KN Gü 4

Set 3

4. a) With GO-BACK-N

If success at first ~~time~~ $(1-P)$

-> time to transmit frame t_f

If failure at first time (p)

(knowing that we need $\left(\frac{1}{1-p}\right)$ transmission attempts on average time to deliver frame)

$$t_f + N_F \cdot t_f \left(\frac{1}{1-p}\right) = t_f + T\left(\frac{1}{1-p}\right)$$

number of frames transmitted after the last one and until timeout -> $N_F = \frac{T}{t_f}$ -> timeout

=> Total time for frame:

$$(1-p)\, t_f + P\left(t_f + T\left(\frac{1}{1-p}\right)\right) = t_f + P\frac{T}{1-P}$$

$$\Rightarrow \text{Utilization} = \frac{t_f}{t_f + P\frac{T}{1-p}} = 0{,}7074,$$

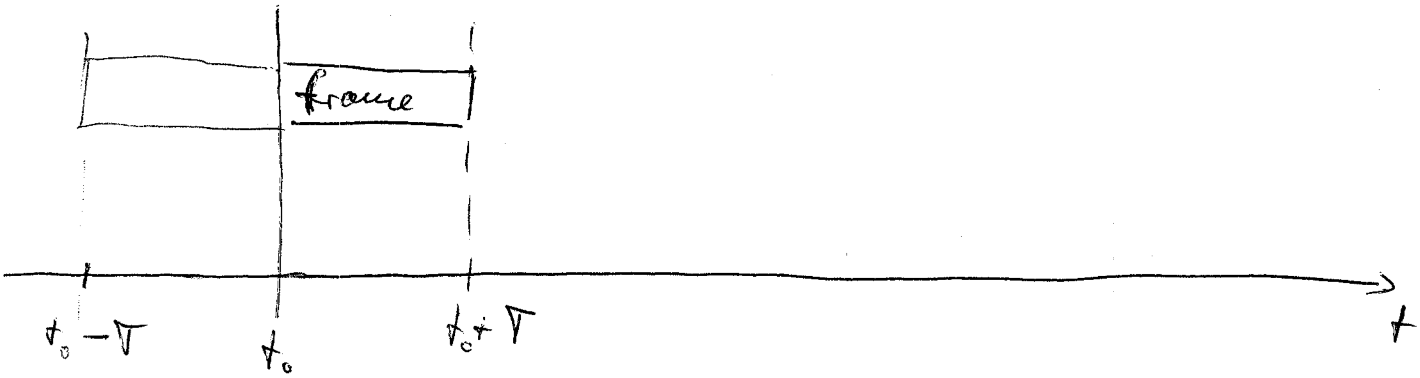
pkt delivery rate $= 64 \cdot 0{,}7 = 42{,}5 \frac{\text{pkts}}{\text{sec}}$

set 4.)

1.) Poisson arrivals $P_G[K] = \dfrac{G^k \cdot e^{-G}}{k!}$

→ probability of k frame arrivals in a frame time

Throughput: $S = G \cdot P_{suc}$



Pure ALOHA

Vulnerable period: $[t_0 - T, t_0 + T]$

time interval $T \longleftrightarrow G$

$2T \longleftrightarrow 2G$

$P_{suc} = P_{2G}[0] = \dfrac{(2G)^0}{0!} \cdot e^{-2G} = e^{-2G}$

$\Rightarrow S = G e^{-2G}$

slotted ALOHA

Vulnerable period: $[t_0 - T, t_0]$

$P_{suc} = P_G[0] = e^{-G}$

$\Rightarrow \boxed{S = G \cdot e^{-G}}$

1.c.) Pure ALOHA

$S_{max} \rightarrow (G e^{-2G})' \stackrel{!}{=} 0$

$\Rightarrow G(-2) e^{-2G} + e^{-2G} \stackrel{!}{=} 0 \Rightarrow \underline{G = \frac{1}{2}}$

$S_{max} = \frac{1}{2e} = 0{,}18$

slotted ALOHA

$S_{max} \rightarrow (G e^{-G})' \stackrel{!}{=} 0 \Rightarrow G e^{-G} + e^{-G} = 0$

$\Rightarrow G = 1 \quad , \quad S_{max} = 0{,}36$

4.) CSMA/CD (BEB)

I want: prob. of having $(k-1)$ collisions, and then success on round k ?

Round	after collision, select timeslot among	No. of choices
1	0	$1 = 2^0$
2	0, 1	2^1
3	0, 1, 2, 3	2^2
4	0, 1, 2, ..., 7	2^3
i		2^{i-1}

Collision at round i

$$P_{round\_i\_coll} = \left(\frac{1}{2^{i-1}}\right)\left(\frac{1}{2^{i-1}}\right) + \left(\frac{1}{2^{i-1}}\right)\left(\frac{1}{2^{i-1}}\right) + \dots + \underbrace{\left(\frac{1}{2^{i-1}}\right)\left(\frac{1}{2^{i-1}}\right)}_{\text{two stations per slot colliding}}$$

number of summands: 2^{i-1}

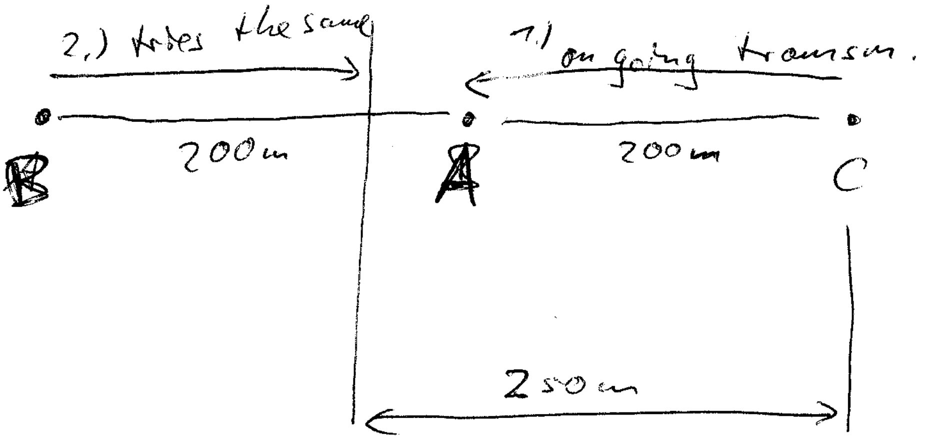
$$\ldots = \frac{2^{i-1}}{2^{2(i-1)}} = 2^{-(i-1)}$$

$\Rightarrow$ collision at first $(k-1)$ rounds

$$= \prod_{i=1}^{k-1} 2^{-(i-1)}$$

Final result: $P_k = \prod_{i=1}^{k-1} 2^{-(i-1)} \cdot \left(1 - 2^{-(k-1)}\right)$

6.)



$\Rightarrow$ collision

Hidden Terminal (Problem)