CS 4220 Computer Networks
Assignment 3

1. Explain the difference between forwarding and routing.
Solution: Forwarding uses these forwarding tables to choose where to send packets. It involves a computationally expensive operation, such as finding the longest matching prefix. Routing algorithms maintain a forwarding table in routers to keep their view of the network up to date.

2. When a router receives a packet, which plane determines the outgoing interface?
Solution: The data plane determines the outgoing interface. It performs a lookup in the forwarding table, matches the destination IP address (typically using longest-prefix matching), and selects the corresponding output interface for forwarding the packet.

3. Given a forwarding table:

Prefix	Interface
200.23.16.0/20	1
200.23.18.0/23	2
200.23.30.0/23	3
Otherwise	4

Determine the outgoing interface for packets with destination addresses:
(a) 200.23.16.10 (b) 200.23.18.2 (c) 200.23.30.8 (d) 200.23.31.5

Solution:
(a) 200.23.16.10 $\rightarrow$ /20 $\rightarrow$ Int 1
(b) 200.23.18.2 $\rightarrow$ /23 $\rightarrow$ Int 2
(c) 200.23.30.8 $\rightarrow$ /23 $\rightarrow$ Int 3
(d) 200.23.31.5 $\rightarrow$ /20 only (not /23 match) $\rightarrow$ Int 1

4. How does the control plane populate the forwarding table used by the data plane?
Solution: The control plane computes routes using routing protocols (e.g., OSPF, BGP) and/or static configuration, builds a routing table, and then installs the selected best routes into the forwarding table. This installation process translates high-level routing decisions into concrete forwarding entries that the data plane can use efficiently.

5. What is the role of a centralized controller in SDN?
Solution: In Software-Defined Networking, the centralized controller acts as the control plane. It maintains a global view of the network, makes routing and policy decisions, and installs forwarding tables on routers (e.g., via OpenFlow).

6. A network on the Internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts it can handle?
Solution: The mask is 20 bits long, so the subnet part is 20 bits. The remaining 12 bits are for the host, so 4096 host addresses exist.

7. Consider Figure 1 and find the shortest distance between router G and D.

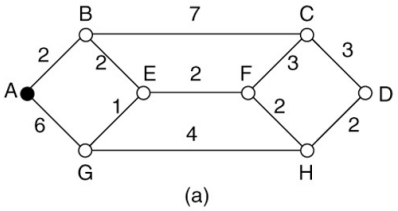

Figure 1: Net

Solution:

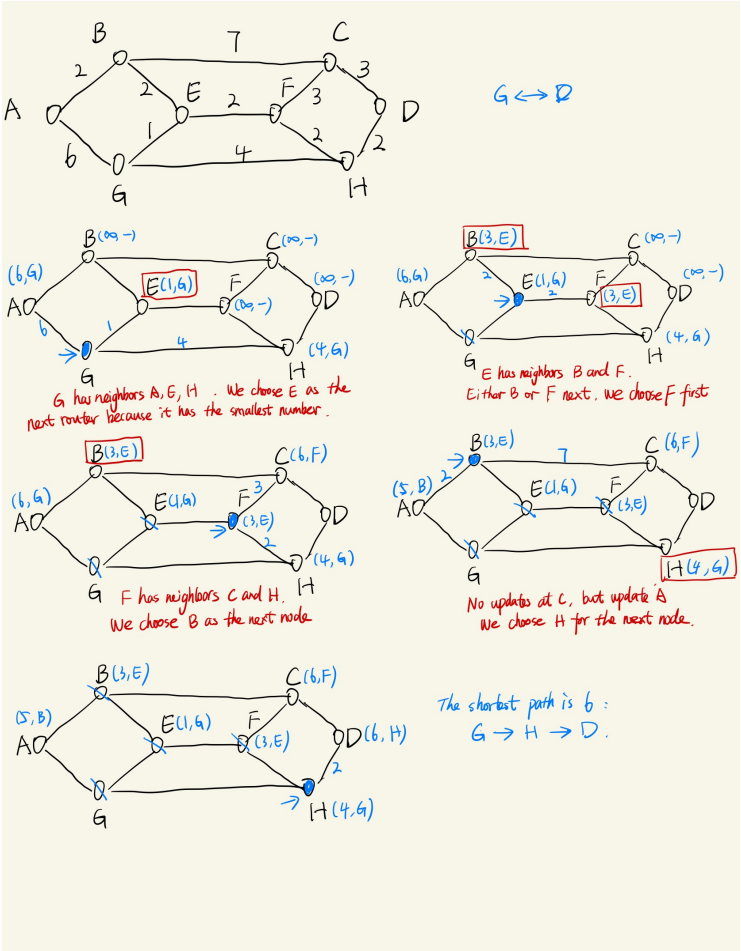

Figure 2: Link State Algorithm

7. Consider the following subnet. Distance vector routing algorithm is used, and the following vectors have just come in to router F: from B: (5, 0, 8, 12, 6, 2); from D: (16, 12, 6, 0, 9, 10); and from E: (7, 6, 3, 9, 0, 4). The measured delays to B, D, and E, are 9, 6, and 3, respectively. What is F's new distance vector routing table? Give both the outgoing line to use and the expected delay.

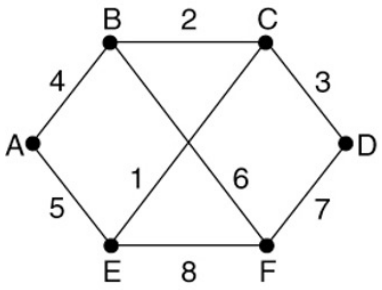

Figure 3: Subnet

Solution:

New vectors to F

	from B	from D	from E
A	5	16	7
B	0	12	6
C	8	6	3
D	12	0	9
E	6	9	0
F	2	10	4

New delays from F to neighbors

B	9
D	6
E	3

F's new routing table

	Via B	Via D	Via E
A	14	22	10
B	9	18	9
C	17	12	6
D	21	6	12
E	15	15	3
F	11	16	7

Going via B gives (14, 9, 17, 21, 15, 11)
Going via D gives (22, 18, 12, 6, 15, 16)
Going via E gives (10, 9, 6, 12, 3, 7)
Taking the minimum for each destination except F gives (10, 9, 6, 6, 3, -)
The outgoing lines are (E, B, E, D, E, -)