1.)
Routing is finding a suitable end-to-end path from the sender to the destination for a packet. It is a process that spans the entire network. Forwarding is specific to each individual router, and it is the process of sending the packet closer to the destination using the given routing information.

2.)
a.)
Packet loss can occur at router input ports when two input ports are both trying to use a single output port, causing full buffers during high traffic, which can result in packet loss. This is called head-of-line blocking. It can be avoided in several ways, one of which is to increase buffer size, and not let input ports send more traffic than the output ports can handle. Another way to handle head-of-line blocking situations is by using a switch that has two separate queues, one for high priority data and one for low priority data. A packet is then checked to see if it has high priority, in which case the packet is placed in the high-priority queue, and if it is low priority, the packet can be discarded depending on whether a transmission is necessary or not.

b.)
Packet loss can occur at router output ports when the queue for the output port becomes very large. This results in the buffer filling up very quickly, and massive packet loss. This cannot be completely avoided, but the damage can be reduced. Dropping packets before the buffer is full will slow down TCP threads, and while not ideal, losing a few packets is preferable to the massive packet loss that will occur when the buffer fills up very quickly.

3.)
a.)

Dest. Address	Interface
224.0.0.0/10	0
224.64.0.0/16	1
224.0.0.0/8	2
225.0.0.0/9	2
0.0.0.0/0	3

b.)
Address 1 - 200.145.81.85
This address does not match the first 10 bits of 224.0.0.0, the first 16 bits of 224.64.0.0, the first 8 bits of 224.0.0.0, or the first 9 bits of 225.0.0.0. This means that the only matching entry in the table is 0.0.0.0, so the address uses interface 3, according to the above table.
Address 2 - 255.64.195.60

This address does not match the first 10 bits of 244.0.0.0, the first 16 bits of 144.64.0.0, or the first 8 bits of 244.0.0.0. It matches the first 9 bits of 245.0.0.0, so according to the table above, the correct interface is interface 2.

Address 3 - 255.128.17.119
This address does not match the first 10 bits of 244.0.0.0, the first 16 bits of 144.64.0.0, or the first 8 bits of 244.0.0.0, but it also matches the first 9 bits of 245.0.0.0, so according to the table above, the correct interface for this address is also interface 2.

4.)
a.)
All routers are parts of autonomous systems, and all systems use the same AS (Automated System) protocol. Therefore, adding new routers just involves creating a new AS with all the routers you want to use in that system. Each router in the system only needs to know information about the other routers in it's AS, and about the gateway router that communicates with other system's gateway routers. This makes it very easily scaleable, because non-gateway routers only need to know about the other routers in their system and the gateway router, and the gateway router only needs to know about other gateway routers for other systems. So each router only needs to know about a few other routers.

b.)
Using different inter-AS and intra-AS protocols helps with the scalability of the internet. If only one protocol existed, the routing information for the protocol would need to be dispersed all over the entire network, which would make it very slow and inefficient. Having many different protocols means that a system can make it's own protocol specific to its individual needs and system layout.

5.)
a.) eBGP

b.) iBGP

c.) iBGP

d.) I1 is the first edge in the lowest cost path going to 4a, and it passes through 1c. Using I2 would add extra hops because the path would still have to go to 1a before going to 4a.

e.) I2, because it will use less hops than I1.

6.)

x-axis: Cost to node	v	x	y	u	z

y-axis: Cost from node					
v	∞	∞	∞	∞	∞
x	∞	∞	∞	∞	∞
y	∞	∞	∞	∞	∞
u	∞	∞	∞	∞	∞
z	6	3	∞	∞	0

x-axis: Cost to node y-axis: Cost from node	v	x	y	u	z
v	0	3	∞	1	6
x	3	0	3	∞	2
y	∞	3	0	2	∞
u	1	∞	2	0	∞
z	5	3	∞	∞	0

x-axis: Cost to node y-axis: Cost from node	v	x	y	u	z
v	0	3	3	1	5
x	3	0	3	4	2
y	3	3	0	2	5
u	1	4	2	0	7
z	5	3	5	6	0

x-axis: Cost to node	v	x	y	u	z

y-axis: Cost from node					
v	0	3	3	1	5
x	3	0	3	4	2
y	3	3	0	2	5
u	1	4	2	0	6
z	5	3	5	6	0

7.)
The number of steps necessary for the distance vector algorithm in the textbook comes from the number of edges in the network. The table is filled once the two nodes furthest away from each other are filled in. When a non infinite value is in the table, the only way it can be changed is without increasing the value. Since the algorithm can only update path cost values if a lower value exists, and since there is a finite number of paths, the table will only be able to hold a finite number of steps.