

1. Which of the following graph must contain a cycle?
  - a. Graph G with degree sequence  $\langle 1,2,2,3,4,4 \rangle$
  - b. Graph G with degree sequence  $\langle 1,1,1,1,2,2,2,2 \rangle$
  - c. Graph G with degree sequence  $\langle 1,1,2,2,2 \rangle$
  - d. Graph G with degree sequence  $\langle 1,1,1,13,3 \rangle$
  - e. G with degree sequence  $\langle 1,1,1,1,1,1,1,1 \rangle$
2. An **orientation** of a graph G is a digraph D obtained from G by choosing an orientation ( $x \rightarrow y$  or  $y \rightarrow x$ ) for each edge  $xy \in E(G)$ . An oriented graph is an orientation of a simple graph. A **tournament** is an orientation of a complete graph.
  - 2(A). The number of oriented graphs with vertices  $V_1, V_2, \dots, V_n$  is
    - a.  $2^{n(n-1)/2}$
    - b.  $3^{n(n-1)/2}$
    - c.  $4^{n(n-1)/2}$
    - d.  $3^{n(n-1)}$
    - e.  $4^{n(n-1)}$
  - 2(B). The number of tournaments is
    - a.  $2^{n(n-1)/2}$
    - b.  $3^{n(n-1)/2}$
    - c.  $4^{n(n-1)/2}$
    - d.  $3^{n(n-1)}$
    - e.  $4^{n(n-1)}$
3. A graph G with n vertices and m edges has at least
  - a.  $m-n+1$  cycles
  - b.  $m*n+1$  cycles
  - c.  $m+n+1$  cycles
  - d.  $m^n$  cycles
  - e.  $n^m$  cycles
4. If G is a simple n-vertex graph with  $\delta(G) \geq (n-1)/2$  then which of the following is always true?
  - a. G cannot have a cut vertex
  - b. G cannot have a bridge
  - c. G is connected

- d. G has an Euler path
  - e. G has Hamiltonian cycle
5. Let  $G(V,E)$  be a connected graph with at least 3 vertices. If there is no single vertex disconnecting the graph. Then which of the following statements are true?
- a. Graph G has Hamiltonian cycle
  - b. Graph G has Euler ckt
  - c. Graph G does not contain bridge
    - I. Only a
    - II. Only b
    - III. Only a&b
    - IV. Only a&c
    - V. All of the above