Name:_____ Class:_____ Date:_____

Chapter 12: Graphs

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1. An example of a process or model that can be graphed is the links between pages on the Internet.
   a. True
   b. False

2. A graph is a set of edges and vertices such that each edge connects two vertices.
   a. True
   b. False

3. On a weighted graph, the vertices are labeled with numbers.
   a. True
   b. False

4. In a connected graph, there must be an edge from each vertex to every other vertex.
   a. True
   b. False

5. In a complete graph with six vertices, the degree of a vertex is five.
   a. True
   b. False

6. A simple path in a graph is one in which a path passes through the same vertex at least twice.
   a. True
   b. False

7. In an undirected graph, two or more edges connect the same pair of vertices.
   a. True
   b. False

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8. In a digraph, each edge has a source vertex and destination vertex.
   a. True
   b. False

9. In a DAG, there are no cycles.
   a. True
   b. False

10. The adjacency matrix representation of a graph stores graph information in an array of lists.
   a. True
   b. False

11. In an adjacency matrix, a 1 is used to represent an edge between two vertices.
   a. True
   b. False

12. The adjacency list supports finding all the vertices adjacent to a given vertex more efficiently than the adjacency matrix.
   a. True
   b. False

13. When you traverse a graph, there is always a single direct link from one item to any other item.
   a. True
   b. False

14. The depth-first traversal of a graph uses a queue as the collection in the generic algorithm.
   a. True
   b. False

15. A a depth-first traversal cannot be implemented recursively.
   a. True
   b. False

16. A spanning tree has the fewest number of edges possible while still retaining a connection between all the vertices in the component.

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a. True
b. False

17. Repeated application of finding the minimum spanning tree for all the components in a graph yields a minimum spanning forest for a graph.
a. True
b. False

18. A topological order assigns a rank to each edge such that the vertices go from lower-to higher-ranked edges.
a. True
b. False

19. To find the shortest path, you can use a wighted graph and sum the edge of the weights between two vertices.
a. True
b. False

20. Dijkstra's algorithm consists of two steps: the initialization step and the execution step.
a. True
b. False

21. In Python, you need to define *infinity* as a long integer.
a. True
b. False

22. All graphs, except weighted graphs, are collections of vertices connected by edges.
a. True
b. False

23. A graph has a single length attribute, similar to the lists, queues, and stacks.
a. True
b. False

24. In the implementation of a graph, the len function returns the number of the graph's vertices.
a. True
b. False

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25. Removing a vertex also entails removing any edges connecting it to other vertices.
    a. True
    b. False

26. Which of the following is NOT a process for which a graph can serve as a model?
    a. a road map between hotels a town
    b. a line at a movie theater
    c. the paths that data can travel in a network
    d. the routes between rooms in a building

27. Which of the following is true about graphs?
    a. graphs consist of vertices and nodes
    b. the edges between vertices are always labeled
    c. an adjacency is when one vertex has a path to another vertex
    d. the length of a path is the number of edges on the path

28. What makes a graph complete?
    a. when there is an edge from each vertex to all other vertices
    b. when there is a path from each vertex to all other vertices
    c. when there is a path between at least half the vertices
    d. when there are two or more edges between vertices

29. Which term best describes a neighbor?
    a. a path exist between vertices
    b. a vertex is reachable from another vertex
    c. two vertices have consecutive labels
    d. two vertices are adjacent

30. The number of edges connected to a vertex describes which of the following?
    a. a complete graph
    b. the neighbor of a vertex
    c. the degree of a vertex
    d. whether a graph is connected

31. If vertex Penguins can reach vertex Capitals and vertex Capitals can reach vertex Islanders, but none of them can reach vertices Sharks or Ducks, what can you say about the set of vertices

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Penguins, Capitals, and Islanders?

a. the set is a connected component
b. the set describes a complete graph
c. the vertices in the set are all adjacent to each other
d. the set describes a connected graph

