End Semester Exam [COMN]

10 May 2024 01:01 AM

A3) (a) Using equation (6) and (9) of Bianchi Paper

$$\tau = \frac{2(1-2p)}{(1-2p)(33) + p(32)(1-(2p)^5)}$$

and

$$p = 1-(1-\tau)^{n-1} \qquad n = 10, 50, 100$$

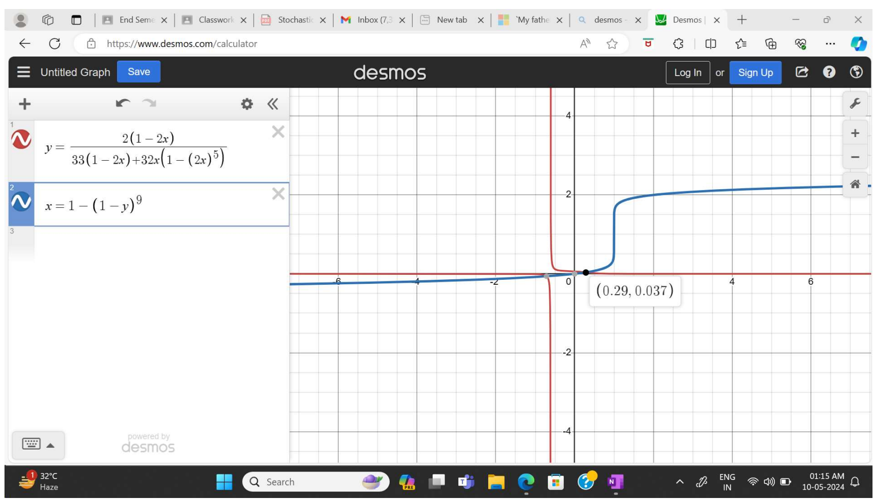
we have used desmos graphing calculator for graphical analysis :

→ $n=10$ $\qquad (p, \tau) = (0.29, 0.037)$

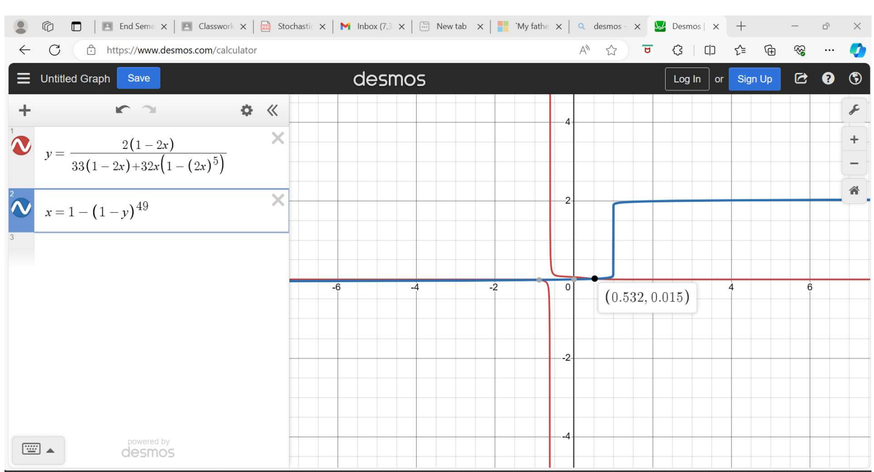
($\tau = y \to$ Red)

