Quiz 5B (Module 7-9)
Graph Theory

ONLY THE ANSWERS IN THE ANSWER SHEET WILL BE GRADED.

Module 7: (20%)

1. Yes or No?
    a. Is there a simple graph that has 5 vertices with degree 2, 2 , 3, 3, 4?
    b. Is there a simple graph that has 7 vertices with degree 2, 2 , 3, 3, 4, 4, 5?
    c. Is there a simple graph that has 100 vertices with degree 0, 1, 2, 3, ..., 99?
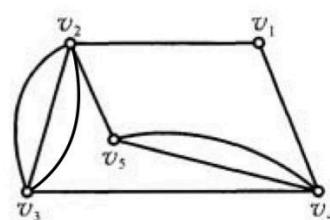
2. Fill the table (answer only positive integer, Yes, No)

	W_5	Q_5	C_5	K_5	$K_{3,2}$
Number of vertices					
Number of edges					
Is it bipartite or not? **(Yes/No)**					

3. Match each vertex in the following two isomorphic graphs.
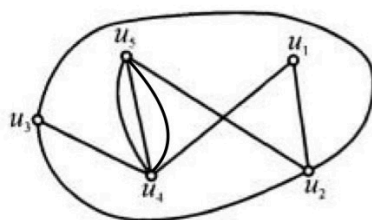
(1)   (2)

$$(v_1, v_2, v_3, v_4, v_5) = (u_a, u_b, u_c, u_d, u_e)$$
Find a, b, c, d, e

4. Find the number of maximum edges of a bipartite graph with 23 vertices.
5. Let G be **a simple graph** with 888 edges.

    Find the difference of minimum number of vertices in G and maximum number of vertices in G?
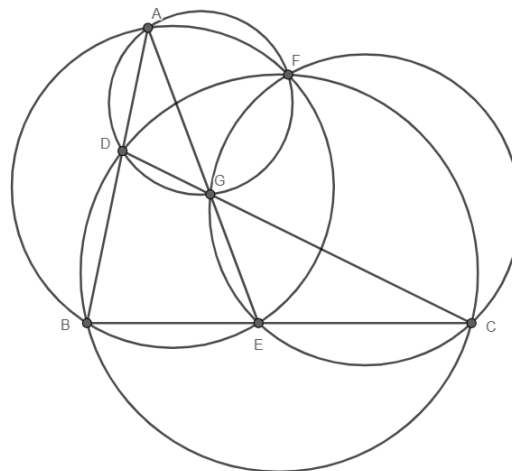
6. Taeyeon tries to draw all possible simple graphs that make all vertices degree = 2. For example, if the number of vertices is 4 let's say vertices are A, B, C, D then the number of graphs that is possible is 3 (like the picture below). How many graphs can Taeyeon draw if there are 5 vertices?
[Each vertex is considered different]
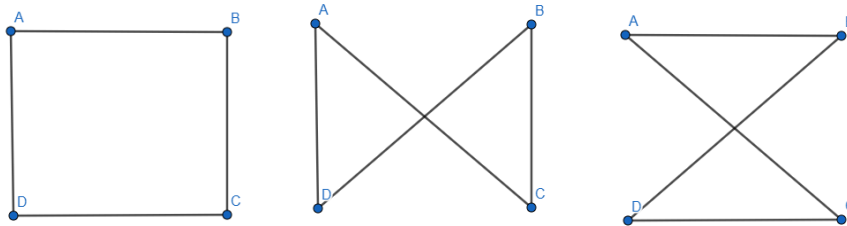
7. Fill the adjacency matrix of vertex G.

8. Nolan tries to draw all possible edges in a n-vertex simple graph such that there is no triangle(triangle means K_3) in that graph. What is the maximum number of edges Nolan can draw if
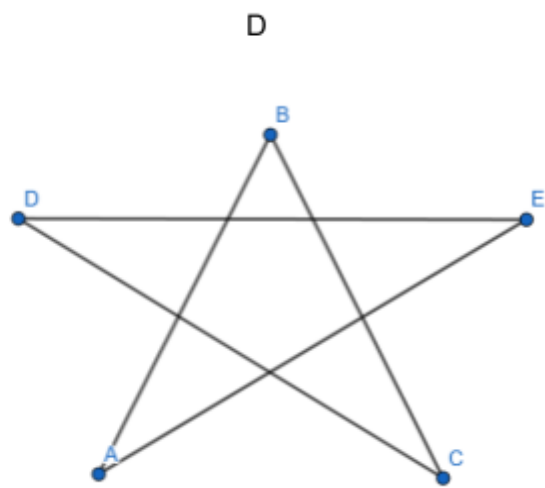
   a. $n = 4$
   b. $n = 5$
   c. $n = 6$
   d. $n = 7$

