1. C

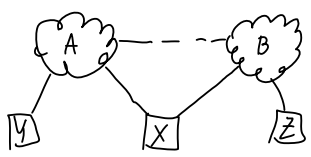
2. X – Transmissão com sucesso
$\tilde{X}$ – Falhou

$P(X) = 1 - P(\tilde{X}) = 1 - \frac{1}{5} = \frac{4}{5}$ C//

$P(\tilde{X}) = p^2 \cdot \sum_{i=0}^{\infty} (1-p)^{2i} = p^2 \cdot \frac{1}{1-(1-p)^2} = \frac{1}{q} \cdot \frac{1}{1-(\frac{2}{3})^2} = \frac{1}{5}$

3. C

4. A



5. 512 = 1 processo por máquina

4×2^{16} = portos disponíveis

$\frac{4 \times 2^{16}}{512} = \frac{2^2 \times 2^{16}}{2^9} = 2^{18-9} = 2^9 = 512 \approx 500$

6. C

7. tempo de espera médio

$\frac{2^5}{2} \times 8\mu s = 2^4 \times 2^3 \mu s = 2^7 \mu s = 128 \mu s$

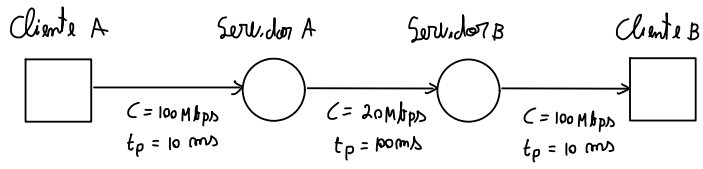
tempo de propagação

$t_p = \frac{1500 \times 8}{64 \times 10^6} = \frac{2^3 \times 1500}{2^6 \times 10^6} = \frac{1500}{2^3} \mu s = 187{,}5 \mu s$

$\frac{1500 \times 8}{128 + 187{,}5} \times 10^6 \approx \frac{1500}{300} \times 8 \times 10^6 \approx 40$ Mbps// A

8. C

9.



F = 1 Mbyte

$t_p = 10 + 10 + 100 = 120$ ms

$t_t = \frac{1 \times 10^6 \times 8}{100 \times 10^6} \times 2 + \frac{1 \times 10^6 \times 8}{20 \times 10^6} = \frac{16}{100} + \frac{8}{20} = \frac{16 \times 20 + 800}{2 \times 1000} = 160 + 400$ ms $= 560$ ms

$t = 120 + 560 = 680$ ms C//

10. NR : 1000 + 1500 = 2500

Window : 2000 − 1500 + 1200 = 1700

B//

11. 193.136.64.0/19 → 193.136.010 0 0000.0

193.136.8.0/21 → 193.136.0000 1|000.0

193.136.96.0/20 → 193.136.0110|0000.0

193.136.0.0/16 → 193.136.|0000 0000.0

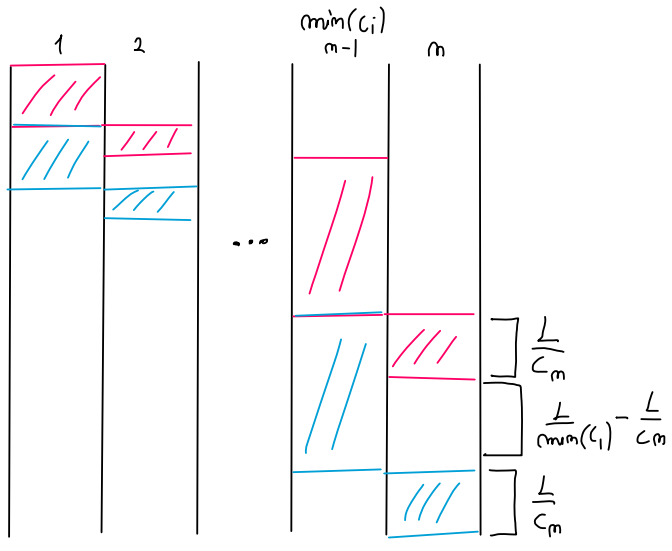
193.136.0.0/17 → 193.136.0|000 0000.0 ← Mais longe