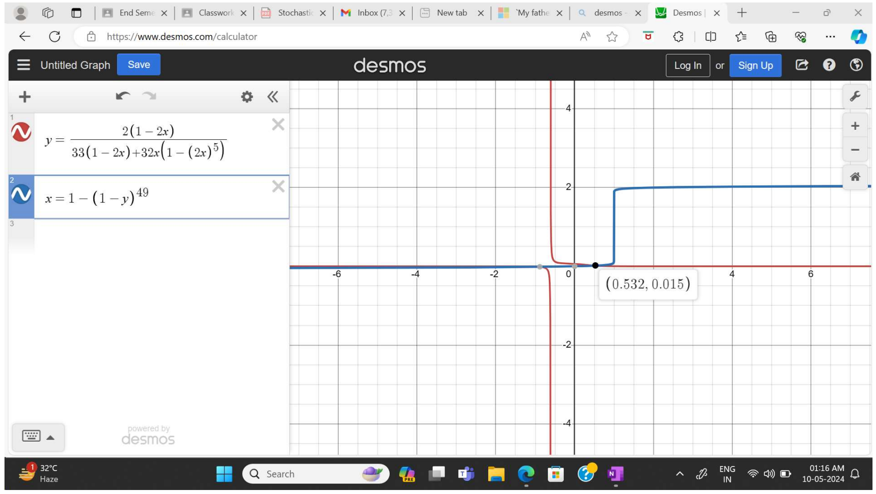
($p = x \to$ Blue)

Only 'Q1' Results are allowed

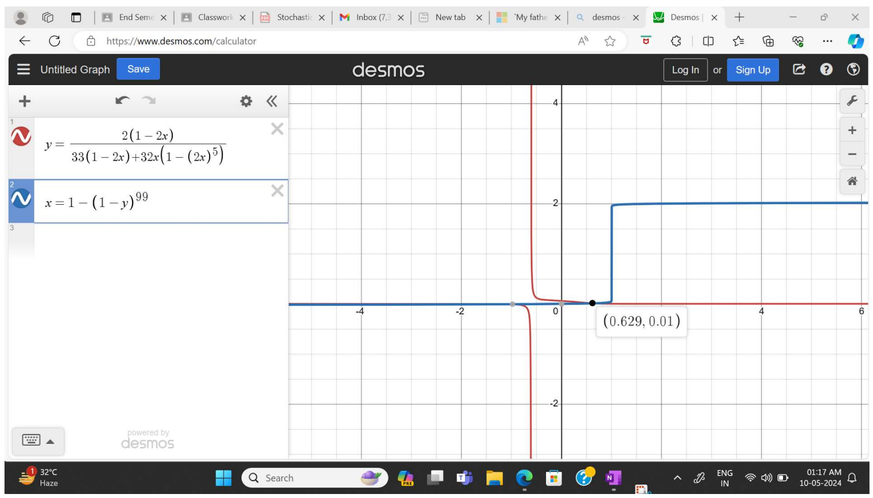


→ $n = 50$ $\qquad (p, \tau) = (0.5332, 0.015)$





→ $n = 100$ $\quad (p, \tau) = (0.629, 0.01)$



(b) p(c) Considering Equation (13) of the paper:

$$S = \frac{P_s P_{tx} E(P)}{(1-P_{tx})\sigma + P_s P_{tx} \times T_s + P_{tx}(1-P_s)T_c}$$

In our case $E[P^*] = E(P) = 8184$ bits
and $\sigma = 50\mu s$

$$T_s = H + E(P) + DIFS + SIFS + 2\delta + Ack$$

$$T_c = H + E(P^*) + DIFS + \delta$$

and $P_s = \frac{n\tau(1-\tau)^{n-1}}{1-(1-\tau)^n}$ and $P_{tx} = 1-(1-\tau)^n$

or simply

$S = \quad E(P)$

or simply

saturated throughput, $S = \dfrac{E(P)}{T_s - T_c + \sigma \dfrac{(1-P_{tx})/P_{tx} + T_c}{P_s}}$

using Table 2

$\delta = 1\mu s$, $SIFS = 28\mu s$, $DIFS = 128\mu s$

$H = MAC + PHY = 128 + 272 = (400 \text{ bits} \times Y)\mu s$

$ACK = 112 + PHY = 128 + 112 = (240 \text{ bits} \times Y)\mu s$

$Y = \dfrac{1}{10^{-6}} \times \dfrac{1}{R}$

n	10	50	100
P	0.29	0.5332	0.629
τ	0.037	0.015	0.01
P_{tx}	0.3141	0.5303	0.63397
P_s	0.839	0.674	0.583