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Graph Theory

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A

B

C

D
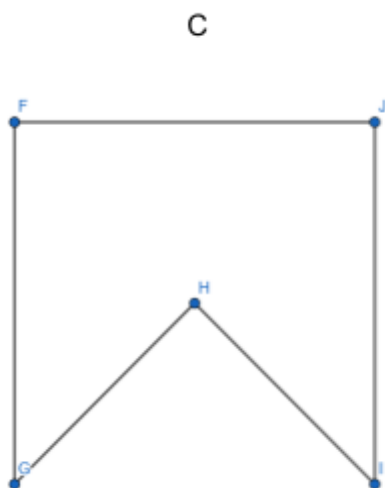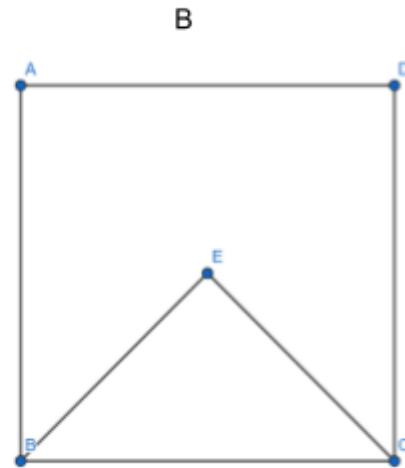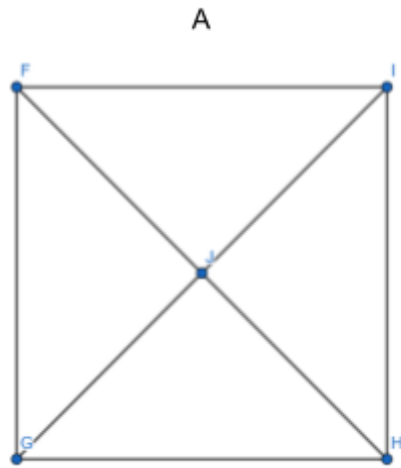
use this following graph to answer question 8-14

9. Which one is isomorphic?
   a. C, D
   b. A, B
   c. A, C
   d. B, C
10. What is the maximum number of edges that we can remove from K_5 and keep the graph connected?
   a. 7
   b. 0
   c. 5
   d. 6

11. Which of the following statements is true?
    a. simple path can contain the same edge more than once
    b. the longest simple path in C_7 has its length equal to 6

    c. circuit need to start and end at the same vertex
    d. graph that have cut edge can has a hamilton circuit

12.
    How many cut edges are in this graph?
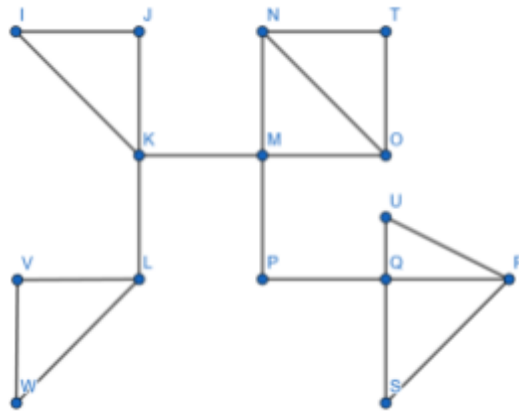   a. 4
    b. 3
    c. 2
    d. 1

$$\begin{array}{cccc} & A & B & C \\ A & \begin{bmatrix} 2 & 2 & 0 \\ B & 2 & 0 & 2 \\ C & 0 & 2 & 0 \end{bmatrix} \end{array}$$

13.
    From this adjacency matrix find the number of paths with length 3 between vertex A and C.
    a. 0
    b. 4
    c. 6
    d. 8

