calculos

May 14, 2020

[1]:
```
#EJ 1_A
t_phl = ln(2)*3.5e3*0.2e-12
t_plh = ln(2)*7e3*0.2e-12

print('t_phl:', t_phl.n())
print('t_plh:', t_plh.n())
```

```
('t_phl:', 4.85203026391962e-10)
('t_plh:', 9.70406052783923e-10)
```

[2]:
```
#EJ 1_D
var('s')
resistencia_necesaria = ln(2)*s*0.2e-12 < 0.1e-9
print(solve(resistencia_necesaria,s)[0][0].lhs(), 'menor que',␣
 ↪solve(resistencia_necesaria,s)[0][0].rhs().n())
tam_nmos = 3.5e3*500e-9/solve(resistencia_necesaria,s)[0][0].rhs()
tam_pmos = 7e3*500e-9/solve(resistencia_necesaria,s)[0][0].rhs()
print('Tamano del NMOS: ',tam_nmos.n())
print('Tamano del PMOS: ',tam_pmos.n())
```

```
(s, 'menor que', 721.347520444482)
('Tamano del NMOS: ', 2.42601513195981e-6)
('Tamano del PMOS: ', 4.85203026391962e-6)
```

[3]:
```
#EJ 2
num_inversores = 1/(4e9*(16.9e-12+16.2e-12))
print('numero de inversores:', num_inversores)

print('inversa de la frecuencia', 1/4e9)
```

```
('numero de inversores:', 7.55287009063444)
('inversa de la frecuencia', 2.50000000000000e-10)
```

[4]:
```
#EJ 3_a
resistencia_pmos = 7e3*500e-9/1125e-9

t_phl = ln(2)*3.5e3*10e-12
t_plh = ln(2)*resistencia_pmos*10e-12
```

```
print('t_phl:', t_phl.n())
print('t_plh:', t_plh.n())
```

```
('t_phl:', 2.42601513195981e-8)
('t_plh:', 2.15645789507539e-8)
```

[5]:
```
#EJ 3_B
C_in_nmos = 0.63e-15 #0.63 fF
C_in_pmos = C_in_nmos*2.25 #el pmos tiene 2.25 veces más anchura
C_in = 1.5*(C_in_nmos+C_in_pmos)
C_l = 10e-12 #10 pF
F = C_l/C_in
var('n')
num_inversores = (ln(4) == (1/n)*ln(F))
total_inversores = ceil(solve(num_inversores, n)[0].rhs().n()) if␣
 ↪ceil(solve(num_inversores, n)[0].rhs().n())%2 == 1 else␣
 ↪ceil(solve(num_inversores, n)[0].rhs().n())+1
print('necesitamos:', solve(num_inversores, n)[0].rhs().n(), 'inversores, que␣
 ↪se redondean a', total_inversores)
escalado = F^(1/total_inversores)
print('el escalado sera', round(escalado))
print('tamanos nmos:', [round(escalado)^i*500 for i in range(total_inversores)])
print('tamanos pmos:', [round(escalado)^i*500*2.25 for i in␣
 ↪range(total_inversores)])
```

```
('necesitamos:', 5.83444321348101, 'inversores, que se redondean a', 7)
('el escalado sera', 3)
('tamanos nmos:', [500, 1500, 4500, 13500, 40500, 121500, 364500])
('tamanos pmos:', [1125.00000000000, 3375.00000000000, 10125.0000000000,
30375.0000000000, 91125.0000000000, 273375.000000000, 820125.000000000])
```