**King Saud University**

**College Of Computer & Information Sciences**

**Department Of Computer Sciences**

**Tutorial 3 Fall 15**

**(Computer Networks CSC 329)**

1. **Explain the advantage of communication with optical fiber as a physical media.**

Optical fibre is a thin and flexible piece of fiber made of glass or plastic.

Unlike copper wire, optical fiber is typically used for long-distance data communications, being that it allows for data transmission over far distance at high transmission speeds.

Optical fiber also does not require signal repeaters, which ends up reducing maintenance costs, since signal repeaters are known to fail often.

1. **Explain the concept of modulation/ demodulation**

The process of transforming digital information ( 1’s an o’s) into analog.

In the case of modems, capable of being transmitted over telephone lines.

The process of transforming analog signals, previously modulated, back into digital information.

1. **Explain the concept of frequency multiplexing and time multiplexing channels.**

**FDM-** shares the channel by placing users on different frequencies, used for 802.11, 4G cellular and other communications.

**TDM:** shares a channel over time

-Users take turns on a fixed schedule . this is not packet switching or STDM ( statistical TDM)

-Widely used in telephone / cellular system

1. **Give and explain the Shannon and Nyquist theorems**

Both are theorems to calculate Maximum data rate of a channel

Nyquist theorems relates the data rate to the bandwidth ( B) and number of signal levels ( V) without noises.

Shannon theorems relates the data rate to the bandwidth ( B) and signal strength( S) relative to the noise ( N).

1. **Consider a noiseless channel with a bandwidth of 3000 Hz transmitting a signal with two signal levels. Calculate the maximum bit rate for this channel?**

Max. data rate = 2B log2V

Bit Rate = 2 \* 3000 \* log 22 = 6000 bps

1. **Consider the same noiseless channel transmitting a signal with four signal levels (for each level, we send 2 bits). Calculate the maximum bit rate for this channel?**

Max. data rate = 2B log2V

Bit Rate = 2 \* 3000 \* log 24 = 12000 bps

1. **Calculate the theoretical highest bit rate of a regular telephone line that has a bandwidth of 3000? The signal-to-noise ratio is usually 3162.**

We can calculate the theoretical highest bit rate of a regular telephone line.

A telephone line normally has a bandwidth of 3000 Hz ( 300 Hz to 3300 Hz) . the signal to noise ratio is usually 3162. Than channel capacity

Max. data rate = B log 2 ( 1 + S/N) bits / sec… S/N = 3162

= 3000 log 2 ( 1 + 3162)

= 3000 \* 11.62

= 34860 bps

1. **The signal-to-noise ratio is often given in decibels. Assume that SNRdB = 36 and the channel bandwidth is 2 MHz. calculate the theoretical channel capacity?**

2 MHz = 2 \* 106 Hz.

**Capacity =** B log 2 ( 1 + S/N) bits / sec

SNR dB  = 10 log 10 SNR => SNR = 10 SNRdB/10 = > SNR = 10 3.6 = 3981

C = B log 2 ( 1 + SNR) = 2 \* 10 6  log 2 3982 = 24 Mbps