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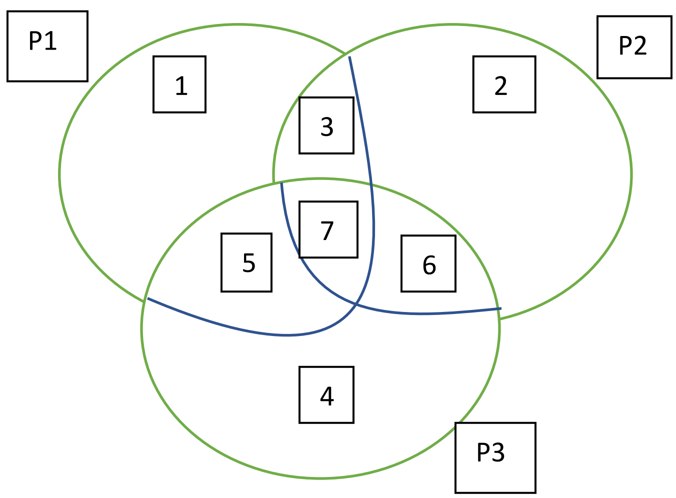
CS 35201
Homework 4
1. Using Hamming code, assume the sender want to send a message of 4 bits, 1111.

(a) What is actually transmitted

Assuming that the hamming code is H(7,4) where n=7, r=3, m=4 we will need 3 parity bits.

M7	M6	M5	P4	M3	P2	P1
1	1	1	1	1	1	1



The sent transmission will be 1111111, assuming that the hamming code uses H(7,3).

(b) Assume during transmission the parity bit p1 is inverted by an error (noise)

If parity bit p1 is inverted then the received transmissions will be 1111110

(c) How does the receiver detect the error?

The receiver can detect the bit error by:

S1= p1⊕m3⊕m5⊕m7=1

S2=m3⊕p2⊕m6⊕m7=0

S3=p4⊕m5⊕m6⊕m7=0

s3s2s1=001 → p1 must be reverted to a 1

(d) How does the receiver correct the error?

The receiver changes the p1 bit to a 1 since the above work shows that p1 is in error.

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2. The distance from earth to a distant planet is approximately 9×10^{10} m. What is the channel utilization if a stop-and-wait protocol is used for frame transmission on a 64 Mbps point-to-point link? Assume that the frame size is 32 KB and the speed of light is 3×10^{8} m.

Problem 27, page 253 of the text.

Channel utilization= $1/(1+2\alpha)$

where α= (distance*bitrate)/(frame size* speed of signal)

$\alpha=(9 \times 10^{10}$ m*64Mbps)/(32KB*3×10^{8} m)=75000

$1/(1+2(75000))= 6.66662222\times10^{-6}$

3. In the previous problem, suppose a sliding window protocol is used instead. For what send window size will the link utilization be 100%? You may ignore the protocol processing times at the sender and the receiver.

Problem 28, page 253 of the text

In order to make the link utilization 100 percent w would need to equal 150001

where $w/(1+2\alpha)= 150001/1+2(75000)=1$

4. Consider five wireless stations, A, B, C, D, and E. Station A can communicate with all other stations. B can communicate with A, C and E. C can communicate with A, B and D. D can communicate with A, C and E. E can communicate A, D and B.

Problem 10, page 351 of the text.

(a) When A is sending to B, what other communications are possible?

Because A can communicate with all other stations, this communication will interfere with the receiving of packet(s) to/ from any other stations. Thus, no other communication is possible.

(b) When B is sending to A, what other communications are possible?

B’s packet is seen by stations A, C and E so, communications between stations:

E → D

A → D

C →D

Are still possible.

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(c) When B is sending to C, what other communications are possible?

B’s packet is seen by stations A, C and E so, communications between stations:

E → D

A → D

C →D

Are still possible.

5. A 1-km-long, 10-Mbps CSMA/CD LAN (not 802.3) has a propagation speed of 200 m/µsec. Repeaters are not allowed in this system. Data frames are 256 bits long, including 32 bits of header, checksum, and other overhead. The first bit slot after a successful transmission is reserved for the receiver to capture the channel in order to send a 32-bit acknowledgement frame. What is the effective data rate, excluding overhead, assuming that there are no collisions? Problem 15, page 351 of the text.

Round trip time of said cable is 2*1000m/(200 m/µsec)= 10 µsec

Time for the sender to take cable = 10 µsec

Transmission is= 256/10000000=25.6 µsec

Time for the last bit to reach the receiver = 5 µsec

Time for the receiver to take cable = 10 µsec

Time for acknowledgement= 32/10000000=3.2 µsec

Time for the last bit to reach the receiver = 5 µsec

All together the total time is:

10+25.6+5+10+3.2+5= 58.8 µsec

256+32=288bits

288bits/58.8 µsec= 288/.0000588= 4,897,959.184 bits/ sec