MA115A Dr. Katiraie Section 7.1 Worksheet Name: _____

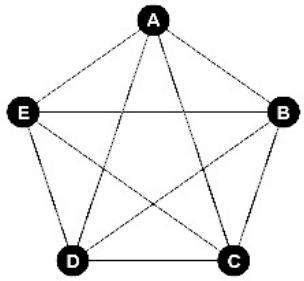
1. A circuit in a graph is a path that begins and ends at the same vertex.
   A) True
   B) False

2. An Euler circuit is a circuit that traverses each edge of the graph exactly:

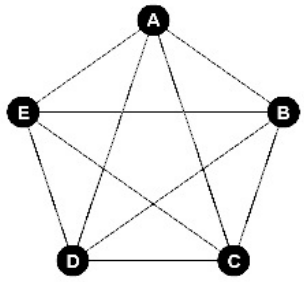
3. The _____ of a vertex is the number of edges that touch that vertex.

4. According to Euler's theorem, a connected graph has an Euler circuit precisely when every vertex has odd degree.
   A) True
   B) False

5. What is the degree of each vertex in the figure below?

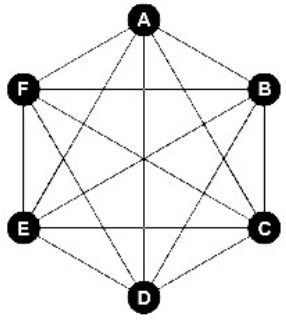



6. According to Euler's theorem, the figure below has an Euler circuit:

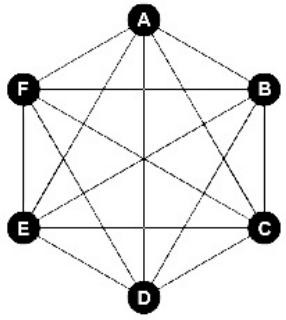



   A) True
   B) False

7. What is the degree of each vertex in the figure below?




8. According to Euler's theorem, the figure below has an Euler circuit:




A) True
B) False

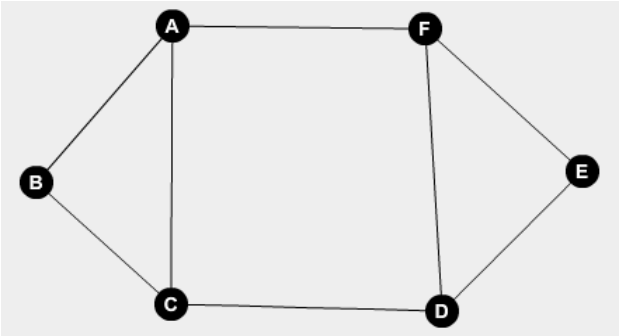
9. The computers in an office area are connected as follows:

   The computer in **Office A** is connected to all computers.
   The computer in **Office B** is connected to Office A and D.
   The computer in **Office C** is connected to Office A and D.
   The computer in **Office D** is connected to Office A, B, and C.

   Which two offices are not directly connected?

10. Suppose the edges of a certain graph represent phone lines that must be maintained, and the vertices represent junctions. A worker maintaining the lines would like to find an Euler circuit for this graph to increase:

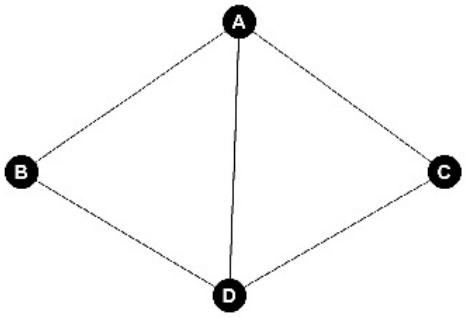
11. Find an Euler circuit for the figure below:



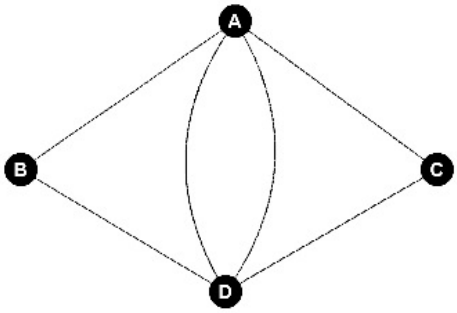

12. When graphs are represented pictorially using dots and segments, the dots are called:

13. When graphs are represented pictorially using dots and segments, the segments connecting the dots are called:

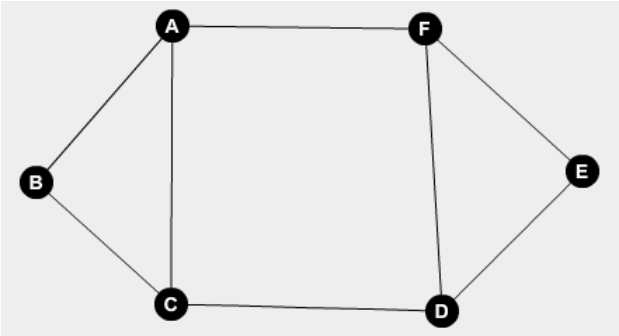
14. Find an Euler circuit for the figure below:




