**Handshaking Theorem**

Handshaking Theorem states that “**The sum of degrees of the vertices of a graph is twice the number of edges**.”

If G = (V, E) be a graph with E edges, then

**Σ degG(V) = 2E**

**Proof:**

           Since the degree of a vertex is the number of edges incident with that vertex, the sum of degree counts the total number of times an edge is incident with a vertex. Since every edge is incident with exactly two vertices, each edge gets counted twice, once at each end. Thus the sum of the degrees is equal twice the number of edges.

This theorem applies even if multiple edges and loops are present. The theorem holds this rule that if several people shake hands, **the total number of hands shake must be even** that is why the theorem is called **handshaking theorem**.

**Corollary**: In a graph, the total number of odd degree vertices is even.

### Directed and Undirected Graph

A **Digraph or directed graph** is a graph in which each edge of the graph has a**direction**. Such edge is known as directed edge.

An **Undirected graph** G consists of set V of vertices and set E of edges such that each edge is associated with an unordered pair of vertices.

Suppose e = (u, v) is a directed edge in a diagraph, then

1. u is called the initial vertex of e and v is the terminal vertex of e.

2. e is said to be incident from u and to be incident to v.

3. u is adjacent to v, and v is adjacent from u.

### Isomorphism of Graphs

### Two graphs are said to be isomorphic if there exists a bijective function from the set of vertices of the first graph to the set of vertices of the second graph in such a way that the adjacency relation (if 2 vertices are adjacent, then their images are also adjacent) is maintained.