32. In graph terms, what is a path that begins and ends at the same vertex?

a. a simple path
b. an undirected path
c. a cycle
d. a directed path

33. Which of the following is true about an undirected graph?

a. a graph-processing algorithm can move in only one direction along an edge that connects two vertices
b. their edges do not indicate direction
c. there can be multiple edges connecting any two vertices
d. there is a source vertex and a destination vertex

34. What are edges called that emanate from a given source vertex?

a. incident edges
b. directed edges
c. destination edges
d. cyclical edges

35. Which of the following is NOT true about an adjacency matrix?

a. it stores information about the graph in a grid
b. the grid cell contains a 0 if there is no edge between vertices
c. a graph with four vertices contains 16 cells
d. it can be represented by an array of lists

36. In a complete undirected graph with five vertices how many cells will contain a value of 1 in an adjacency matrix?

a. 15
b. 10
c. 25
d. 125

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37. In a complete undirected graph consisting of 3 vertices, how many total adjacencies will there be?

a. 2
b. 6
c. 9
d. 4

38. What is the performance behavior of a linked adjacency list for determining whether an edge exists between two vertices?

a. constant time
b. $O(N^2)$ where N is the number of vertices
c. linear with the length of the list
d. logarithmic with the total number of vertices

39. Which of the following is true about graph traversals?

a. a single path to each item is assumed
b. all algorithms are nonrecursive
c. the algorithm should find the shortest path to a given item
d. the type of collection used is irrelevant to the traversal algorithm

40. In a breadth-first traversal of a graph, what type of collection is used in the generic algorithm?

a. queue
b. set
c. stack
d. heap

41. In the pseudocode for the dfs function for partitioning the vertices in a graph into disjointed components, what is the missing pseudocode statement?

```
dfs(graph, v, s):
    mark v as visited
    s.add(v)
    for each vertex, w, adjacent to v:
        if w is unvisited:
            <missing pseudocode>
```

a. s.add(w)
b. dfs(graph, v, s)

c. s.add(v)
d. dfs(graph, w, s)

42. In a component with *n* vertices, how many edges are in the spanning tree?
a. *n*
b. n^2
c. *n* + 1
d. *n* - 1

43. What is the minimum sum of all weights in a spanning tree of a weighted graph?
a. spanning forest
b. minimum spanning tree
c. shortest path spanning tree
d. topological spanning tree

44. What can be described as the assignment of a rank to each vertex in a graph such that the edges go from lower-to higher-ranked vertices?
a. directed acyclic graph
b. sparse graph
c. topological order
d. shortest-path problem

45. The smallest sum of edge weights between two vertices describes which of the following?
a. the shortest path
b. topological order
c. topological sort
d. maximum spanning tree

46. What is the output of Dijkstra's algorithm?
a. a three-dimensional array
b. a two-dimensional grid
c. a source vertex
d. the number of vertices in the graph

47. Which of the following is NOT true after the initialization step in Dijkstra's algorithm?
a. the cells in the included list are all False, except for the cell that corresponds to the row of the source vertex in the results grid

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b. the distance in a row's distance cell is either 0, infinity, or a positive number
c. the shortest path from the source to a vertex is found and the vertex's cell is marked in the included list
d. the vertex in a row's parent cell is either the source vertex or undefined

48. In the *LinkedDirectedGraph* class, which of the following methods is an iterator?
a. incidentEdges
b. getEdge
c. containsEdge
d. sizeEdges

49. In the following code to add an edge in the *LinkedDirectedGraph* class, what is the missing code?

```
def addEdge(self, fromLabel, toLabel, weight):
    fromVertex = self.getVertex(fromLabel)
    <missing code>
    fromVertex.addEdgeTo(toVertex, weight)
    self.edgeCount += 1
```

a. self.getVertex(toLabel) = fromVertex
b. fromVertex.addEdgeTo(fromVertex, weight)
c. self.weight += 1
d. toVertex = self.getVertex(toLabel)

50. In the *__init__* method code for the *LinkedVertex* class, what is the missing code?

```
def __init__(self, label):
    self.label = label
    self.edgeList = list()
    <missing code>
```

a. self.size += 1
b. self.mark = False
c. return iter(result)
d. result = self.label