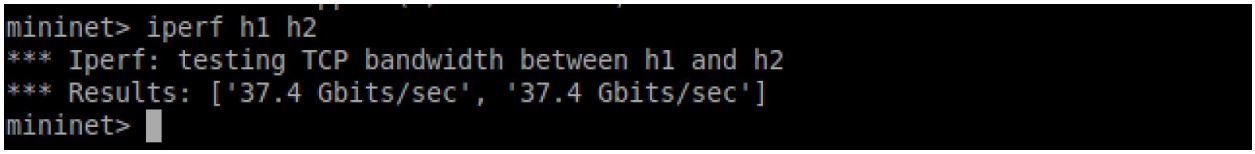
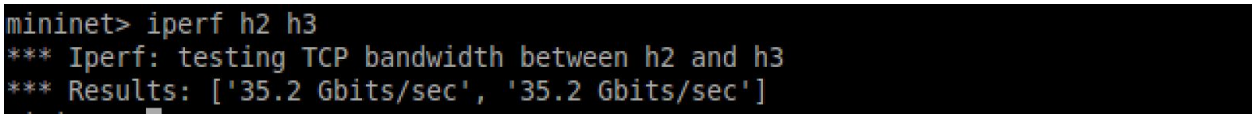
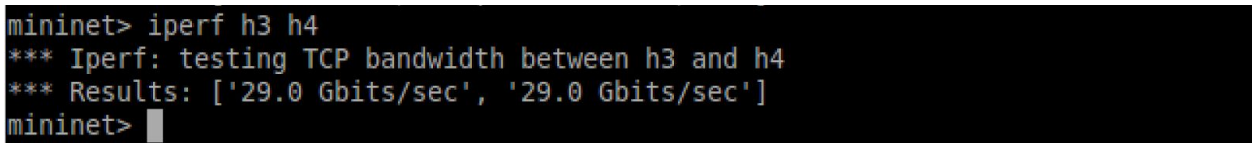
Lab 3

1. The command iperf automatically tests the bandwidth between h1 and h4 by default through TCP tests. However, as shown in the screenshots, the connection between h1 and h2, h2 and h3, h3 and h4, and h1 and h3 also works as the protocol being used is TCP. As the packet sent by iperf is of TCP protocol, my code automatically floods the packet as it matches the rule that all TCP traffic will be accepted and can pass through. As shown in the screenshot, the bandwidth of the connection between the two is 28.8 Gbits/sec.







2. pingall sends ICMP traffic through each hosts, and as my code checks for the IP addresses of h1 and h4, only those two hosts may reach each other while the rest of the hosts who have a different IP address will have their packets dropped from the switch's timeout as they will not hit any cases in the controller's rules.

3. The entries represent the "rules" that the controller has sent to the switch in order to remember for a short period of time what packet has to follow what action. As shown in the entry table, each entry represents a packet, which my code had assigned to of.ofp_flow_mod().match. When the switch gets a packet, it will look into the table to see if that packet matches any entry from the table. If so, it will use that action which is labeled "actions=FLOOD" in the screenshot. If not, it will send that packet to the controller to see if any actions should be taken or if it should be dropped if it misses all the rules from the flow entry. As I had set the idle timeout to 70 seconds and hard timeout to 100 seconds, it follows that any rule that is not used for 70 seconds will be dropped, and any rules will be dropped after 100 seconds regardless.

```
mininet> dpctl dump-flows
*** s1 ------------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=34.044s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=34, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,nw_src=10.0.1.40,nw_dst=10.0.1.10,nw_tos=0,icmp_type=8,icmp_code=0 actions=FLOOD
 cookie=0x0, duration=34.043s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=34, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:01,dl_dst=00:00:00:00:00:04,nw_src=10.0.1.10,nw_dst=10.0.1.40,nw_tos=0,icmp_type=0,icmp_code=0 actions=FLOOD
 cookie=0x0, duration=49.041s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=49, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:02,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.20,arp_tpa=10.0.1.30,arp_op=2 actions=FLOOD
 cookie=0x0, duration=29.048s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=29, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:01,dl_dst=00:00:00:00:00:04,arp_spa=10.0.1.10,arp_tpa=10.0.1.40,arp_op=2 actions=FLOOD
 cookie=0x0, duration=59.053s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=59, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.10,arp_tpa=10.0.1.30,arp_op=2 actions=FLOOD
 cookie=0x0, duration=28.919s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=28, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:02,dl_dst=00:00:00:00:00:04,arp_spa=10.0.1.20,arp_tpa=10.0.1.40,arp_op=2 actions=FLOOD
 cookie=0x0, duration=44.058s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=44, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:04,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.40,arp_tpa=10.0.1.30,arp_op=2 actions=FLOOD
 cookie=0x0, duration=44.06s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=44, arp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:03,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.30,arp_tpa=10.0.1.40,arp_op=1 actions=FLOOD
 cookie=0x0, duration=49.041s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=49, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.30,arp_tpa=10.0.1.20,arp_op=1 actions=FLOOD
 cookie=0x0, duration=29.048s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=29, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.40,arp_tpa=10.0.1.10,arp_op=1 actions=FLOOD
 cookie=0x0, duration=18.957s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=18, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:04,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.40,arp_tpa=10.0.1.30,arp_op=1 actions=FLOOD
 cookie=0x0, duration=18.956s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=18, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:03,dl_dst=00:00:00:00:00:04,arp_spa=10.0.1.30,arp_tpa=10.0.1.40,arp_op=2 actions=FLOOD
 cookie=0x0, duration=59.054s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=59, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.30,arp_tpa=10.0.1.10,arp_op=1 actions=FLOOD
 cookie=0x0, duration=28.983s, table=0, n_packets=0, n_bytes=0, idle_timeout=70, hard_timeout=100, idle_age=28, arp,vlan_tci=0x0000,dl_sr
c=00:00:00:00:00:04,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.40,arp_tpa=10.0.1.20,arp_op=1 actions=FLOOD
mininet>
```