14. Which graph does not have an euler circuit?
    a. K_3

    b. W_5

    c. C_4

    d. $K_{2,4}$

15. Which graph does not have a Hamilton circuit?

a. W_4

b. C_5

c. $K_{3,2}$

d. Q_2

16. What is the maximum number of edges that can be removed from Q_7 and keep the graph connected?

17. How many subgraphs of $K_{5,5}$ are isomorphic with Q_3?

18. **(BONUS)** Superpower CEDT

Suppose that while you are doing a graph and tree quiz you suddenly are teleported to balkan area. in your left hand there is map look like picture below
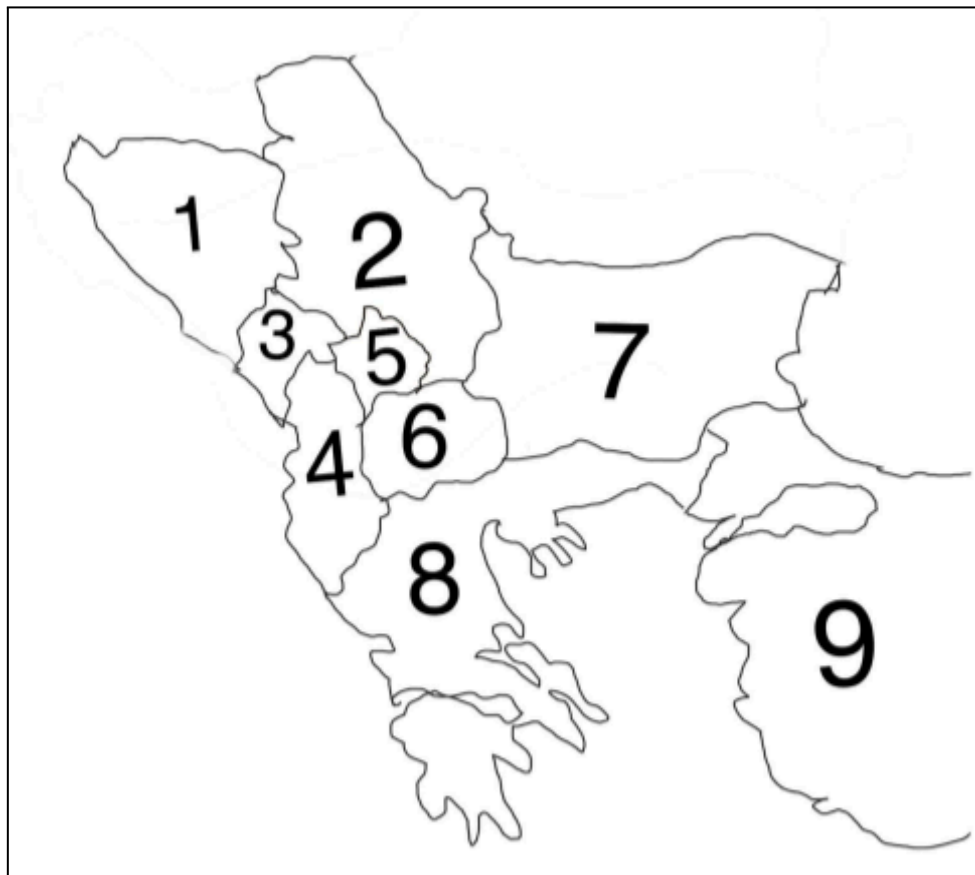
and in your right hand there are 2 notes

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"gae-mai-rod-nae"

"gems are keys" You will receive the gems once you pass the border between 2 specific countries there are 11 gems that you can collect which receive when you pass the border between (1,2), (1,3), (2,3), (2,5), (2,7), (5,6), (4,6), (4,8), (6,7), (7,9), (8,9) for the first time and you can pass either both direction furthermore there are 6 teleportation center between (1,8), (1,7), (2,8), (2,9), (3,6), (3,7) that you can use to teleport between 2 country but will not get gems and will be destroy after using it one time.

you can only pass the border that gives you gems or use teleportation center which mean you cannot go back the same route and route that does not give gems for example you cannot go from 3 to 5 because they don't give you a gem and you can go from 1 to 2 because it give you gems first time you cross border but you cannot go back from 2 to 1 or pass 1 to 2 again because it will not give you gems second time

there are 5 ability that you can get

1. "Fly ability" for those who collect all gems, start and end at the same country and without using any teleportation center
2. "Healing ability" for those who collect all gems, start and end at the same country and use teleportation center at least 1 times
3. "Mind Reading ability" for those who collect all gems and without using any teleportation center
4. "Super strength ability" for those who visit every country, start and end at the same country without using any teleportation center (don't need to collect all gems)
5. "unlimited stamina ability" for those who visit every country and without using any teleportation center (don't need to collect all gems)

from this rule answer the following 4 question

   18.1 how many ability that are possible to get

   18.2 if you want to get "Healing ability" what is The least number of times that you need to use teleportation center to get it

