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Homework 6

2. There are (10^3 bit/fr) / (56 (10^3) bit s^{-1}) = (1/56) s per frame time.

Max throughput S for pure ALOHA is (1/(2e)) successful transmissions per frame time.

There are (1/(2e)) fr $frtm^{-1}$ (100 s) / ((1/56) s $frtm^{-1}$) = 1030.062 frames transmitted for each period during which each station may transmit once, so there are maximum

1030 stations.

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3. At low load there are few collisions, so we expect the typical frame offering to succeed.

So, for pure ALOHA, because a transmission begins immediately, the delay should equal the time it takes to transmit a frame; i.e., the frame time, call it **T**.

For slotted ALOHA, a frame must wait, on average, 1/2 the slot time, or 1/2 T, to begin transmission. So the delay under low load for slotted ALOHA is (T + 0.5 T) = **1.5 T**.

Therefore under low load, **pure ALOHA has less delay**.

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6. a. Channel load G is expected value of (# frames generated / frame time), or P(a frame will be generated within one frame time), so

G = (1 - 0.1) = **0.9**

b. $S = Ge^{-G} = 0.9e^{-0.9}$ = **0.366**

c. An optimal load for slotted ALOHA is G = 1.0, with S = 0.37, so the channel is

slightly underloaded.

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21. The time for the signal to travel twice the distance between the cable ends is:

2 km / (2 (10^5) km/s) = 10^{-5} s

The frame must take at least this long to be transmitted. So,

min frame length = (10^9 bits/s) (10^{-5} s) = 10^4 bits = **10 kb**