1.Compare and contrast link-state and distance-vector routing algorithms. Also, for each routing algorithm category, name one example protocol along with its corresponding RFC. (25 points)

Link state routing algorithm is an algorithm that computes the least-cost path between a source and destination. Its input is the whole network topology together with all the edge cost. This means the distance is calculated using the complete knowledge of network and the algorithm it uses is actually Dijkstra's algorithms. Open Shortest Path First(OSPF) implements link state routing algorithm and its corresponding RFC is RFC 2328.

Distance-vector algorithms is also finding the least-cost path. However, its input is just the cost with current nodes to its neighbors. This means a node only knows the information of its neighbor. The algorithm it uses is Bellman Ford algorithms. Routing Information Protocol implement Distance-vector algorithms and its corresponding RFC is RFC 1058.

2. Consider a network with the following five nodes: V, W, X, Y, and Z. Using distance vector routing, fill out the entries in V 's routing table immediately after receiving the following updates from its neighbors. V 's current costs to its neighbors are also shown below. (25 points)

   Routing Updates from V 's Neighbors

   W: [(V, 6), (W, 0), (X, 2), (Y, 5), (Z, 11)]

   X: [(V, 7), (W, 2), (X, 0), (Y, 3), (Z, 9)]

   V 's Link Cost to Its Neighbors

   W : 6

   X : 7

   In addition to filling out the routing table entries, be sure to show the Bellman-Ford equations that you used to derive the routing table.

Start with W:

D(V→W) = min(C(V→X)+0,D(V→X)+C(X→W)) = min(6,7+2) = 6 through W

Y:

D(V->Y) = min(C(V→W)+D(W→Y), C(V→X)+D(X→Y)) = min(6+5,7+3) = 10 through X

X:

D(V→X) = min(C(V→X)+0, C(V→W)+D(W→X)) = min(7,6+2) = 7 through X

Z:

D(V→Z) = min(C(V→X)+D(X→Z),C(V→W)+D(W→Z)) = min(7+9,6+11) = 16 through X

Destination	cost	Next Hop
W	6	W
X	7	X
Y	10	X
Z	16	X

3. Answer the following questions about the Border Gateway Protocol (BGP).

a. What is the purpose of BGP? (5 points)

BGP or Border Gateway Protocol is to exchange routing information between autonomous systems. Peers exchange information using network prefix announcement such that the packet knows where to go in the next stop. BGP determines the route by considering a lot of information such as policy, or paths.

b. What is the difference between iBGP and eBGP? (5 points)

iBGP is the interior BGP, which determines the route inside a AS.

eBGP is the external BGP, which determines the route between different AS. It runs between two BGP rounters in different AS.

c. Do autonomous systems always advertise all reachable destinations? Explain your answer. (5 points)

BGP provides policy-based routing where the routes rank routes according to the administrator. Therefore, the AS will not always advertise all destination, it will filter some routes based on policies.

d. Is it possible to detect BGP routing loops? If so, then explain how. If not, then explain why not. (10 points)

According to RFC4271, this is possible. And this could be done by scanning the AS_path attribute and checking whether the current local system's number is in the whole AS_path attribute.

4. Suppose that an ISP decides to switch from OSPF to a new routing algorithm. Would the transition be easier with a traditional monolithic routing infrastructure or with a software-defined network? Explain your answer. (25 points)

The transition will be easier using SDN.

The major difference of SDN and traditional network is that traditional network is hardware-based while SDN is software based. That is to say, traditional network use routers and switches to create the whole

connections. While SDN uses an interface that communicates with APIs such that developers can program the networks. Since it is software-based, it allows administrators to control the network from a centralized user interface. In this case, SDN uses open protocols that access switches and routers from centralized user interface to change algorithms. However, for traditional monolithic routing, functionalities are implemented by specific hardware. Therefore, changing algorithm will need us to install software for routers or even change to new hardware which make the switch difficult.