GATE CSE NOTES

by

UseMyNotes

CN Formulae

* Flow Control

$T_t = \frac{L}{B}$ | $T_p = \frac{d}{v}$ [$v = 2.1 \times 10^8$ m/s for optical fiber links]

$\eta = \frac{\text{Useful time}}{\text{Total time}}$ $\quad \eta = \frac{T_t}{\text{Total time}}$

Throughput $= \eta B$

$RTT = (T_t)_S + (T_p)_{pkt} + T_q + T_{proc} + (T_t)_R + (T_p)_{ack}$

When $T_q = T_{proc} = (T_t)_R = 0$,

$RTT = T_t + 2T_p$.

• S&W / S&W ARQ

$$\eta = \frac{(T_t)_{pkt}}{(T_t)_{pkt} + 2T_p} \quad \Big| \quad a = \frac{T_p}{T_t}$$

$$\eta = \frac{1}{1+2a}$$

For any SW protocol, (Sliding window)

avl seq. no. $\geq W_S + W_R$

$\eta = \frac{\text{Amount of data sent}}{\text{Max. data that could be sent.}}$

Capacity (half duplex) $= T_p B$

Capacity (full duplex) $= 2T_p B$

$\eta = \frac{\text{\#frames sent in one window}}{\text{Total \#frames that can be sent in one window}} = $ * $\frac{\text{sender window size in protocol}}{\text{optimal sender window size}}$ $\rightarrow 1+2a$

• SWP

Optimal sender window size $= 1 + 2a = \frac{T_t + 2T_p}{T_t}$ (for max η)

Max #frames that can be sent in a window $= 1 + 2a$

Min # SN reqd $= 1 + 2a$ | Min # bits reqd in SN field $= \lceil \log_2(1+2a) \rceil$

Sender window size $= \min(1+2a, 2^n)$, $n \rightarrow$ # bits in SN field

~~Min~~

• GBN

$\eta = N/1+2a$ $\quad N \rightarrow W_S$ | # bits in SN field $= \lceil \log_2(N+1) \rceil$

$W_S = N$, $W_R = 1$

• SR

$W_S = W_R = N = 2^{n-1}$ if n bits for SN field

$$\eta = \frac{N}{1+2a}$$

When p is error in packet (probability)

$$\eta = \frac{N}{1+2a}(1-p)$$

* Access Control.

TDM

1 time slot $= T_t + T_p$.

$$\eta = \frac{T_t}{T_t + T_p}$$

Max avl. effective BW = Total #stations × BW requirement of 1 station.

Polling

$$\eta = \frac{T_t}{T_{poll} + T_t + T_p}$$

CSMA/CD.

Collision det^n cond^n: $T_t \geq 2T_p$ | $L \geq \frac{2Bd}{v}$

$$\eta_{CSMA/CD} = \frac{T_t}{c \times 2T_p + T_p + T_t}$$ c = # contention slots / collision slots

Pr(succ. transmission of 1 station) = $^nC_1\, p(1-p)^{n-1}$ $p \to$ prob. of transmitting data

$Pr|_{max} = (1 - 1/n)^{n-1}$ @ $p = 1/n$ $n \to$ # stations

When $n \to \infty$, avg. # collisions that might occur before a successful transmission = e. $\Rightarrow$ $\eta = \frac{T_t}{e \times 2T_p + T_t + T_p} = \frac{1}{1 + 6.44a}$

Binary exp. backoff. | $[0, 2^n - 1]$ Backoff time = K × Time slot.
$\downarrow$
1 rtt.

Token Passing. | Ring latency = $\frac{d}{v} + \frac{Nb}{B}$ sec = $\frac{dB}{v}$ + Nb bits

Cycle time = $\frac{d}{v}$ + N × (token holding time).

* $\eta = \frac{NT_t}{T_p + N \times THT}$

DTR | $THT = T_t + T_p + N \times \overset{0}{\cancel{\text{bit delay}}} = T_t + T_p$.

$$\eta = \frac{NT_t}{T_p + N(T_t + T_p)} = \frac{1}{1 + \left(\frac{N+1}{N}\right)a}$$

ETR | $THT = T_t$

$$\eta = \frac{NT_t}{T_p + NT_t} = \frac{1}{1 + a/N}$$

Use ETR when not said otherwise.

Aloha | Throughput, $S = Ge^{-2G}$ (Pure)
$= Ge^{-G}$ (Slotted)

S_{max}	P	S
	18.4%	36.8%

Prob. that k frames are generated during a given frame time, $Pr[k] = \frac{G^k e^{-G}}{k!}$

* For Biphase Manchester & Diff. Manchester,
Baud rate = 2 × Bit rate

For Biphase encoding,
Clock rate = 2 × Data transfer rate

* Bit rate = Baud rate × (#bits / symbol)

* Circuit switching   Time taken to send a message from S to R -

Remember to subtract hdr. size from packet size to calculate #pkts reqd.

$T = T_t$ (#hops + (#packets the msg is broken into $- 1$)) as pipelining is used.

$T_t \to$ for 1 packet
L/B

* Fragmentation overhead = (#fragments − 1) × size of IP hdr.

→ Efficiency = $\frac{\text{Useful}}{\text{Total}} = \frac{\text{Data w out hdr}}{\text{Data w hdr}}$

* WAT = #SNs available / BW

TCP

#bits min reqd in SN field for satisfying WAT ≥ LT − $\log_2(LT \times B)$