Solution pe nwc203c Summer 2021

Networking (FPT University)

1. Let g1(x) = x + 1 and let g2(x) = x3 + x2 + 1. Consider the information bits (1,1,0,1,1,1).

a. Find the codeword corresponding to these information bits if g1(x) is used as the generating polynomial.

```
    _100101___________
  11 | 1101110
     11______   ______
      0011
        11_________
        0010
  ________11_____________
          01
```

Codeword = 1101101

b. Find the codeword corresponding to these information bits if g2(x) is used as the generating polynomial.

```
     100010
1101 | 110111000
______1101
        01100
         1101
         00010
         00000
           010
```

Codeword = 110111010

2. Consider the 7-bit generator, G=10111, and suppose that D has the value 1010100001. What is the value of R? Show your all steps to have result.

Given data:

G = 10111

D = 1010100001

The polynomial expression of G:

$= x^4 * 1 + x^3 * 0 + x^2 * 1 + x^1 * 1 + x^0 *1$

$= x^4 + x^2 + x + 1$

Here, the degree of the expression is 4, so r = 4.

Thus, D+r becomes 10101000010000

Calculating the value of R:

1001011001

10111)10101000010000

10111

00010000

10111

0011101

10111

010100

10111

00011000

10111

1111

Codeword: 10101000011111

3. Consider the following network Figure 1. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from u to all network nodes. Show how the algorithm works by computing a table.

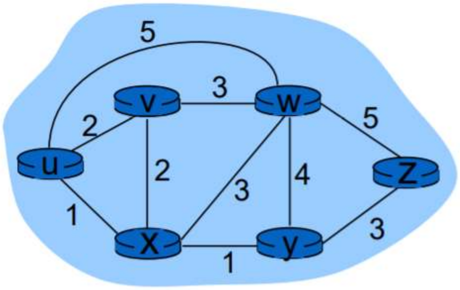

Figure 1

The below table is the computation of shortest path from source u to all the nodes by using Dijikstra's algorithm:

S'	**l(v),c(v)**	**l(w),c(w)**	**l(x),c(x)**	**l(y),c(y)**	**l(z),c(z)**
u	2,u	5,u	**1,u**	∞	∞
u**x**	**2,u**	4,x	1,u	2,x	∞
ux**v**	2,u	4,x	1,u	**2,x**	∞
ux**y**	2,u	**4,x**	1,u	2,x	5,y
ux**w**	2,u	4,x	1,u	2,x	**5,y**
uxy**z**	2,u	4,x	1,u	2,x	5,y

Here,

S' = subset of nodes.

c(v) = Current path of node v

l(v) = least cost path of node v

So, the following are shortest paths from u along with their costs:

v: uv = 2;

w: uxw = 4;

x: ux = 1;

y: uxy = 2;

z: uxyz = 5;

4. A router has the following CIDR entries in its routing table:

Address/mask Next hop

135.46.56.0/22 Interface 0

135.46.60.0/22 Interface 1

192.53.40.0/23 Router 1

default Router 2

(a) What does the router do if a packet with an IP address 135.46.63.10 arrives?

Ans:(a)135.46.63.10
Taking the first 22 bits of 135.46.63.10 as network address, we have 135.46.60.0. The bit pattern of 135.46.63.10 is 10000111.00101110.00111111.00001010 When we perform the bit and operation with 22 leading bit 1s and 10 bit 0s, it is equivalent of making the last 10 bit zero. We get the following network address bit pattern: 10000111.00101110.00111100.00000000. The first two bytes are not changed. The 3rd type changes from 63 to 60 while the 4th byte become zero. Match with network address in the routing table. The 2rd row matches. The router will forward the packet to Interface 1.

(b)What does the router do if a packet with an IP address 135.46.57.14 arrives?

Taking the first 22 bits of the above IP address as network address, we have 135.45.56.0. It matches the network address of the first row. The packet will be forwarded to Interface 0.

5. Suppose two hosts, A and B, are separated by 30,000 kilometers and are connected by a direct link of R = 3 Mbps. Suppose the propagation speed over the link is 2.5 x 10^8 meters/sec.

a. Calculate the bandwidth-delay product, R _ dprop.

b. Consider sending a file of 900,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time?

The distance (Distance) between two hosts A and B = 30,000 km

a)

The distance (Distance) between two hosts A and B = 30,000 km

= 3 x10^7 meters (since 1km = 10^3m).