   18.3 from question 18.2 find sum of all country that your teleport center connect (for example you use (1,8), (1,7) your answer should be 1+8+1+7 = 17)

   18.4 if you want to get "Mind Reading ability" you need to start in country S and end in country C so find S x C

Quiz 5B (Module 7-9)
Graph Theory

Module 9 : (20%)

19. Which one is a Planar graph ?
    a. K_8
    b. K_{10}
    c. K_6
    d. K_4

20. Which one is a Planar graph ?
    a. $K_{7,7}$
    b. $K_{20,2}$
    c. $K_{3,3}$
    d. $K_{4,5}$

21. If a simple connected graph G has 17 vertices and 30 edges, find the number of regions of G ?
    a. 20
    b. 19
    c. 15
    d. 17

22. How many leaves are there in a full 5-ary tree with 21 vertices ?
    a. 11
    b. 13
    c. 15
    d. 17

23. In the given tree below
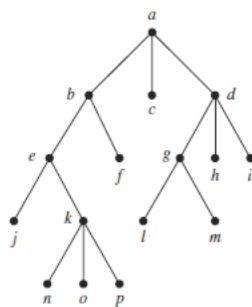
    which transversal has vertex c visited before vertex p ?
    a. inorder
    b. preorder
    c. postorder
    d. none of the above

24. (TA Tar vs the cursed spirit)

When not working as a TA , TA Tar works as a jujutsu sorcerer to dispel(kill) the cursed spirit. One day TA Tar meets a special grade cursed spirit named "Chesu".

Chesu is a special grade which mean it's strong enough to use special technique called "Domain Expansion" to create a $n \, x \, n$ grid (n is a positive integer , $n \geq 2$).

where he puts his opponent opposite to him like in the figure below.
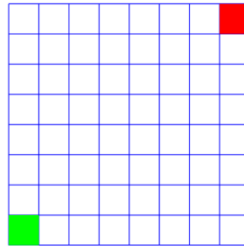
TA Tar is at the most bottom-left block and Chesu is at the most up-right block
In order to kill Chesu , TA Tar uses a fireball cursed technique from the green block,
The fireball can travel in left,right,up,bottom direction (not in any diagonal direction).
To kill Chesu , a fireball must travel from green to red block and must visit all blocks only once !!!.

(start at the most bottom-left block and end at the most up-right block , visit every block exactly one time per block).

Find the necessary and sufficient condition for n if TA Tar want to kill Chesu.

    a. n is odd integer , $n \geq 2$
    b. n is even integer , $n \geq 2$
    c. n is prime number , $n \geq 2$
    d. none of the above

25. Fill the table (answer only positive integer)

	25.1) Q_{11}	25.2) C_{11}	25.3) W_{11}	25.4) $K_{11,11}$	25.5) K_{11}
chromatic numbers					

ANSWER SHEET for Quiz 5B

Module 7:

Provide an answer with "**Yes**" or "**No**".

No 1	a		b		c	

Provide an answer in terms of **INTEGER ONLY**

No. 2	W_5	Q_5	C_5	K_5	$K_{3,2}$
Number of vertices					
Number of edges					
Bipartite or not (Yes/No)					

No.	Answer			
3	a		b	
	c		d	
	e			

4		5		6	

No. 7	A	B	C	D	E	F
G						

No.	Answer		
8	a		b	

	c		d	

Module 8: Choose the correct answer and provide the **X** mark.

No.	Choice				No.	Choice			
	a.	b.	c.	d.		a.	b.	c.	d.
9.					13.				
10.					14.				
11.					15.				
12.									

Provide an answer in terms of **INTEGER ONLY**.

No.	Answer			
16			17	
18	18.1		18.2	
	18.3		18.4	

Module 9: Choose the correct answer and provide the **X** mark.

No.	Choice				No.	Choice			
	a.	b.	c.	d.		a.	b.	c.	d.
19.					22.				
20.					23.				
21.					24.				

Provide an answer in terms of **INTEGER ONLY**.

No.	Answer			
25	25.1		25.2	
	25.3		25.4	
	25.5			