is isomorphic or not.
Note: If you answer only "isomorphic" or "not isomorphic", you cannot get points. Show your work.

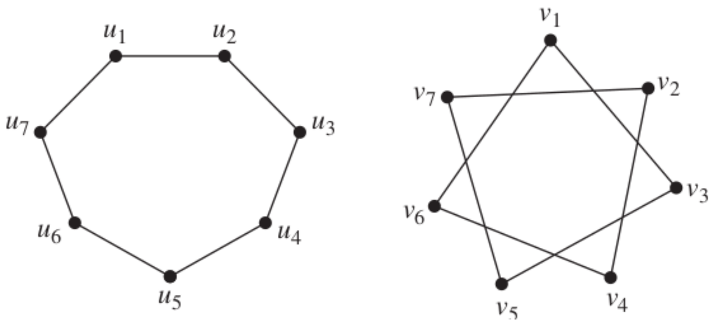


Figure 2: The graphs G_{a1}(left) and G_{a2}(right) to find isomorphism for Problem 2(a)

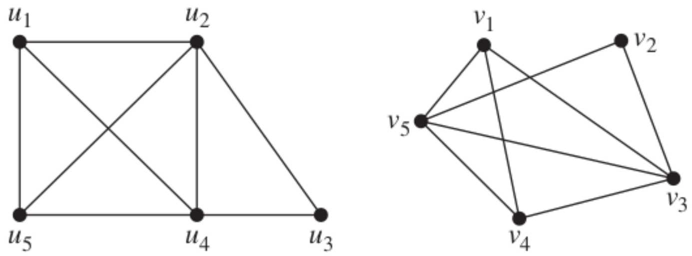


Figure 3: The graphs G_{b1}(left) and G_{b2}(right) to find isomorphism for Problem 2(b)

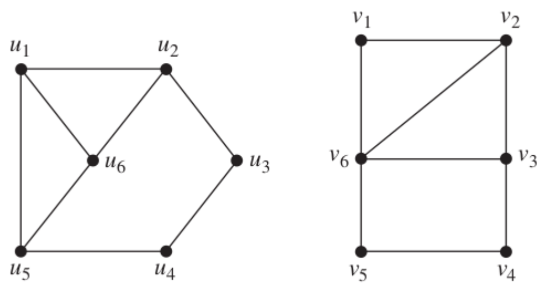


Figure 4: The graphs G_{c1}(left) and G_{c2}(right) to find isomorphism for Problem 2(c)

(a) ***(Solution)***
a has 7 edges and 7 vertices and also b has 7 edges and 7 vertices according to shape:

$u_1 \Rightarrow 2$	$v_1 \Rightarrow 2$	$u_1 \Rightarrow v_1$
$u_2 \Rightarrow 2$	$v_2 \Rightarrow 2$	$u_7 \Rightarrow v_6$
$u_3 \Rightarrow 2$	$v_3 \Rightarrow 2$	$u_6 \Rightarrow v_4$
$u_4 \Rightarrow 2$	$v_4 \Rightarrow 2$	$u_5 \Rightarrow v_2$
$u_5 \Rightarrow 2$	$v_5 \Rightarrow 2$	$u_4 \Rightarrow v_7$
$u_6 \Rightarrow 2$	$v_6 \Rightarrow 2$	$u_3 \Rightarrow v_5$
$u_7 \Rightarrow 2$	$v_7 \Rightarrow 2$	$u_2 \Rightarrow v_3$

