Rusu Wu
11694764
CPT_s 455
Assignment7
11/29/2021

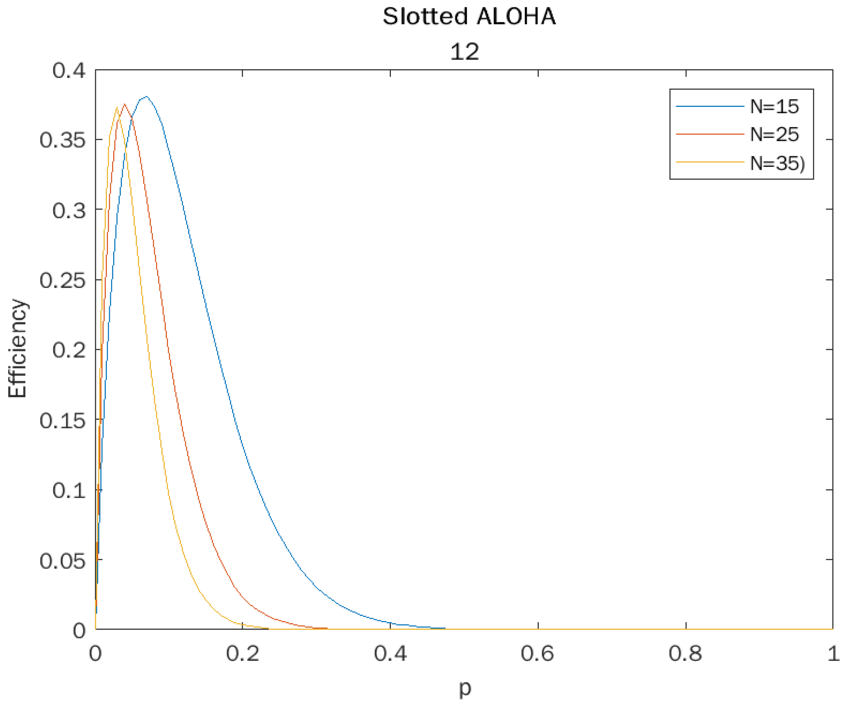
1.

1110	1
0110	0
1001	0
1101	1
1100	0

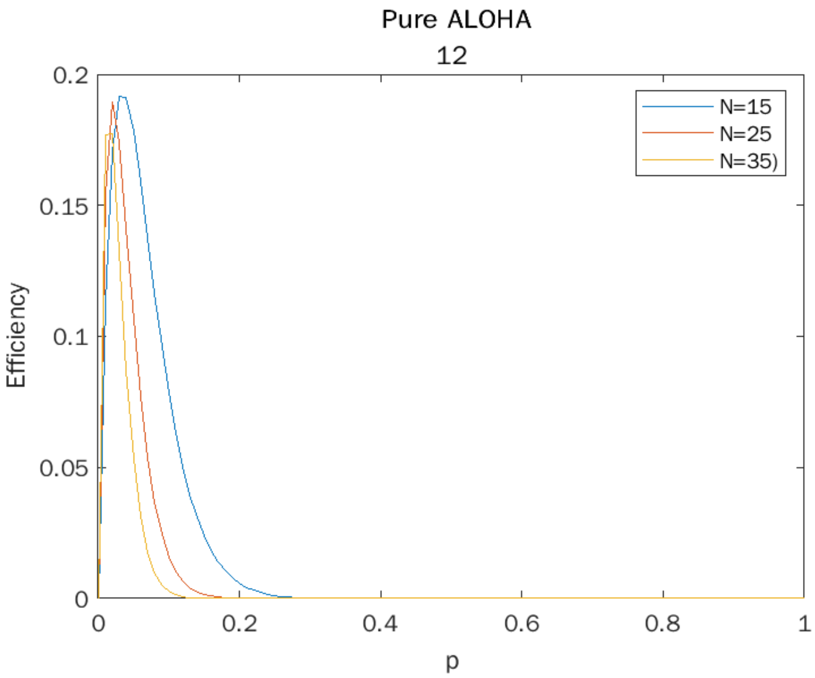
2. G=10011, so it is a 5-bit generator not 7-bit
   r=4
   R=remainder[$\frac{D*2^r}{G}$]=0100, below is the calculation.

```
                1011011100
10011 ) 10101010100000
        10011
          11001
          10011
           10100
           10011
             11110
             10011
              11010
              10011
               10010
               10011
                  0100
```

