# Computer Networks

## Homework 2

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## Exercise 1:

> Let A and B be two stations attempting to transmit on an Ethernet. Each has a steady queue of frames ready to send; A's frames will be numbered A1, A2, and so on, and B's similarly. Let T= 51.2µs be the exponential backoff base unit. Suppose A and B simultaneously attempt to send frame 1, collide, and happen to choose backoff times of 0 x T and 1 x T, respectively, meaning A wins the race and transmits A1 while B waits. At the end of this transmission, B will attempt to retransmit B1 while A will attempt to transmit A2. These first attempts will collide, but now A backs off for either 0 x T or 1 x T, while B backs off for time equal to one of 0 x T, . . ., 3 x T.
>
> - Give the probability that A wins this second backoff race immediately after this first collision; that is A's first choice of backoff time k x 51.2 is less that B's.
> - Suppose A wins this second backoff race. A transmits A3, and when it is finished, A and B collide again as A tries to transmit A4 and B tries once more to transmit B1. Give the probability that A wins this third backoff race immediately after the first collision.
> - Give a reasonable lower bound for the probability that A wins all the remaining backoff races.
> - What then happens to the frame B1?
>
> This scenario is known as the Ethernet capture effect.

- The idea is that A has to be smaller than B, thus as $k(A) = [0, 1]$ and $k(B) = [0, 1, 2, 3]$, then the case is that A is 0 and B is any other than 0 or A is 1 and B is either 2 or 3, thus, as we expect same probability of each case then

$$P[E = A] = P[A = 0, B \neq 0] + P[A = 1, B > 1]$$

$$P[E = A] = \frac{1}{2} * \frac{3}{4} + \frac{1}{2} * \frac{2}{4}$$

$$P[E = A] = \frac{3}{8} + \frac{2}{8}$$

$$P[E = A] = \frac{5}{8}$$

- Same idea in this case $k(A) = [0, 1]$ and $k(B) = [0, 1, 2, 3, 4, 5, 6, 7]$

$$P[E = A] = P[A = 0, B \neq 0] + P[A = 1, B > 1]$$

$$P[E = A] = \frac{1}{2} * \frac{7}{8} + \frac{1}{2} * \frac{6}{8}$$
$$P[E = A] = \frac{7}{16} + \frac{6}{16}$$
$$P[E = A] = \frac{13}{16}$$

- I think we can actually calculate for an n collision what is the probability for A to win, for that we can see that for $P[E = A_n]$ that is the probability for A to win in the n step is

$$P[E = A_n] = \frac{2^{n-1} + 2^{n-2}}{2^{n+2}}$$