Due to the print book page limit, we cannot inlcude all good CheckPoint questions in the physical book. The CheckPoint on this Website may contain extra questions not printed in the book. The questions in some sections may have been reordered as a result. Nevertheless, it is easy to find the CheckPoint questions in the book on this Website. Please send suggestions and errata to Dr. Liang at [y.daniel.liang@gmail.com](mailto:y.daniel.liang@gmail.com). Indicate the book, edition, and question number in your email. Thanks!

**Chapter 29 Check Point Questions**

Section 29.2

[▼](javascript:collapse('expandText0',%20'collapseText0');)29.2.1

For the code WeightedEdge edge = new WeightedEdge(1, 2, 3.5), what is edge.u, edge.v, and edge.weight?

edge.u is 1, edge.v is 2, and edge.weight is 3.5

[▼](javascript:collapse('expandText1',%20'collapseText1');)29.2.2

What is the output of the following code?

List<WeightedEdge> list = new ArrayList<>();

list.add(new WeightedEdge(1, 2, 3.5));

list.add(new WeightedEdge(2, 3, 4.5));

WeightedEdge e = java.util.Collections.max(list);

System.out.println(e.u);

System.out.println(e.v);

System.out.println(e.weight);

The output is

2

3

4.5

Section 29.3

[▼](javascript:collapse('expandText2',%20'collapseText2');)29.3.1

If a priority queue is used to store weighted edges, what is the output of the following code?

PriorityQueue<WeightedEdge> q = new PriorityQueue<>();

q.offer(new WeightedEdge(1, 2, 3.5));

q.offer(new WeightedEdge(1, 6, 6.5));

q.offer(new WeightedEdge(1, 7, 1.5));

System.out.println(q.poll().weight);

System.out.println(q.poll().weight);

System.out.println(q.poll().weight);

The output is

1.5

3.5

6.5

[▼](javascript:collapse('expandText3',%20'collapseText3');)29.3.2

If a priority queue is used to store weighted edges, what is wrong in the following code? Fix it and show the output.

List<PriorityQueue<WeightedEdge>> queues = new ArrayList<>();

queues.get(0).offer(new WeightedEdge(0, 2, 3.5));

queues.get(0).offer(new WeightedEdge(0, 6, 6.5));

queues.get(0).offer(new WeightedEdge(0, 7, 1.5));

queues.get(1).offer(new WeightedEdge(1, 0, 3.5));

queues.get(1).offer(new WeightedEdge(1, 5, 8.5));

queues.get(1).offer(new WeightedEdge(1, 8, 19.5));

System.out.println(queues.get(0).peek()

.compareTo(queues.get(1).peek()));

The code is wrong because there is no queues.get(0). You need to first create and add a queue into queues using the following statements:

queues.add(new PriorityQueue<WeightedEdge>());

queues.add(new PriorityQueue<WeightedEdge>());

After the fix, the output is -1.

[▼](javascript:collapse('expandText4',%20'collapseText4');)29.3.3

Show the output of the following code.

public class Test {

public static void main(String[] args) throws Exception {

WeightedGraph<Character> graph = new WeightedGraph<>();

graph.addVertex('U');

graph.addVertex('V');

int indexForU = graph.getIndex('U');

int indexForV = graph.getIndex('V');

System.out.println("indexForU is " + indexForU);

System.out.println("indexForV is " + indexForV);

graph.addEdge(indexForU, indexForV, 2.5);

System.out.println("Degree of U is " +

graph.getDegree(indexForU));

System.out.println("Degree of V is " +

graph.getDegree(indexForV));

System.out.println("Weight of UV is " +

graph.getWeight(indexForU, indexForV));

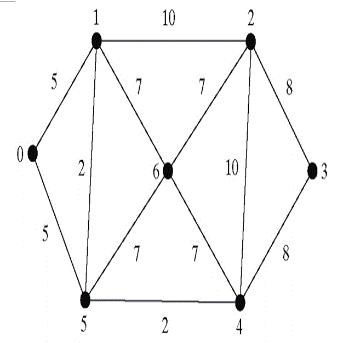
}

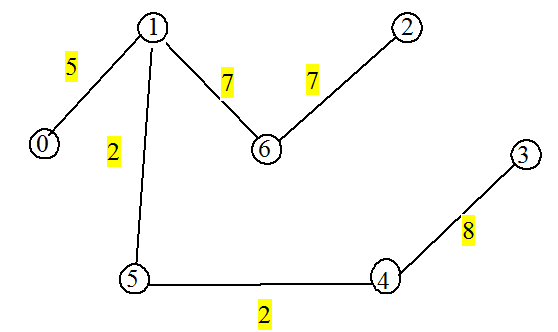
}

indexForU is 0   
indexForV is 1   
Degree of U is 1   
Degree of V is 0   
Weight of UV is 2.5

Section 29.4

[▼](javascript:collapse('expandText5',%20'collapseText5');)29.4.1

Find a minimum spanning tree for the following graph.   




[▼](javascript:collapse('expandText6',%20'collapseText6');)29.4.2

Is a minimum spanning tree unique if all edges have different weights?

Yes.

[▼](javascript:collapse('expandText7',%20'collapseText7');)29.4.3

If you use an adjacency matrix to represent weighted edges, what will be the time complexity for Prim's algorithm?

O(n^2logn), n is the number of vertices.

[▼](javascript:collapse('expandText8',%20'collapseText8');)29.4.4

What happens to the getMinimumSpanningTree() method in WeightedGraph if the graph is not connected? Verify your answer by writing a test program that creates an unconnected graph and invokes the getMinimumSpanningTree() method.