Trasmission rate(R) of the direct link between A and B = 3Mbps

= 3 x 10^6bps(1Mbps = 10^6bps).

Propagation Speed(S) of the link between A and B $= 2.5 \times 10^8 meters/sec$

Calculate the propagation delay:

Dprog = Distance/Speed = (3x10^7)/(2.5x10^8) = 0.12sec

Calculate the band-width delay product:

R x dprog = 3 x 10^6 x 0.12 = 36 x 10^4 bits.

Therefore, band-with delay product is 360000bits.

b)

Size of the file =900000 bits = 9 x10^5 bits.

Trasmission rate(R) of the direct link between A and B = 3Mbps

= 3 x 10^6bps(1Mbps = 10^6bps).

The band-width delay product:

R x dprog = 3x10^6 x 0.12 = 36x10^4 bits.

Therefore, the maximum number of bits at a given time will be 360000bits.

6. Let g(x)=x3+x+1. Consider the information sequence 1011. Find the codeword corresponding to the preceding information sequence. Using polynomial arithmetic we obtain

1000

1011 | 1011000

1011

0000

0000

0000

Codeword: 1011000

7. A packet switch receives a packet and determines the outbound link to which the packet should be forwarded. When the packet arrives, one other packet is halfway done being transmitted on this outbound link and four other packets are waiting to be transmitted. Packets are transmitted in order of arrival.

Suppose all packets are 2,500 bytes and the link rate is 3 Mbps. What is the queuing delay for the packet? More generally, what is the queuing delay when all packets have length L, the transmission rate is R, x bits of the currently-beingtransmitted packet have been transmitted, and n packets are already in the queue?

Consider the given data:

Packet length = L

Transmission rate = R

Currently transmitted packet = x bits

Waiting queue = n packets

Formula for Queuing delay:

Queuing delay = [nL + (L – x)]/R

Given data:

L = 2500 bytes

R = 3 Mbps (or) 3 x 10^6 bps.

x = 2500/2 = 1250 bits.

n = 4.

Calculation:

[nL + (L –x)] = (4x2500) + (2500 – 1250)

= 10000 + 1250

= 11250 bytes.

Packets are transmitted at 3Mbps,

= 10000*3*4

= 120000

The queuing delay for packet is calculated as follows:

Queuing delay = 120000/3x10^6

= 0,04sec.

Thus, the queuing delay = 0.04seconds.

8. Suppose a header consists of four 16-bit words: (11111111 11111111, 11111111 00000000, 11110000 11110000, 11000000 11000001). Find the Internet checksum for this code

Solution:

b0 = 11111111 11111111 = 2^16 – 1 = 65535

b1 = 11111111 00000000 = 65280

b2 = 11110000 11110000 = 61680

b3 = 11000000 11000001 = 49345

x = (b0 + b1 + b2 + b3) mod 65535

= 241480 mod 65535

= 45235.

b4 = -x mod 65535 = 20300

So the Internet checksum = 0100 1111 0100 1100.

9. Consider a packet of length 2,000 bytes that propagates over a link of distance 3,500 km with propagation speed of 2,5 · 10^8 m/s, and transmission rate 2 Mbps?

a. How long does the packet propagation take?

Ans: (3500*10^3)/(2.5*10^8) = 0.014s = 14ms.

b. Does this propagation delay depend on the packet length?

=> No.

c. Does this propagation delay depend on the transmission rate?

=> No.

10. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates R1 = 250 kbps, R2 = 3 Mbps, and R3 = 2 Mbps.

a. Assuming no other traffic in the network, what is the throughput for the file transfer?

b. Suppose the file is 4 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?

a) Consider given data:

R1 = 250kbps, R2 = 3Mbps, R3 = 2Mbps

The throughput for the file transfer = min{R1,R2,R3}

= min{250 kbps, 3 Mbps, 2Mbps}

= 250 kbps

So, the throughput for the file transfer = 250 kbps.

b. Consider given data:

The file size = 4million bytes

Convert million bytes to bits

= 32000000 bits.

From (a), Throughput for the file transfer = 250 kbps = 250000 bps

Diving the file size by the throughput, roughly how long will it take to transfer the file to Host B:

= file size/hroughput for the file transfer

=32000000 bits/250000bps

= 128 seconds.