Solutions to Homework # 11

Introduction to Communication Systems –E3701

Problem 1

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a) From the class, we know

$$C = W \log_2\left(1+\frac{S}{N}\right)$$

W=3000 HZ and S/N=28 dB=631. C=3000log$_2$ (1+631)=27.9K bps.

b) S/N$_0$W= 28 dB and W = 3000 Hz

S/N$_0$ = 28 dB+10 log$_{10}$ 3000= 28 + 34.8 dB=62.8 dB

S/N$_0$ =1.89 x 10^6

If the bandwidth is infinity then the capacity is

C= [1/ ln 2] S/N$_0$ bps = = [1/ ln 2] 1.89 x 10^6=2.749 Mbps

c)

We need to find that frequency W, for which

C'= W log $_2$ [1+ (S/N$_0$W)] = 0.99 C (at infinity bandwidth) = .99 x 2.749 x 10^6

Also, S/N$_0$ =1.89 x 10^6. Solve the above equation we get W is about 94 MHz.