Line 95 in WeightedGraph.java, the loop

while (T.size() < numberOfVertices) {

continues if T.size() < numberOfVertices. If the graph is not connected, the v will be set to -1 in line 98, if no edges are found to connect vertices between T and V - T. In this case, the statement

if (v != -1)

T.add(v); // Add a new vertex to the tree

else

break; // The tree is not connected, a partial MST is found

causes the while loop in line 95 to end.

[▼](javascript:collapse('expandText9',%20'collapseText9');)29.4.5

Show the output of the following code:

public class Test {

public static void main(String[] args) {

WeightedGraph<Character> graph = new WeightedGraph<>();

graph.addVertex('U');

graph.addVertex('V');

graph.addVertex('X');

int indexForU = graph.getIndex('U');

int indexForV = graph.getIndex('V');

int indexForX = graph.getIndex('X');

System.out.println("indexForU is " + indexForU);

System.out.println("indexForV is " + indexForV);

System.out.println("indexForX is " + indexForV);

graph.addEdge(indexForU, indexForV, 3.5);

graph.addEdge(indexForV, indexForU, 3.5);

graph.addEdge(indexForU, indexForX, 2.1);

graph.addEdge(indexForX, indexForU, 2.1);

graph.addEdge(indexForV, indexForX, 3.1);

graph.addEdge(indexForX, indexForV, 3.1);

WeightedGraph<Character>.MST mst

= graph.getMinimumSpanningTree();

graph.printWeightedEdges();

System.out.println(mst.getTotalWeight());

mst.printTree();

}

}

indexForU is 0

indexForV is 1

indexForX is 1

U (0): (0, 1, 3.5) (0, 2, 2.1)

V (1): (1, 0, 3.5) (1, 2, 3.1)

X (2): (2, 0, 2.1) (2, 1, 3.1)

5.2

Root is: U

Edges: (X, V) (U, X)

Section 29.5

[▼](javascript:collapse('expandText10',%20'collapseText10');)29.5.1

Trace Dijkstra's algorithm for finding shortest paths from Boston to all other cities in Figure 29.1.

See the text.

[▼](javascript:collapse('expandText11',%20'collapseText11');)29.5.2

Is a shortest path between two vertices unique if all edges have different weights?

No.

[▼](javascript:collapse('expandText12',%20'collapseText12');)29.5.3

If you use an adjacency matrix to represent weighted edges, what would be the time complexity for Dijkstra's algorithm?

O(n^2logn), n is the number of vertices.

[▼](javascript:collapse('expandText13',%20'collapseText13');)29.5.4

What happens to the getShortestPath() method in WeightedGraph if the source vertex cannot reach all vertieces in the graph? Verify your answer by writing a test program that creates an unconnected graph and invoke the getShortestPath() method.

Line 185 in WeightedGraph.java, the loop

while (T.size() < numberOfVertices) {

continues if T.size() < numberOfVertices. If the graph is not connected, the v is set to -1 in line 185, if no edges are found to connect vertices between T and V - T, -1 will add to T in line 208. The statement

if (v != -1)

T.add(v); // Add a new vertex to the tree

else

break; // The tree is not connected, a partial MST is found

causes the while loop in line 185 to end.

[▼](javascript:collapse('expandText14',%20'collapseText14');)29.5.5

If there is no path from vertex v to the source vertex, what will be cost[v]?

cost[v] will be infinity.

[▼](javascript:collapse('expandText15',%20'collapseText15');)29.5.6

Assume that the graph is connected; will the getShortestPath method find the shortest paths correctly if lines 159-161 in WeightedGraph are deleted?

No. cost[i] will be zero for i.

[▼](javascript:collapse('expandText16',%20'collapseText16');)29.5.7

Show the output of the following code:

public class Test {

public static void main(String[] args) {

WeightedGraph<Character> graph = new WeightedGraph<>();

graph.addVertex('U');

graph.addVertex('V');

graph.addVertex('X');

int indexForU = graph.getIndex('U');

int indexForV = graph.getIndex('V');

int indexForX = graph.getIndex('X');

System.out.println("indexForU is " + indexForU);

System.out.println("indexForV is " + indexForV);

System.out.println("indexForX is " + indexForV);

graph.addEdge(indexForU, indexForV, 3.5);

graph.addEdge(indexForV, indexForU, 3.5);

graph.addEdge(indexForU, indexForX, 2.1);

graph.addEdge(indexForX, indexForU, 2.1);

graph.addEdge(indexForV, indexForX, 3.1);

graph.addEdge(indexForX, indexForV, 3.1);

WeightedGraph<Character>.ShortestPathTree tree =

graph.getShortestPath(1);

graph.printWeightedEdges();

tree.printTree();

}

}

indexForU is 0

indexForV is 1

indexForX is 1

U (0): (0, 1, 3.5) (0, 2, 2.1)

V (1): (1, 0, 3.5) (1, 2, 3.1)

X (2): (2, 0, 2.1) (2, 1, 3.1)

Root is: V

Edges: (V, U) (V, X)

Section 29.6

[▼](javascript:collapse('expandText17',%20'collapseText17');)29.6.1

Why is the tree data field in NineTailModel in Listing 28.13 defined protected?

The tree data field in NineTailModel is accessed in WeightedTailModel. A new tree is created in WeightedTailModel.

[▼](javascript:collapse('expandText18',%20'collapseText18');)29.6.2

How are the nodes created for the graph in WeightedNineTailModel?

See the text.

[▼](javascript:collapse('expandText19',%20'collapseText19');)29.6.3

How are the edges created for the graph in WeightedNineTailModel?

See the text.