# Branch : CSE/IT Batch : English

# Discrete Mathematics
# Graph Theory

**DPP-04**

**[MCQ]**

**1.** If a hypercube ($Q_n$) is given with edges 193, then the number of vertices will be

(a) 6
(b) 5
(c) 7
(d) None of these

**[MCQ]**

**2.** consider the following statements:

**$S_1$:** Every hypercube graph is a bipartite graph.

**$S_2$:** Every bipartite graph is also a hypercube.

Which of the following options is True?

(a) $S_1$ only (b) $S_2$ only
(c) Both $S_1$ and $S_2$ (d) Neither $S_1$ nor $S_2$

**[NAT]**

**3.** A certain graph G has order 16 and size 29. The degree of each vertex of G is 3, 4 or 5. There are six vertices of degree 4. How many vertices of G having degree 5?

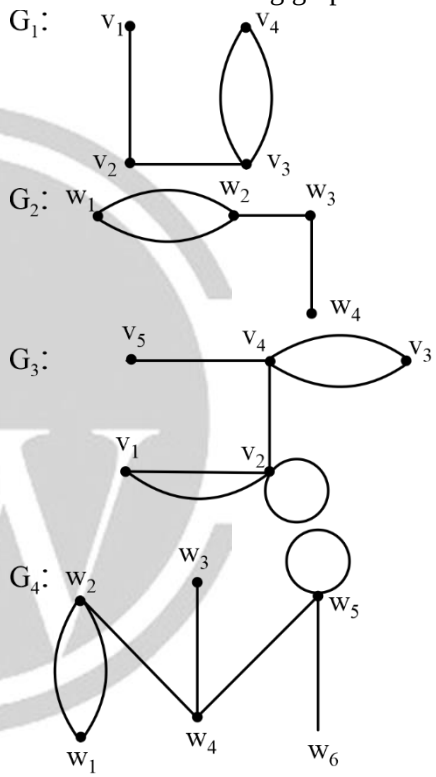
**[MCQ]**

**4.** If the sequence x, 7, 7, 5, 5, 4, 3, 2 is graphical then what are the possible value of x ($0 \le x \le 4$)?

(a) 0 (b) 2
(c) 3 (d) 1

**[MSQ]**

**5.** Which of the following graphs are isomorphic graph?




(a) $G_1$ and $G_2$ are isomorphic
(b) $G_3$ and $G_4$ are isomorphic
(c) $G_1$ and $G_2$ are not isomorphic
(d) $G_3$ and $G_4$ are not isomorphic

# Answer Key

1. **(d)**
2. **(a)**
3. **(2)**
4. **(c)**
5. **(a, d)**

# Hints and solutions

**1. (d)**

As we know that the number of edges in a hypercube ($Q_n$) is given as:

Number of edges = $n.2^{n-1}$

$\therefore \quad 193 = n.\ 2^{n-1}$

Here for any integer value of 'n', the hypercube would not contain 193 edges.

Hence, the correct option is d.

**2. (a)**

**Statement $S_1$ : True**

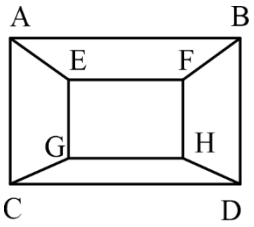
Every hypercube have cycle of length even hence it is possible to divide the vertices into two sets.

So, Every hypercube is a bipartite graph.

**Statement $S_2$ : False**

Every bipartite graph is not hypercube graph.

**Example:**




The above graph is bipartite graph as $V_1$ = {A, G, F, D} and $V_2$ ={B, E, H, C} with number of edge = 12 and vertices = 8.

Still the above graph is not hypercube.

**3. (2)**

**I.** In the problem number of vertices is given 16 and number of edges given is 29.

Now, we have 6 vertices of degree 4.

Assume x is total number of vertices with degree 5.

So, number of vertices with degree 3 will be :

(16 – 6 –x) = (10 – x)

**II.** Now, by using Handshaking lemma:

Sum of degree = 2 * |E|

$\therefore \quad (6 * 4) + (x * 5) + (10 - x) * 3 = 2 * 29$

$\Rightarrow \quad 24 + 5x + 30 - 3x = 58$

$\Rightarrow \quad 5x - 3x = 58 - 54$

$\Rightarrow \quad 2x = 4$

$\therefore \quad x = 2$

Hence, we have 2 vertices with degree 5 and 8 vertices with degree 3.

**4. (c)**

**I.** In any graph the number of odd degree vertices must be even. Now, in the given degree sequence, we have 5 vertices with odd degree

{7, 7, 5, 5, 3}

Thus, the value of x must be odd number between 0 to 4 that is either 1 or 3.

**II.** Now, case I assume x = 1:

Degree sequence: 1, 7, 7, 5, 5, 4, 3 ,2

⇓ order

7, 7, 5, 5, 4, 3, 2, 1

as we know that if we have 2 vertices with maximum degree (n - 1) then the degree of each vertex must be ≥ 2.

Thus, x will be 3 only.

Hence, right answer is option c.

**5. (a, d)**

I. $G_1$ and $G_2$ are isomorphic as it has equal number of vertices, edges and same degree sequence.

II. $G_3$ and $G_4$ are not isomorphic because incident property not satisfied.

Degree of $V_2$ is 5 in $G_3$ but there is not any vertex in $G_4$ with same degree.