3. Efficiency of slotted ALOHA=$Np(1-p)^{N-1}$

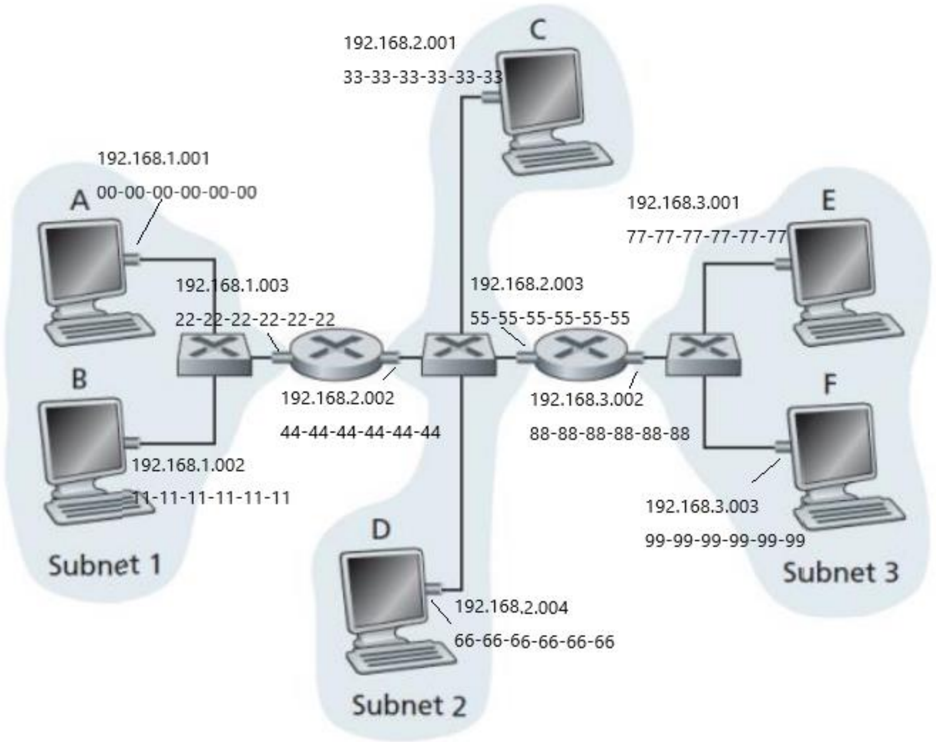


Efficiency of Pure ALOHA= $Np(1-p)^{2(N-1)}$



4.

a)b)



c)

1. E creates IP datagram with IP source E(192.168.3.001), destination B(192.168.1.002); A creates link-layer frame containing E-to-B IP datagram, while the right-side router's MAC address 88-88-88-88-88-88 is frame's destination, source MAC address is 77-77-77-77-77-77.

2.Frame sent from E to the right-side router; datagram removed, and frame passed up to IP.

The right-side router determines outgoing interface, passes datagram with IP source E(192.168.3.001), destination B(192.168.1.002) to link layer; R creates link-layer frame containing E-to-B IP datagram. Frame destination address is the left-side router 's MAC address 44-44-44-44-44-44. source MAC address is 55-55-55-55-55-55.

3.Frame sent from E to the right-side router; datagram removed, and frame passed up to IP.

The right-side router determines outgoing interface, passes datagram with IP source E(192.168.3.001), destination B(192.168.1.002) to link layer; R creates link-layer frame containing E-to-B IP datagram. Frame destination address is the left-side router 's MAC address 11-11-11-11-11-11. source MAC address is 22-22-22-22-22-22.

4.Finally, B receives frame, extracts IP datagram destination B;B passes datagram up protocol stack to IP.

d)

E must firstly know it's own MAC address through APR and then can send data. Hence, E first broadcast an APR query packet frame, and then the right-side router replies back an APR response packet. Mac destination address is 77-77-77-77-77-77. In this case, E's APR becomes latest.

Then, the process is the same as c）

5）

a) E do not need router R1 to forward the datagram, because E and F are in the same LAN.
Source IP address: E’s address
Destination IP address: F’s address
Source Mac address: E’s Mac address
Destination MAC address: F’s Mac address

b) No, because E only need to know R1’s Mac address, and R1 would help to forward the data frame.
Source IP address: E’s address
Destination IP address: B’s address
Source Mac address: E’s Mac address
Destination MAC address: R1’s Mac address that connect to E’s subnet

c)Switch S1 would broadcast the APR request, and so it know that A is in the subnet1. After that, S1 would update it’s forwarding table adding and entry of A.

