

Discrete Mathematics

Graph Theory

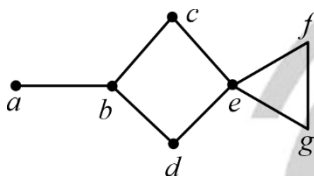
DPP-09

[NAT]

1. If G is a bipartite graph with 6 vertices and 9 edges then the chromatic number of \overline{G} = ____.

[MSQ]

2. Consider the graph shown below.

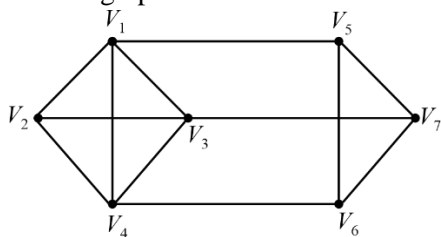


Which of the following option is correct?

- (a) Dominating set = $\{e, b\}$ and Domination no = 2
 (b) Dominating set = $\{a, c, d, f\}$ and Domination no = 4
 (c) Dominating set = $\{b, f\}$ and Domination no = 2
 (d) None of these

[NAT]

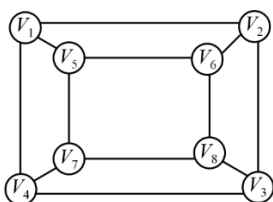
3. For the graph shown below.



Assume x is the chromatic number of the graph and y is the domination number then find $x + y$?

[MCQ]

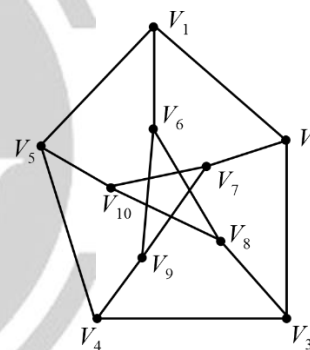
4. Which of the following is/are a independent set for the graph shown below?



- (a) $\{V_1, V_8, V_2\}$
 (b) $\{V_1, V_8\}$
 (c) $\{V_2, V_4, V_5, V_8\}$
 (d) $\{V_1, V_3, V_6, V_7\}$

[MCQ]

5. Consider the given graph G .



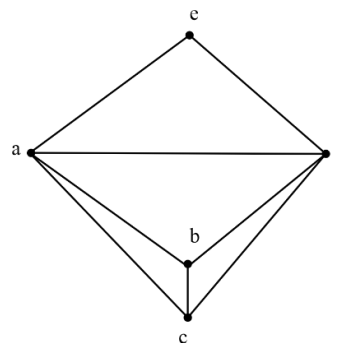
Which of the following option is correct?

S_1 : The chromatic number for the given graph is 3.
 S_2 : The independence number of the graph is 4.

- (a) S_1 only
 (b) S_2 only
 (c) S_1 and S_2 both
 (d) Neither S_1 nor S_2

[NAT]

6. For the graph shown below, the chromatic number is ____.



Answer Key

- | | |
|--------------|--------|
| 1. (3) | 5. (c) |
| 2. (a, c) | 6. (4) |
| 3. 6 | |
| 4. (b, c, d) | |

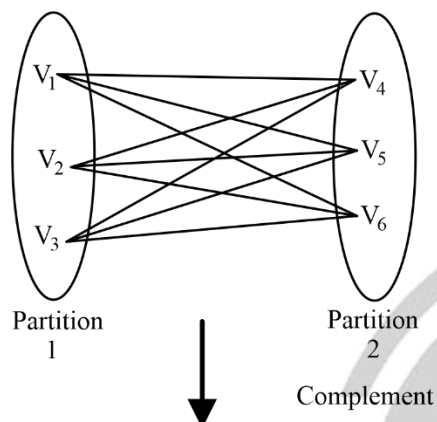


Hints and solutions

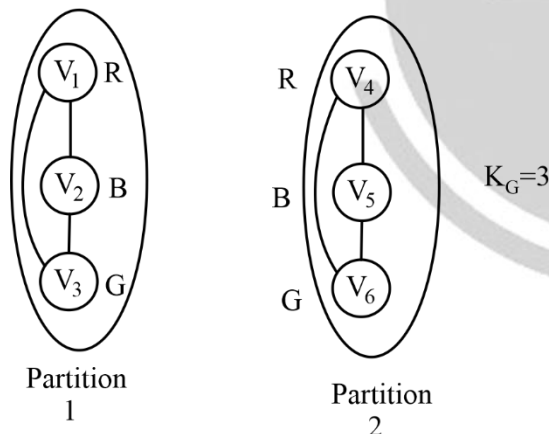
1. (3)

In the problem we have a bipartite graph with 6 vertices and 9 edges

So,



The complement of the bipartite graph will have complete graph with 3 vertices within partition 1 and partition 2.



Hence, the chromatic number of \bar{G} is 3

2. (a, c)

I. Dominating Set: The set of vertices from which the whole graph can be covered in the single move.

II. Domination No: The smallest/minimal dominating set.

Option a and c: correct

The vertex sets $\{e, b\}$ and $\{b, f\}$ covers the complete graph and it is also the minimal dominating set with Domination number is 2.

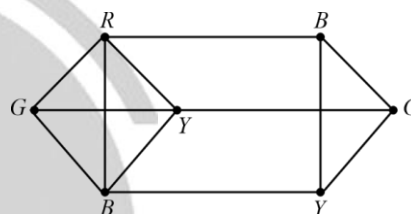
Option b: Incorrect

As the vertex set $\{a, c, d, f\}$ is the dominating set but it is not the minimal dominating set.

Hence, the domination number 4 is incorrect

3. (6)

I. Chromatic number: The above graph have complete graph (K_4) so, the ' $K_G \leq 1 + \Delta(G)$ ' and due to complete graph ' K_4 ', we need at least '4' color for K_4 .



Hence, the chromatic number is 4 so, $x = 4$.

II. Domination Number: To find the minimal dominating set, always start with maximum degree vertex.

\therefore Dominating set = $\{V_1, V_6\}$

Hence, the domination No. is 2 so, $y = 2$

$\therefore x + y = 4 + 2 = 6$

4. (b, c, d)

Independent Set : The set of vertices which are not adjacent to each other.

Option a : Incorrect

As vertex V_1 is adjacent to vertex V_2 .

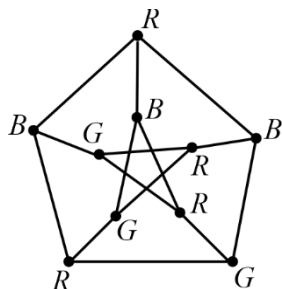
Hence, given vertex set is not independent set.

Option b, c, d : Correct

All the vertices of option b, c, d are adjacent to none within the set.

Hence, b, c, d are the independent set of given graph.

5. (c)

Statement S_1 : True

Hence, the chromatic number of the graph is 3.

Statement S_2 : True

All the red (R) colored vertices could be the maximal independent set.

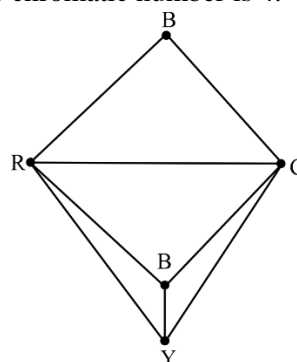
Independent Set : $\{V_1, V_4, V_7, V_8\}$

Hence, the independence number of the graph is 4

6. (4)

The graph contains complete graph of 3 vertices (K_3) so, the chromatic number will be at least 3.

Hence, the chromatic number is 4.



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