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| **KING SAUD UNIVERSITY**  **COLLEGE OF COMPUTER AND INFORMATION SCIENCES**  **COMPUTER SCIENCE DEPARTMENT** | | | |
| **CSC 329: Computer Network** | **Tutorial 3** | | **1st Semester 1437-1438** |
| **Name:** | | **Student ID:** | |
| **Serial Number:** | | **Section Number:** | |

**Part1: Multiple-Choice Questions**

1. **\_\_\_\_\_\_\_\_\_\_\_ encoding has a transition at the middle of each bit.**

a .NRZ

b. Manchester

c. Bipolar encoding

d. All the above

1. **In \_\_\_\_\_\_\_encoding, we use three levels: positive, zero, and negative.**
2. unipolar
3. bipolar
4. polar
5. none of the above
6. **Modulation of an analog signal can be accomplished through changing the\_\_\_\_\_\_\_ of the carrier signal.**
   1. Amplitude
   2. Frequency
   3. Phase
   4. Any of the above
7. **ASK, PSK, and FSK are examples of \_\_\_\_\_\_\_\_ modulation.**
8. Digital-to-digital
9. Digital-to-analog
10. Analog-to-analog
11. Analog-to-digital
12. **A signal is measured at two different points. The power is P1 at the first point and P2 at the second point. The dB is 0. This means \_\_\_\_\_**

a. P2 is zero

b. P2 equals P1

c. P2 is much larger than P1

d. P2 is much smaller than P1

1. **\_\_\_\_\_\_ is a type of transmission impairment in which the signal loses strength due to the resistance of the transmission medium.**

a. Attenuation

b. Distortion

c. Noise

d. Decibel

1. **A type of transmission impairment in which the signal changes its shape due to the different propagation speeds of each frequency that makes up the signal.**
2. Attenuation
3. Distortion
4. Noise
5. Decibel
6. **\_\_\_\_\_\_\_\_ is a type of transmission impairment in which an outside source corrupts a signal.**
7. Attenuation
8. Distortion
9. Noise
10. Decibel
11. **\_\_\_\_\_\_\_\_ has units of bits/second.**
12. Throughput
13. Propagation speed
14. Propagation time
15. (b)or(c)
16. **When propagation speed is multiplied by propagation time, we get the**
17. Throughput
18. Wavelength of the signal
19. Distortion factor
20. Distance a signal or bit has traveled
21. **Propagation time is \_\_\_\_\_\_\_\_ proportional to distance and \_\_\_\_\_\_\_ proportional to propagation speed.**
22. Inversely; directly
23. Directly; inversely
24. Inversely; inversely
25. a Directly; directly

**11) Using the Shannon formula to calculate the data rate for a given channel, if C = B, then \_\_\_\_\_\_\_**

a. The signal is less than the noise

b. The signal is greater than the noise

c. The signal is equal to the noise

d. Not enough information is given to answer the question

**Part2: Exercises**

1. Assume a data stream as “**11100011”**. Encode this stream, using the following encoding schemes:
   1. NRZI

has a transition “in the beginning” if the bit being transmitted is a digital 1

does not has a transition if the bit being transmitted is a digital 0.

* 1. Manchester

Clock XOR Bit

1. Draw the bit sequence **“001101010“**using the following types of digital modulation: ASK, FSK and PSK. Note: Use the below coordinate system.



**ASK:** only amplitude changes for each bit. Phase shift and frequency are the same.

**FSK:** only frequency changes for each bit. Phase shift and amplitude are the same.

**PSK**: only phase shift changes for each bit. Amplitude and frequency are the same.

1. A signal travels from point 1 to point 4. At point 1, the signal power is **120 W**. The signal is attenuated by the time it reaches point 2, the power becomes **80w**.
2. Calculate the total relative power in dB?

Attenuation = 10log10 *80*/*120*

Attenuation = 10log10 *(0.667)*

Attenuation = -1.8= -2dB

The total relative power= -2+5 - 4= -1 dB

1. If the power is gained or loss?

Loss

1. What is the signal power in point 4.

Attenuation = 10log10 *P4*/*P1*

-1 = 10 log10 *P4*/*120*

*-0.1=* log10 *P4*/*120*

10-0.1 =P4/120

0.8=P4/120

P4=95.3 watt

Amplifier

P1

P2

P3

P4

5 dB

- 4 dB

1. We have a channel with a signal-to-noise ratio of **200**, what is the bandwidth of channel when we want to send data at **100 Kbps**?

Capacity = bandwidth \* log2 (1 +SNR)

bandwidth= Capacity / log2 (1 +SNR)

= 100 \* 103 / log2 (1 +200)

1. Consider a noiseless channel with a bandwidth of **5000 Hz** transmitting a signal with eight signal levels. What is the maximum bit rate?

Bit rate= 2\* 5000\*log28=30000bps

1. A line has a signal-to-noise ratio of **1000** and a bandwidth of **4000 KHz**. What is the maximum data rate supported by this line?

C = B \* log2(1+SNR)

= 4000\*1000\*log2(1+1000)

= 39868.90 Kbps = 40 Mbps

1. We have a channel with **4 KHz** bandwidth. If we want to send data at **100 Kbps**, what is the minimum SNRdb ? What is SNR?

Capacity = bandwidth \* log2 (1 +SNR)

log2 (1 +SNR) = Capacity / bandwidth

= 100 \* 103 / 4 \* 103

= 25

SNR = 225 -1

SNRdB = 10 \*log10 (225 -1) =75.25

1. What is the bandwidth of the channel, if the packet with size **4 Kbyte** takes **30 second** to transmit?

transmission time = message size/ bandwidth

Bandwidth=message size/transmission time

=4\*8\*1000/30=1066.67 Hz =1.1 KHz

1. What is the total delay (latency) for a frame of **size 5 million bits** that is being sent on a link with **5 routers** each having a **queuing time of 2 µs**. The **length of the link is 2000 Km**. The speed of light inside the link is **2 × 10 m/s**. The link has a **bandwidth of 5 Mbps**. Ignore processing time at the nodes. Which component of the total delay is dominant?

**Latency** = processing time + queuing time +transmission time + propagation time

Processing time = 0

Queuing time = 5 × 2 μs = 10 μs = **0.000010 s**

Transmission time = 5,000,000 / (5 Mbps) = **1 s**

Propagation time = (2000 Km) / (2 × 108) = **0.01 s**

**Latency = 0 + 0.000010 + 1 + 0.01 = 1.010030 s**