Router R1 would also receive this ARP request message, but R1 would not forward the message to Subnet 3.

B would not send an ARP query message to ask for A’s MAC address, because it can get the MAC address from A’s ARP query message.

Once S1 receives an ARP response message from Host B, it would create an entry of B in its forwarding table. Also, it would drop the frame because it knows both A and B is in the same subnet.

6)

K=100; broadcast channel=10 Mbps

Wait time $=\frac{100\times 512\text{bits}}{10\times 10^6\text{bps}}$=5.12msec

K=100; broadcast channel=100Mbps

Wait time $=\frac{100\times 512\text{bits}}{100\times 10^6\text{bps}}$=0.512msec

7)

A would finish its transmission at t=512+64=576

The worst case is that B start to transmit right before A arrive, which is t=324. The time when B’s transmission arrived is t =324+325=649>576. Hence, A can finish its transmission.

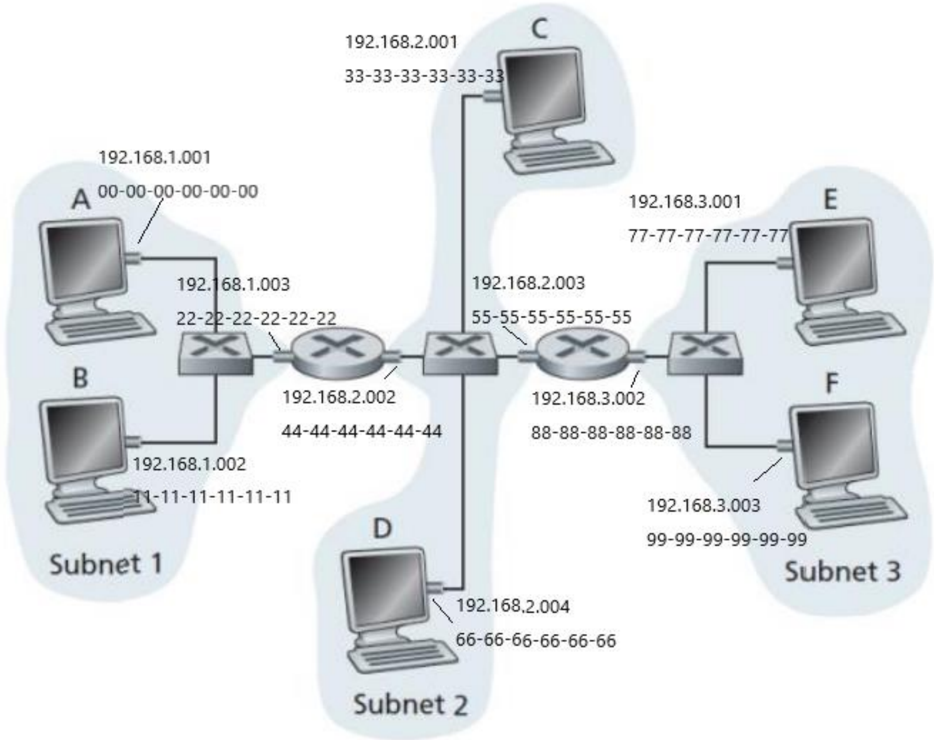
8)

A and B transmit	t=0
A and B detects collision	t=245
A and B finish sending jam signal	t=245+48=293

B last bit arrives A, A detect an ideal signal	t=293+245=538
A wait 96-bit time and transmit	t=538+0*512+96=634
B ready to transmit	t=293+1*512=805
A’s data reaches B	t=634+245=879
B 96-bit time and transmit	t=805+96=901

B schedule its retransmission at t=805+96=901
A begin to retransmission at t=538+0*512+96=634
A’s signal reach B at t=634+245=879
B does not refrain from transmitting at its scheduled time.