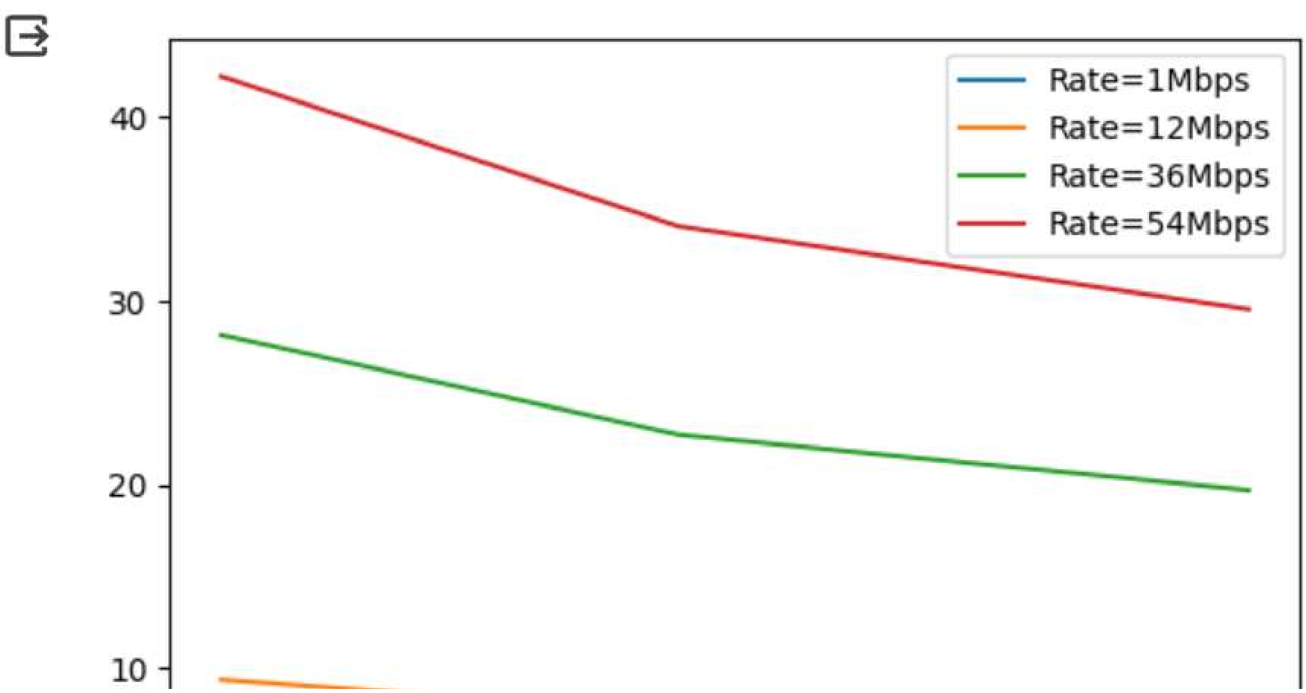
⇐ Using above Equations and the Results of (a)