(b) ***(Solution)***

	u_1	u_7	u_6	u_5	u_4	u_3	u_2
u_1	0	1	0	0	0	0	1
u_7	1	0	1	0	0	0	0
u_6	0	1	0	1	0	0	0
u_5	0	0	1	0	1	0	0
u_4	0	0	0	1	0	1	0
u_3	0	0	0	0	1	0	1
u_2	1	0	0	0	0	1	0

	v_1	v_6	v_4	v_2	v_7	v_5	v_3
v_1	0	1	0	0	0	0	1
v_6	1	0	1	0	0	0	0
v_4	0	1	0	1	0	0	0
v_2	0	0	1	0	1	0	0
v_7	0	0	0	1	0	1	0
v_5	0	0	0	0	1	0	1
v_3	1	0	0	0	0	1	0

b1 and b2 both of them has 5 vertices and 5 edges

according to shape:
$u_1 \Rightarrow 3$ $v_1 \Rightarrow 3$ $u_1 \Rightarrow v_1$
$u_2 \Rightarrow 4$ $v_2 \Rightarrow 2$ $u_2 \Rightarrow v_3$
$u_3 \Rightarrow 2$ $v_3 \Rightarrow 4$ $u_3 \Rightarrow v_2$
$u_4 \Rightarrow 4$ $v_4 \Rightarrow 3$ $u_4 \Rightarrow v_5$
$u_5 \Rightarrow 3$ $v_5 \Rightarrow 4$ $u_5 \Rightarrow v_4$

(c) ***(Solution)***

both of them have 8 edges and 6 verticles
$u_1 \Rightarrow 3$ $v_1 \Rightarrow 2$
$u_2 \Rightarrow 3$ $v_2 \Rightarrow 3$
$u_3 \Rightarrow 2$ $v_3 \Rightarrow 3$
$u_4 \Rightarrow 2$ $v_4 \Rightarrow 2$
$u_5 \Rightarrow 3$ $v_5 \Rightarrow 2$
$u_6 \Rightarrow 3$ $v_6 \Rightarrow 4$

butthedegreeofthegraphsdoesntmatch

Problem 3: Euler Circuits $(10 + 10 = 20 points)$

DeterminewhetherthereisaEulercircuitforeachgivengraph(SeeFigure5a, Figure5b).IfthegraphhasaEulercircuit, showth

(Solution)

to become euler circuits in directed graphs the in degree must be equal to out degree
for a::::

	u_1	u_2	u_3	u_4	u_5
u_1	0	1	0	1	1
u_2	1	0	1	1	1
u_3	0	1	0	1	0
u_4	1	1	1	0	1
u_5	1	1	0	1	0

	v_1	v_3	v_2	v_5	v_54
v_1	0	1	0	1	1
v_3	1	0	1	1	1
v_2	0	1	0	1	0
v_5	1	1	1	0	1
v_4	1	1	0	1	0

(a) The graph G_{3a} (b) The graph G_{3b}

Figure 5: The graphs to find Euler circuits for Problem 3

id(a)=1 od(a)=2
id(b)=3 od(b)=3
id(c)=2 od(c)=2
id(d)=2 od(d)=2
id(e)=4 od(e)=3

so for the a graph the a and e vertices have different indegree and out degree so there is no euler circuit
for b::::
id(a)=2 od(a)=2
id(b)=4 od(b)=3
id(c)=2 od(c)=3
id(d)=2 od(d)=2
id(e)=3 od(e)=3
id(f)=3 od(f)=3

so for the a graph the b and c vertices have different indegree and out degree so there is no euler circuit

Problem 4: Applications on Graphs (20 points)

Schedule the final exams for Math 101, Math 243, CSE 333, CSE 346, CSE 101, CSE 102, CSE 273, and CSE 211, using the fewest number of different time slots, if there are no students who are taking:

- both Math 101 and CS 211,
- both Math 243 and CS 211,
- both CSE 346 and CSE 101,
- both CSE 346 and CSE 102,
- both Math 101 and Math 243,
- both Math 101 and CSE 333,
- both CSE 333 and CSE 346