9)



Set all the address the same as problem 4

(i)

Source Mac address: A’s Mac address (00-00-00-00-00-00)

Destination MAC address: Mac address of the interface the connected to subnet 1 of router1 (22-22-22-22-22-22)

Source IP address: A’s IP address(192.168.1.001)

Destination Ip address: F’s IP address(192.168.3.003)

(ii)

Source Mac address: Router1’s right-side Mac address (44-44-44-44-44-44)

Destination MAC address: Router2’s left-side Mac address (55-55-55-55-55-55)

Source IP address: A’s IP address(192.168.1.001)

Destination Ip address: F’s IP address(192.168.3.003)

(iii)

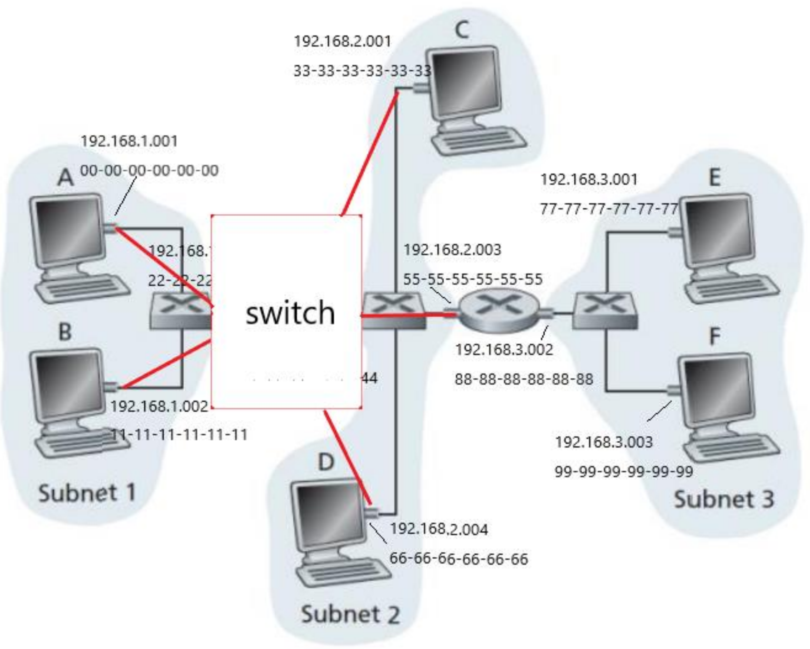
Source Mac address: Router2’s right-side Mac address (88-88-88-88-88-88)

Destination MAC address: F’s Mac address (99-99-99-99-99-99)

Source IP address: A’s IP address(192.168.1.001)

Destination Ip address: F’s IP address(192.168.3.003)

10)



(i)

Source Mac address: A’s Mac address (00-00-00-00-00-00)

Destination MAC address: Mac address of the router(88-88-88-88-88-88)

Source IP address: A’s IP address(192.168.1.001)

Destination Ip address: F’s IP address(192.168.3.003)

(ii)

Source Mac address: A’s Mac address (00-00-00-00-00-00)

Destination MAC address: Mac address of the router(88-88-88-88-88-88)

Source IP address: A’s IP address(192.168.1.001)

Destination Ip address: F’s IP address(192.168.3.003)

(iii)

Source Mac address: Router2’s right-side Mac address (88-88-88-88-88-88)

Destination MAC address: F’s Mac address (99-99-99-99-99-99)

Source IP address: A’s IP address(192.168.1.001)

Destination Ip address: F’s IP address(192.168.3.003)

11)

i) B sends a frame to E, the switch learn B's MAC address and update the table. However, the switch does not know the MAC address of E, so it will broadcast the packet to ACEF.

ii) E replies with a frame to B; the switch learns E's MAC address and update the table. The switch now knows the MAC address of B, so it will forward the frame to B.

iii))A sends a frame to B, the switch learn A's MAC address and update the table. The switch knows the MAC address of B, so it will forward the frame to B.

iv) B replies with a frame to A. The switch knows the MAC address of A so it will forward the frame to A.

12.

a) Packetization Delay $=\frac{L\times 8}{128kbps}=\frac{L}{16}msec$

b) L=1500; Packetization Delay $=\frac{L\times 8}{128kbps}=\frac{L}{16}msec = 93.75msec$

L=50; Packetization Delay $=\frac{L\times 8}{128kbps}=\frac{L}{16}msec = 3.125msec$

c) Store-and-Forward delay$=\frac{L\times 8+40}{R}$

L=1500; Store-and-Forward delay$=\frac{L\times 8+40}{R}=\frac{1500\times 8+40}{622Mbps}sec \approx 19.4us$

L=50; Store-and-Forward delay$=\frac{L\times 8+40}{R}=\frac{50\times 8+40}{622Mbps}sec \approx 0.707us$

b) No matter with L=1500, and L=50, Store-and-Forward delay is small, but when L=1500, the Packetization Delay is too long.