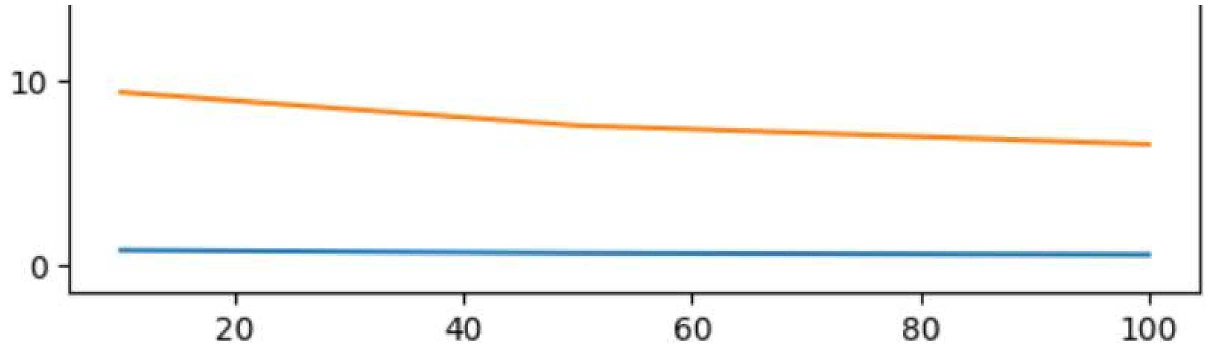
Now we plot (b) & (c) together

$R_1 = 12 \text{ Mb/s}$

$R_2 = 36 \text{ Mb/s}$

$R_3 = 54 \text{ Mb/s}$





what do we observe ?
as Rate increases
the gap between Throughput
and the Rate widens.
OR To say for higher Rate the
Gradient of Through put decreases.

(d)

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42.20043543297107,34.05560733208298,29.531546629912828,
42.2013416421519б,34.055905303398085,29.53171548286185,
42.20206663751937,34.05614368420445,29.53185056661132,
42.202218889711354,34.05619374459778,29.531878934355717,
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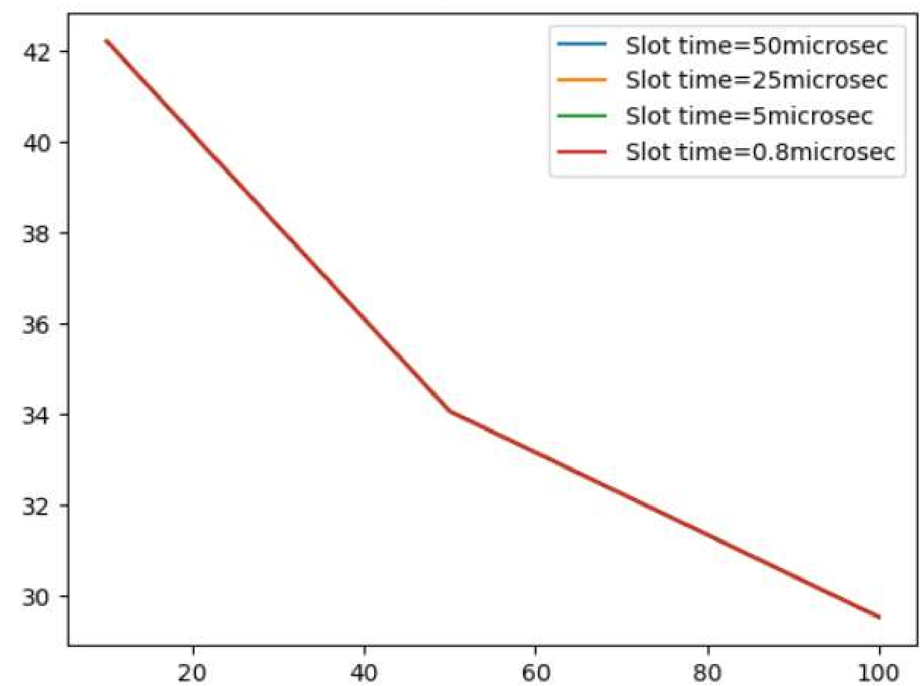

clearly as slot Time Decreases

clearly as slot Time Decreases Throughput improves a bit but this is not sigificantly Large

(e) eq (13) states,

$$S = \frac{P_s P_{tx} E(P)}{(1-P_{tx})\sigma + P_s P_{tx} \times T_s + P_{tx}(1-P_s) T_c}$$

clearly P_s, P_{tx}, $E(P)$, T_s, T_c are all indipendent of σ so as $(1-P_{tx})\sigma$ will decrease the saturation through put will increase,

as 'n' (no. of systems) increases $(1-P_{tx})$ decreases as a result effect of σ becomes Less and Less. Also this term decays faster bigger Rate as compared to other denominator Term

