Slide Examples Solutions

Lecture 1,2,3

Lecture 1

Example 1:

- Lets consider the spectrum of a channel is between 3 MHz and 4 MHz and SNR_{db} =24 dB. Then find the maximum capacity achieved by channel. If it is possible to achieved the limit then how many signal level is required?

Solution: ***by Younus-131***

Bandwidth, $B = 4 - 3 = 1$ MHz

$$SNR = 10^{(SNR_{db}/10)} = 10^{(24/10)} = 251.1886$$

Maximum capacity, $C = B \log_2(1+SNR)$

$$= 1 \times \log_2(1 + 251.1886)$$

$$= 7.978 \text{ Mbps} \approx 8 \text{ Mbps}$$

Nyquist Formula, $C = 2B \log_2 M$

$$\Rightarrow \frac{C}{2B} = \log_2 M$$

$$\Rightarrow M = 2^{\frac{C}{2B}} = 2^{\frac{8}{2\times 1}} = 16$$

Example 2:

- What are the propagation time and the transmission time for a 2.5-kbyte message if the bandwidth of the network is 1 Gbps? Assume that the distance between the sender and the receiver is 12,000 km and that light travels at 2.4×10^8 m/s.

Solution: ***by Younus-131***

Given,

$d = 12000$ km

$= 12 \times 10^6$ m

$s = 2.4 \times 10^8$ m/s

$$\text{Propagation time} = \frac{d}{s} = \frac{12 \times 10^6}{2.4 \times 10^8} = 5.357 \times 10^{-3} s = 5357 \mu s$$

Here,

$$\text{Size of the message} = 2.5 \text{ kbyte} = 2.5 \times 10^3 \text{ byte} = 2.5 \times 10^3 \times 8 \text{ bit}$$

$$\text{bandwidth} = 1 \text{ Gbps} = 1 \times 10^9 \text{ bps}$$

$$\text{Transmission time} = \frac{\text{size of the message}}{\text{bandwidth}} = \frac{2.5 \times 10^3 \times 8}{1 \times 10^9} s = 2 \times 10^{-5} s = 20 \mu s$$

Lecture 3

Example: Multistage Switch

Design a three-stage, 200 × 200 switch ($N = 200$) with $k = 4$ and $n = 20$.

Solution: ***Added from the Lecture Slide***

In the first stage we have N/n or 10 crossbars,
each of size 20 × 4.

In the second stage, we have 4 crossbars,
each of size 10 × 10.

In the third stage, we have 10 crossbars,
each of size 4 × 20.

The total number of crosspoints is $2kN + k(N/n)^2$, or 2000 cros

This is 5 percent of the number of crosspoints in a single-stage
(200 × 200 = 40,000).

Example- Non-blocking

Redesign the previous three-stage, 200 × 200 switch, using the Clos criteria with a minimum number of crosspoints.

Solution: ***Added from the Lecture Slide***

We let $n = (200/2)^{1/2}$, *or* $n = 10$.

We calculate $k = 2n - 1 = 19$.

In the first stage, we have 200/10, or 20, crossbars, each with 10×19 *crosspoints.*

In the second stage, we have 19 crossbars, each with 20×20 *crosspoints.*

In the third stage, we have 20 crossbars each with 19×10 *crosspoints.*

The total number of crosspoints is

$$20(10 \times 19) + 19(20 \times 20) + 20(19 \times 10) = 15200.$$