Computer Networks Homework 4

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1. Bit Generator $G = 1001$
   Data Payload $D = 10011101$
   Size of R, $r = 3$

   For R to be valid, the following must be true:

   $(D + R)\%G = 0$
   $(10011101 + R)\%1001 = 0$
   $R =$ Remainder of $\frac{D*2^r}{G}$

   Steps of $1001 \div 10011101000$:
   Compare first 4 bits 1001 XOR 1001 = 0000, move onto next 4 bits
   1101 XOR 1001 = 0100, bring down 1 bit
   1000 XOR 1001 = 0001, bring down last 2 bits
   000100 = 100 = R

2. Frames have L bits, R transmission speed
   1 slot takes L/R time to complete, 3 active nodes

   To find the efficeny of slotted ALOHA, we need to find the percent of total time where one node is transmitting and the rest are not

   $p =$ probability a given node is transmitting
   $1 - p$ is the probability a given node is not transmitting
   $p(1-p)^{N-1}$ is the probabily a given node is transmitting and the rest are not
   $Np(1-p)^{N-1}$ is the probability that any of the nodes are transmitting and the rest are not (the case in which no collisions occur and a slot is successful in sloted ALOHA)

To find the efficeny of regular ALOHA, we need to find the percent of total time where one node is transmitting a frame and no other node begins a transmission of a frame during that time (we assumed the same L/R time to transmit a frame)

$p(1-p)^{2(N-1)}$ now represent the probability that a given node is transmitting and the rest are not
$Np(1-p)^{2(N-1)}$ is the probability that any of the nodes are transmitting and the rest are not

(1) Slotted ALOHA - $ME = 3(0.37)(1-0.37)^2 = 0.44$ R bits per second
Normal ALOHA - $ME = 3(0.37)(1-0.37)^4 = 0.17$ R bits per second

(2) Slotted ALOHA - $ME = 3(0.59)(1-0.59)^2 = 0.298$ R bits per second
Normal ALOHA - $ME = 3(0.59)(1-0.59)^4 = 0.05$ R bits per second

3. Encoded channel output = all $Z_{i,m} = d_i \times c_m$ for i in M, and the m bit

(1) The encoded output for bit 1 is the same as M, -1,-1,-1,-1,1,-1,-1,-1

(2) The decoded bit value for the channel output 1,1,1,1,-1,1,1,1 is -1

4. No, because TCP's reliable delivery service could be utilized in network topoligies beside the internet's, where that network's lower layers may or may not provide reliable delivery service

5. Range of K = $0, 1, 2, ...2^{n-1}$
$n = 5$, Range of K = [0, 16]
Probability K = 4 is $\frac{1}{17}$

6. There would be no advantage because increasing the size of RTS and CTS frames would also increase the probability of a collision, and that collision would last the same amout of time as it would for the same length DATA and ACK frames

7. The user and node are not consideremultipule different access points when changing locations and connecting to a network. Since the laptop is always accessing a network through the same access point, it is not considered mobile