Thus as $\sigma \uparrow$ $S \downarrow$

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or $S \propto \frac{1}{\sigma}$

A4) simply when there is a collision at state $(i,0)$

where $0 < i < m$,

with probability p,

then it goes to either of (i,k) states

with probⁿ $= p \times (1-a)$

or goes to either of the $(i+1,k)$ states with

probⁿ $= p \times a$

$\therefore$ Markov chain $\Rightarrow$ all Non Negative state transition probⁿ $\Rightarrow$

$$P\{i,k \mid i,k+1\} = 1 \quad k \in (0, w_i - 2), \; i \in (0,m)$$

$$P\{m,k \mid m,0\} = p/w_m \quad k \in (0, w_m - 1)$$

$$P\{0,k \mid i,0\} = \frac{(1-p)+p(1-a)}{w_0} \quad k \in (0, w_0 - 1), \; i \in (0,m)$$

$$P\{i,k \mid i-1,0\} = \frac{pa}{w_i} \quad k \in (0, w_i - 1), \; i \in (1,m)$$

$$P\{i-1,k \mid i-1,0\} = \frac{p(1-a)}{w_{i-1}} \quad k \in (0, w_{i-1} - 1), \; i \in (1,m-1)$$

- Start from eq (2)

$$b_{i,0} = pa \cdot b_{i-1,0} + p(1-a)\, b_{i,0}$$

$$\Rightarrow b_{i,0} = \left(\frac{pa}{1-p(1-a)}\right) \cdot b_{i-1,0}$$

$$\Rightarrow b_{i,0} = \left(\frac{pa}{1-p(1-a)}\right)^i b_{0,0} \quad 0 < i < m$$

$$p\, b_{m,0} + pa\, b_{m-1} = b_{m,0}$$

[illegible] $= (pa)^m$ [illegible]

$$p\, b_{m,0} + pa\, b_{m-1} = b_{m,0}$$

$$b_{m,0} = \frac{pa}{1-p} b_{m-1,0} = \frac{(pa)^m}{(1-p+pa)^{m-1}(1-p)} b_{0,0}$$

eq (3)

$$b_{i,k} = \frac{w_i - k}{w_i} \begin{cases} \left((1-p)\sum_{i=0}^{m} b_{i,0}\right) + p(1-a)\, b_{0,0} & ; i=0 \\ pa\,(b_{i-1,0}) + p(1-a)\, b_{i,0} & ; 0<i<m \\ p\, b_{m,0} + pa\, b_{m-1} & ; i=m \end{cases}$$

$$\Rightarrow b_{i,k} = \frac{w_i - k}{w_i} b_{i,0} \qquad i>0$$

eq (5)

$$1 = \sum_{i=0}^{m} b_{i,0} \frac{w_i + 1}{2}$$

$$= \frac{b_{0,0}}{2}\left(\left(\sum \frac{w_i b_{i,0}}{b_{0,0}}\right) + \frac{1-(p(1-a))}{1-p}\right)$$

$$= \frac{b_{0,0}}{2}\left(w\left(\left(\sum_{i=1}^{m-1} 2^i \times \left(\frac{pa}{1-p(1-a)}\right)^i\right) + \frac{(2pa)^m}{(1-p(1-a))^{m-1}(1-p)}\right) + \frac{1-p(1-a)}{1-p}\right)$$

$$\therefore 1 = \frac{b_{0,0}}{2}\left(w\left(\frac{1-\left(\frac{2pa}{1-p(1-a)}\right)^m}{1-\left(\frac{2pa}{1-p(1-a)}\right)} + \frac{(2pa)^m}{(1-p(1-a))^{m-1}(1-p)}\right) + \frac{1-p+pa}{1-p}\right)$$

This is going crazy

we will stop here

A5)(13) Didn't do