MAC _Sublayer_ Numericals

Problem 1

A group of *N* stations share a 56-kbps pure ALOHA channel. Each station outputs a 1000-bit frame on an average of once every 100 sec, even if the previous one has not yet been sent (e.g., the stations can buffer outgoing frames). What is the maximum value of *N*?

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Solution:

There are N Stations Sharing 56kbps Pure ALOHA Channel

so with pure ALOHA Usable Bandwidth = 0.184* 56kbps=10.3kbps

1 Station Outputs 1000 bits in every 100sec

so in 1sec One station will ouput at rate 1000/100=10bits/sec

so For N stations in 1 sec Total Output Data is 10*N bits this should be equal to the Channel Capacity in pure ALOHA

N*10=10300

N=1030 it is the maximum value of Number of Station Possible.

Problem 2

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Solution:

The average station makes $\frac{18}{3600} = \frac{1}{200}$ requests/sec. The total channel load is $10000 \times \frac{1}{200} = 50$ requests/sec. Using slot as the time unit, the total channel load is $50 \times (125 \times 10^{-6}) = \frac{1}{160}$ requests/slot.

Problem 3

A slotted aloha system has packets (both new and retransmissions) arriving at a rate of 50 per second. Packets take 40 ms to transmit.
a) What is G (packets per slot)?
b) What is the probability of success of during a slot?
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Solution:

a) $G = 50 * 0.04 = 2$ packets per slot.
b) $P_s = G e^{-G} = 0.27$
c) $1/P_s = 3.69$

Problem 4

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(a) What is the channel load, *G*?

(b) What is the throughput?

(c) Is the channel underloaded or overloaded?

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(c) Is the channel underloaded or overloaded?

Solution:

a) $P(0) = e^{-G} = 0.1 \Rightarrow G = 2.3$
b) $T = G\, e^{-G} = 0.23$
c) Since $G > 1$, the system is overloaded.

Problem 5

Sketch the Manchester encoding for the bit stream: 10000101111

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Solution: