Homework Assignment 3 Solution

1. Memory, bus, and interconnection network. An interconnection network can forward packets in parallel as long as all the packets are being forwarded to different output ports. (1 pt for each sub-questions)

2. HOL blocking: Sometimes a packet that is first in line at an input port queue must wait because there is no available buffer space at the output port to which it wants to be forwarded. When this occurs, all the packets behind the first packet are blocked, even if their output queues have room to accommodate them. HOL blocking occurs at the input port. (2pt for each sub-question, 1st question needs to mention that first packet in the queue blocks other packets behind)

3. Time-to-live or TTL (no partial credit for this question)

4. Reassembly of the fragments of an IP datagram is done in the datagram's destination host (no partial credit for this question)

5.

   a. Data destined to host H3 is forwarded through interface 3

Destination Address	Link Interface
H3	3

b. No, because forwarding rule is only based on destination address. (1pt for each sub-question. For the 2nd question, if using generic forwarding instead of destination-based forwarding, the answers might be different. But in that case, the forwarding entries need to contain two packet fields, e.g., source address & destination address)

6.

a.

Prefix Match	Link Interface
11100000 00	0
11100000 01000000	1
1110000	2
11100001 1	3
otherwise	3

b.

1st destination address matches the last entry, forwarded to interface 3; 2nd destination address matches the 3rd entry, forwarded to interface 2; 3rd destination address matches 4th entry, forwarded to interface 3. (5pts for the 1st sub-question, 1pt for an entry; 3 pts for the 2nd question, 1 pt for each destination)

7.

223.1.17.0/26 for subnet 1
223.1.17.128/25 for subnet 2
223.1.17.192/28 for subnet 3
(3 pts for each subnets. Also, needs to specify which prefix is for which subnet. Otherwise, deduct 1 pt. There are other

viable solutions as long as the three subnets do not overlap and they could support enough hosts in each subnet)

8.

4 segments in total:

length	ID	fragflag	offset
700	x	1	0
700	x	1	85
700	x	1	170
60	x	0	255

(1 pt for having 4 segments, 1 pts for having the correct field values, deduct 0.5 pt for each wrong field value)

9.

a. 192.168.1.1, 192.168.1.2, 192.168,1.3 and 192.168.1.4 for the router interface (1pt for this question, no partial credits. Could be any value in subnet 192.168.1/24)

b.

NAT Translation Table

WAN Side	LAN Side
24.34.112.235, 4000	192.168.1.1, 3345
24.34.112.235, 4001	192.168.1.1, 3346
24.34.112.235, 4002	192.168.1.2, 3445
24.34.112.235, 4003	192.168.1.2, 3446
24.34.112.235, 4004	192.168.1.3, 3545
24.34.112.235, 4005	192.168.1.3, 3546

(2 pt for this sub-question. WAN side needs to use the public IP and LAN side needs to use the internal ip address. The ports also need to be translated. Both internal and external ports could be random numbers as long as they are reserved. Give partial credit if the answers are not completely wrong.)

10. Each entry in the forwarding table of a destination-based forwarding contains only an IP header field value and the outgoing link interface to which a packet (that matches the IP header field value) is to be forwarded. Each entry of the flow table in OpenFlow includes a set of header field values to which an incoming packet will be matched, a set of counters that are updated as packets are matched to flow table entries, and a set of actions to be taken when a packet matches a flow table entry. (1pt, no partial credit. The answers should mention that OpenFlow uses generic forwarding)