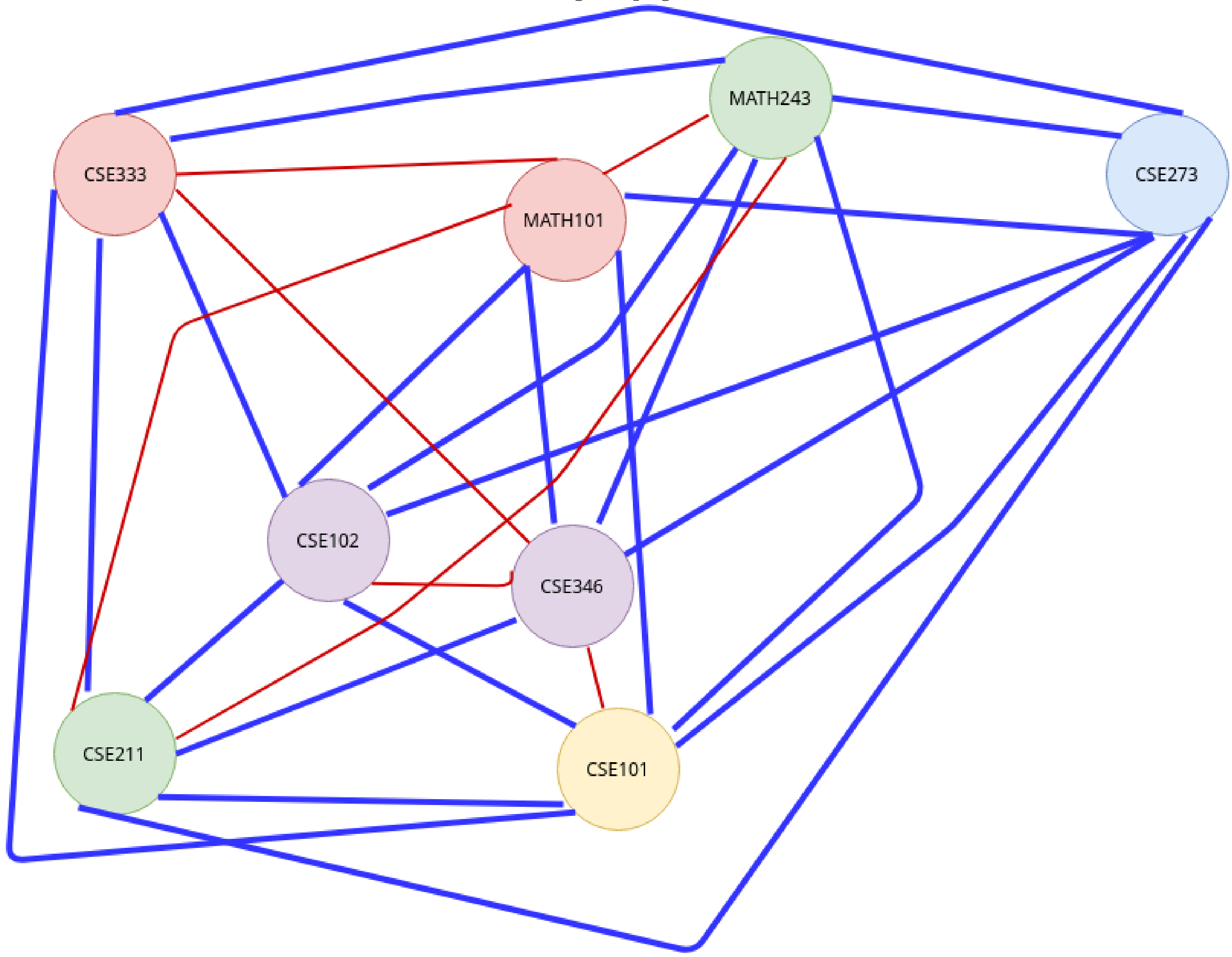
	MON	TUES	WEND	THURS	FRIDAY
1.SESSION	CSE333	MATH243	CSE102	CSE101	CSE273
2.SESSION	MATH101	CSE211	CSE346		

but there are students in every other pair of courses together for this semester.
Note: Assume that you have only one classroom.

Hint 1: Solve the problem with respect to your problem session notes.
Hint 2: Check the website

(Solution)

1.0 Diagram.png



the red lines are the first form of graph and if we get the complement of the graph we can arrange the schedule by using graph coloring technique by giving d'fferent colors to connected vertices