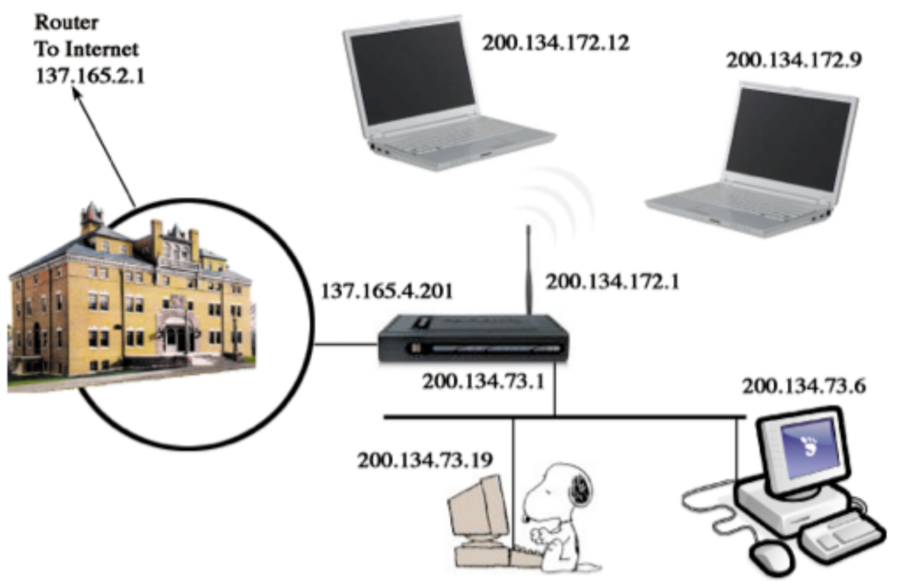

Figure 1: An IP Network.

Question 1. *Consider the imaginary IP network fragment show in Figure 1. The network is composed of three physical networks connected to one another by the internal router shown in the center of the diagram. To make it clear that they are distinct physical networks, the diagram shows that each net- work uses a very distinct networking technology: the two laptops are shown as part of a wireless network, the two cartoon computers are attached to an Ethernet, and the connection between the internal router in the center of the diagram and the external router that connects to the rest of the Internet is drawn as a ring network. The details of ring, wireless and Ethernet technologies, however, are irrelevant to the problem. All that matters is that there are three distinct physical networks involved. Since the internal router has connections to all three physical networks, it has three distinct IP addresses — one for each of the interfaces through which it connects to the three physical networks. The IP addresses associated with router interfaces and with the computers connected to the Ethernet and wireless networks are shown in Figure 1. The physical addresses associated with all of the IP addresses shown in the figure are given in the following table:*

IP Address	Physical Address
200.134.172.12	02:4F:30:A5:00:1F
200.134.172.9	39:22:0D:10:3B:33
200.134.172.1	01:3F:22:9B:6C:99
137.165.2.1	22:31:FF:21:4B:18
137.165.4.201	02:4F:30:03:F2:11
200.134.73.1	39:22:0D:93:83:AA
200.134.73.19	20:90:33:D0:D6:41
200.134.73.6	50:57:30:28:01:9B

(a) *Suppose that 200.134.73.19 wants to send an IP packet to 200.134.73.6. How would 200.134.73.19 figure out whether the IP packet should be sent to 200.134.73.6 directly or whether it must go through the router? Once it realized it should send the packet directly, how would 200.134.73.19 determine 200.134.73.19's Ethernet address (i.e. physical address)?*

(b) *Suppose 200.134.73.19 wants to send an IP packet to 200.134.172.9. How would 200.134.73.19 determine whether the IP packet should be sent to 200.134.172.9 directly or via the router? Once it determined it should send the packet to the router, how would 200.134.73.19 determine the router's IP address? How would Station 200.134.73.19 determine the router's physical address?*

(c) *Suppose that a packet originally sent from IP address 202.34.190.4 to 200.134.73.6 was delivered to 200.134.73.6. What would be the IP source and destination addresses and the Ethernet source and destination addresses in the packet actually received by 200.134.73.6?*

(d) *Suppose that a packet originally sent from IP address 202.34.190.4 to 200.134.73.6 was observed while traveling through the ring network between the two routers shown. What would be the IP source and destination addresses and the physical source and destination addresses in the packet?*

Question 2. *Table 1 shows the process of executing the steps of Dijkstra's shortest path algorithm to build a forwarding table for the router named A. Unfortunately, the table is incomplete and much of the information about the neighbors of the routers disappeared during a freak transcription accident involving cod liver oil and a small rodent.*

Please follow the steps of Dijkstra's Algorithm to complete the entries in the Best Route Length *and* First Step *columns of the table. The columns in which the* connections to neighboring routers *rows are completely empty are the places where the information disappeared. Luckily, you will discover you do not need this information to complete the* Best Route Length *and* First Step *columns of the table if you complete the execution of Algorithm 1.*

Algorithm 1 DISJKSTRA'S SHORTESTPATH

```
1: Mark starting point as KNOWN with length 0
2: Identify each neighbor of start as ADJACENT
3: Set first step of each neighbor of start to itself
4: Set route length of each neighbor to first step distance
5: While you don't know how to reach all the cities:
6:         Select adjacent city with shortest route
7:         Identify adjacent city with shortest route as KNOWN
8:         Mark neighbors of new KNOWN city that were DISTANT as ADJACENT
9:         Update path lengths and record first steps to ADJACENT neighbors of new KNOWN city.
```

Table 1: Shortest Path Table

Cities	Best Route Length	First Step	Status	Neighbors			
A	0	-	*Known*				
B	11	C	*Adjacent*	K: 1	H: 6	D: 5	J:2
C	3	C	*Known*				
D	11	L	*Adjacent*	B: 1	H: 2		
E	7	E	*Adjacent*	C: 3	L: 3	H: 1	D: 2
F	-		*Distant*	L: 3	J: 2		
G	6	L	*Known*				
H	10	C	*Adjacent*	I: 1	D: 2		
I	10	C	*Adjacent*	K: 3	H: 6	D: 5	G: 3
J	5	C	*Known*				
K	14	C	*Adjacent*	F: 1	C: 3	L: 2	
L	4	L	*Known*				
M	7	C	*Known*				

Table 2: Shortest Path Table 1

Cities	Best Route Length	First Step	Status	Neighbors			
A	0	-	*Known*				
B	11	C	*Adjacent*	K: 1	H: 6	D: 5	J:2
C	3	C	*Known*				
D	11	L	*Adjacent*	B: 1	H: 2		
E	7	E	*Adjacent*	C: 3	L: 3	H: 1	D: 2
F	-		*Distant*	L: 3	J: 2		
G	6	L	*Known*				
H	10	C	*Adjacent*	I: 1	D: 2		
I	10	C	*Adjacent*	K: 3	H: 6	D: 5	G: 3
J	5	C	*Known*				
K	14	C	*Adjacent*	F: 1	C: 3	L: 2	
L	4	L	*Known*				
M	7	C	*Known*				