Cairo University
Faculty of Engineering
Electronics and Communications Department

Fouth Year
ELC403A : Computers 4A
"Computer Networks"
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# Sheet 1

1- Certain data are available which are to be stored on 1.44 Mbyte floppy diskettes that weigh 30 g each.Suppose that an airliner can carry 10000 kg(10 tons) of these floppies and can travel at a speed of 1000 km/h over a distance of 5000 km. What is the data transmission rate in bits per second for this system?

2- Consider a transmission path that uses FDM multiplexing between five devices, each one requiring 4000 Hz bandwidth. Let the guard band between successive bandwidths be 200 Hz. Find the minimum bandwidth required for the path:

3- A telephone line is fed with input signal whose power is 0.9 watt and the output noise is measured as 10 μwatt.

a) Calculate the output signal-to-noise ratio in dB if line loss is 20dB.
b) What is the capacity of this line when the frequency band equals 2500Khz?
c) If the attenuation rate of this phone is 6dB/Km, and the minimum output signal is 0.005 watt, how long can the phone line be before requiring a repeater?

4- A standard analog broadcast television channel is 10MHz wide.

a) How many bits/sec can be transmitted using (64-QAM) signal? Assume that bandwidth efficient pulse shapes are used so that baud rate of $8*10^6$ QAM symbol/sec can be achieved.
b) What is the SNR required to support communication at the data rate you found in part(a)?
c) How much smaller could the transmit power S be to send at the same data rate in (b), but using twice the bandwidth (i.e., 20MHz)?

5- Consider a transmission path betweena source and a destination that has 3 intermediate points. Each link has a propagation delay of 2ms, and a bit rate of 4 Mbps. A file of size K bits is to be transmitted over the path assumning three different scenarios: Circuit-Switching, Packet-Switching and Message-Switcing. For the circuit-switched scenario, assume that it takes 1 second to set up the circuit. For the packet-switched scenario, assume that information is transported in the form of packets of 1kbits each, where 24 bits are used as header and 1000 bits are used as payload. In both scenarios, processing delay at each intermediate node is neglected. With the help of appropriate time-sequence-diagrams, determine the following:

a) Total delay to deliver the file using circuit-switching.
b) Total delay to deliver the file using packet-switching.
   Assume that source sends one packet, waits until an acknowledgement is received (assuming that this takes 10ms after the packet has been completely delivered to the destination), then sends the next packet, and so on.
c) Total delay to deliver the file using packet-switching.
   Assume that the source sends all packets back to back, without waiting for acknowledgments.
   For what values of K is scenario (a) faster than scenario (c)?
d) Total delay to deliver the file using virtual-circuit packet-switching. (Assume virtual-circuit setup time to be the same as circuit-switching setup time).
e) Total delay to deliver the file using message switching?
f) If the (K)bits file is a voice signal transmitted from the source (A) to the destination (B). Source A converts analog voice to a digital 64 kbps bit stream on the fly, groups the bits into 48-byte packets (3B Header + 45B Payload), and then sends it using packet-switching as in (c) above. When destination B receives an entire packet, it converts the packet's bits into an analog signal. What is the maximum time that elapses from the time a bit is created (from the original analog signal at Source A) until the bit is decoded (as part of the analog signal at Destination B)?

6- A 5 Mbps ADSL link connects two end users. If the propagation speed is $30*10^6$ m/sec and the legnth of the link is 300 km :
   a) calculate total time delay to send a file of 3000B using circuit-switcing (assume setup time 1ms).
   b) Same as (a) above using packet switching. (Assume the file is divided into packets, each of size 1KB containing header 24B and that all packets are sent without waiting acknowledgment. Consider 2 intermediate switches between A and B).
   c) Same as (b) but when considering acknowledgment?
   d) Assume packet-switching is used with 30 users sharing the same link, such that each user is inactive 60% of the time. What is the probability that **exactly** 5 users are active?