15. Find an Euler circuit for the figure below:

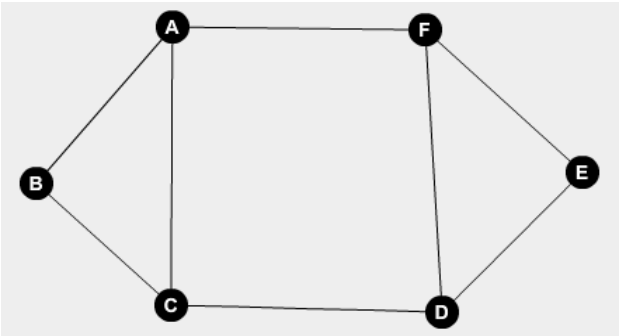


16. Which of the following vertices have degree 2?

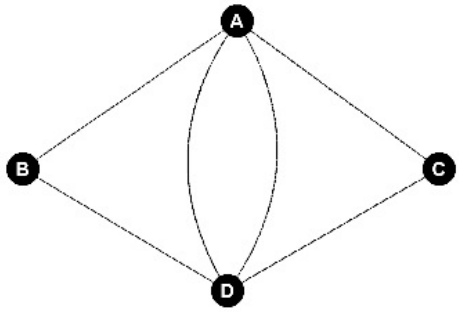



A) A and B
B) C and D
C) B and E
D) D and F

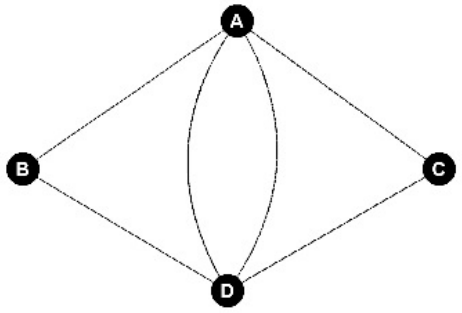
17. What is the degree of vertex F?



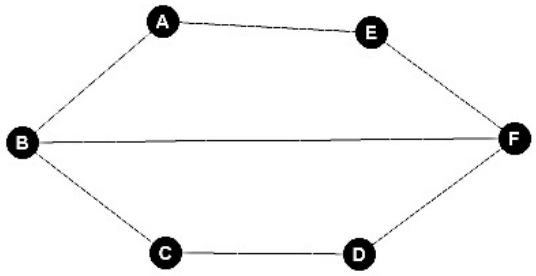

18. Which of the following vertices have degree 2?



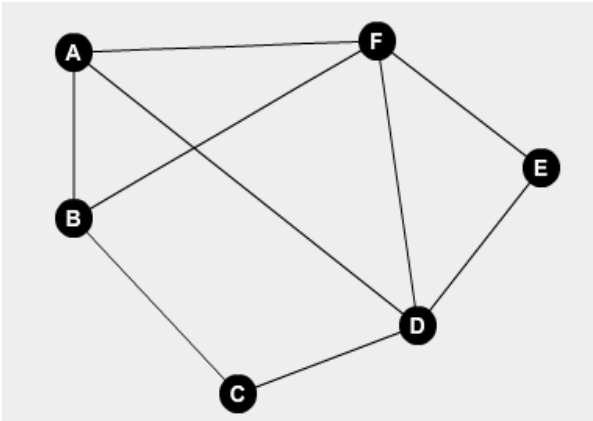
19. Which of the following vertices have degree 4?




20. Find an Euler circuit for the figure below:



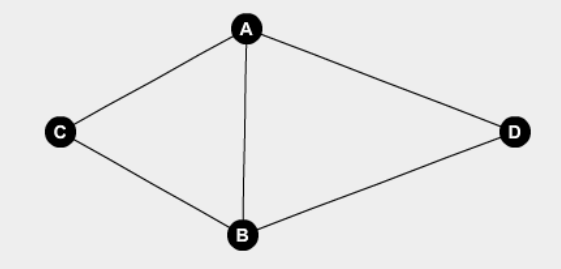

21. The graph below has two odd-degree vertices, so no Euler circuit exists. Suppose we would like to find a route that backtracks as little as possible. What duplicate edge could we create to help us find this route?