193.136.64.0/18 → 193.136.01|00 0000.0
↳ dá todos nos

B

12. A

1.



a) e b)

$\Delta_1 = \frac{L}{C_m} + \frac{L}{\min(C_i)} - \frac{L}{C_m} + \frac{L}{C_m} = \frac{L}{\min(C_i)} + \frac{L}{C_m} \Rightarrow \frac{2L}{\Delta_1} = 2\frac{C_m \cdot \min(C_i)}{C_m + \min(C_i)}$

$\Delta_2 = \frac{L}{\min(C_i)} - \frac{L}{C_m} + \frac{L}{C_m} = \frac{L}{\min(C_i)} \Rightarrow \frac{L}{\Delta_2} = \min(C_i)$

c) A segunda é mais correcta pois só estima a capacidade mínima (que é a que limita)

Envia mais pacotes

2.

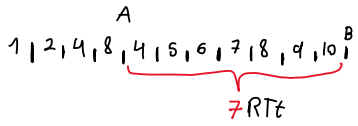
2.1 Vai para fast recovery ⇒ 3 ACKs duplicados

2.2 $\frac{12K}{1.5K} = 8$ Logo N bytes = $(1+2+4+8) 1.5K =$

$= 15 \cdot 1.5K = 22{,}5K$

2.3 Vai de 8 segmentos para 4

$\frac{15K}{1.5K} = 10$



7 RTt = 700 ms

2.4 $T_i - A$: 1 + 2 + 4 + 8 = 15 (3 RTt)

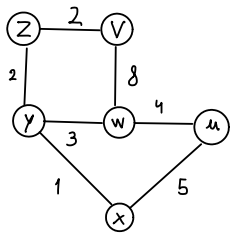
A − B : 4 + 5 + 6 + 7 + 8 + 9 + 10 = 49 (10 RTt)

B − C : 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14 + 15 + 16 = 126 (22 RTt)

C − Tf : 1 + 2 + 4 + 8 + 9 + 10 = 34 (28 RTt)

$\frac{15 + 49 + 126 + 34}{28 \cdot RTt} = 8$ Seg/RTt ⇒ 120 KB/s = 960 Kbit/s

3.



a)

Relay	u	v	w	x	y	z
t	?	?	?	?	?	?
t+1	u	v	u	u	w	v
t+2	u	u	u	u	u	v
t+3	u	u	u	u	u	u

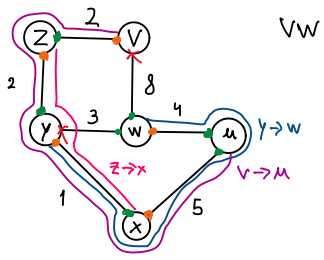
3 tempos

b)

Relay	v	w	x	y	z
t	?	?	?	?	?
t+1	w, 8	u, 4	u, 5	w, 3	v, 2
t+2	w, 12	u, 4	u, 5	x, 6	v, 2
t+3	w, 12	u, 4	u, 5	x, 6	y, 8
t+4	z, 10	u, 4	u, 5	x, 6	y, 8

4 tempos

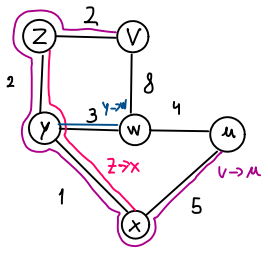
c)



VW e YW fechadas

d) 3 fluxos a irem pelo mesmo canal ⇒ $\frac{1}{3}$ 6 bps por fluxo

e)



Com encaminhadores usamos sempre os caminhos mais curtos

y→w : 1 6 bps

v→u e z→x : $\frac{1}{2}$ 6 bps