A) Between A and B.
B) Between B and C.
C) Between D and E.
D) Between E and F.

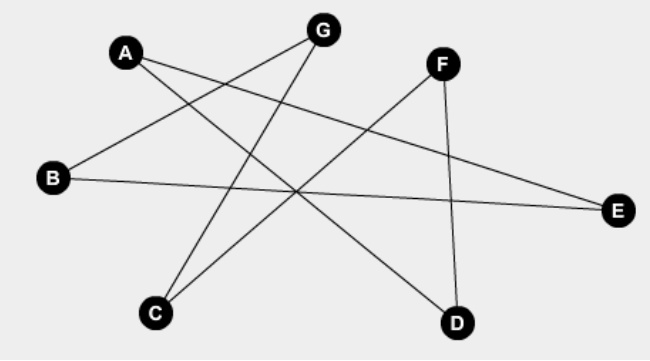
22. Which of the following is a practical situation where finding an Euler circuit may be important.
    A) Delivery of groceries.
    B) Garbage pickup.
    C) Street sweepers.
    D) All of the above.

23. The graph below has exactly two vertices of odd degree, namely A and B. Eulerize this graph to find the most efficient path that starts and ends at the same vertex and traverses each edge at least once.




24. The Little League in our town consists of the Alpha Division—the Bears, the Lions, and the Cheetahs—and the Beta Division—the Dolphins, the Seals, the Otters, and the Sharks. This season each team is to play exactly three teams from the other division. Is such a schedule possible? Explain why or why not.

25. The edges in the graph below represent sewer lines that must be inspected, and the vertices represent homes. Either find a route (starting and ending at A) that will not require the inspection team to travel along lines that have already been inspected or show that no such route exists.



26. The computers in an office area are connected as follows:

    The computer in **Office A** is connected to all computers.
    The computer in **Office B** is connected to Office A and D.
    The computer in **Office C** is connected to Office A and D.
    The computer in **Office D** is connected to Office A, B, and C.

    Make a graph modeling the office computer network.

27. A(n) _____ in a graph is a circuit that visits each vertex exactly once.

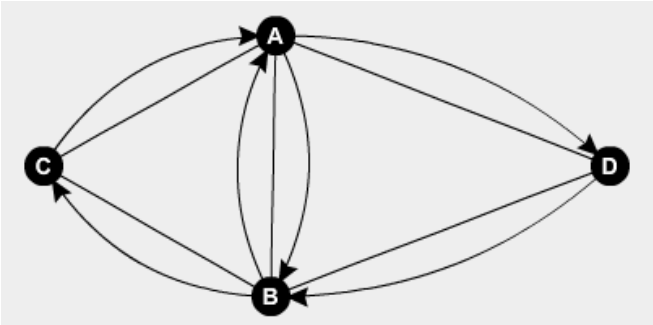
28. If a graph has a vertex of degree _____, then each edge meeting that vertex must be part of any Hamilton circuit.

29. A Hamilton circuit can contain a smaller circuit.
    A) True
    B) False

30. In a(n) _____ graph, each vertex is connected to every other vertex by an edge.
    A) Hamilton
    B) Euler
    C) complete
    D) direct

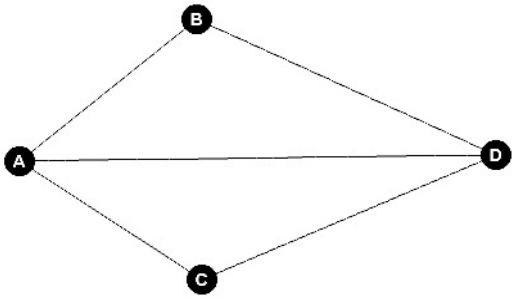
## Answer Key

1. A
2. once
3. degree
4. B
5. 4
6. A
7. 5
8. B
9. B and C
10. efficiency
11. No Euler circuit exists
12. Vertices
13. Edges
14. No Euler circuit exists
15. ABDACDA
16. C
17. 3
18. B and C
19. A and D
20. No Euler circuit exists.
21. A
22. D
23. One possibility: ABCADBA




24. Such a schedule is not possible. Consider the Beta Division. If each of the Beta Division teams plays three games by playing each of the Alpha Division teams, all of the Alpha Division teams would have to play four games, as there are four teams in the Beta division.
25. One possibility: ADFCGBEA

26.




27. Hamilton circuit
28. 2
29. B
30. C