

University of Saskatchewan
EE 352 Communication Systems I
Quiz #1 – Mar. 14/2002

1 1
 2 1
 3 2
 4 2
 5 2
 6 1/2

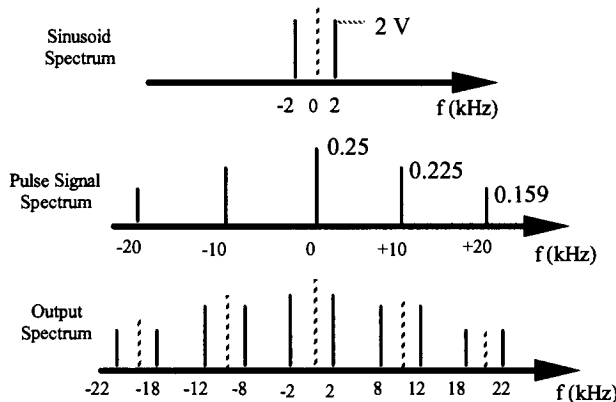
Time: 25 minutes

Permitted: - text, printed notes, student's own *hand-written* materials
 Use the space below each question for your answer.

1 Complete the following drill problem (1 point)

Example 4.1 – Natural Sampling A signal containing a 2.82 V_{rms} tone at 2 kHz is presented to the sampling gate. The sampling pulse sequence has frequency 10 kHz and duty cycle 25%. What frequencies will be present in the output of the sampling gate?

Solution: 2 kHz, 8 kHz, 12 kHz, 18 kHz, 22 kHz,



Drill Problem 4.1

Determine the rms voltages of all frequency components up to 25 kHz.

f (kHz)	V rms
2	0.705 ✓
8	0.635 ✓
12	0.635 ✓
18	0.418 ✓
22	0.418 ✓

Checksum 2.871

7 1/2
10

*2 A PAM multiplexing system interleaves samples from 24 voice channels. The system bandwidth for the voice channels is 3.4 kHz. (2 pts)

i) What is the maximum duty cycle of the sample pulses for one voice channel.

$\frac{1}{24}$ ✓

ii) Considering the sampling theorem and the properties of practical filters, suggest a practical aggregate sample rate on the transmission channel connecting the transmitter and receiver.

twice is the minimum = 6.8 kHz \therefore 20 kHz will work *too large to be practical*

*3 A baseband color television signal has frequency components as high as 4.6 MHz. (2 pts)

i) What is the theoretical minimum sampling rate that can be used to faithfully reproduce this signal?

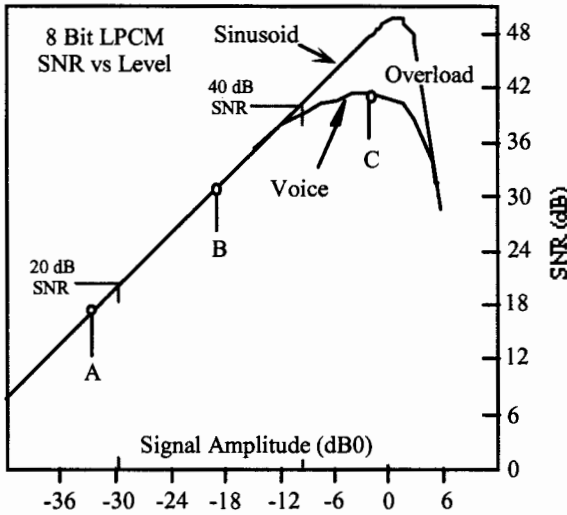
9.2 MHz ✓

ii) Suggest a practical minimum sampling rate.

4 times would leave more room for the filter
 $\therefore \approx 20 \text{ MHz}$ *too large for practical minimum.*

Aggregate rate is 24x

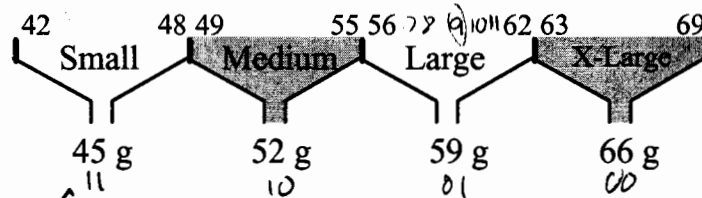
- 4 The graph illustrates 8-bit LPCM SNR for sinusoids and for voice. (2 pts)
 * i) Identify the points A, B, and C as talking, whispering and shouting.
 ii) Explain why voice SNR is less than sinewave SNR as the signal level approaches the overload level (0 dB0). *Hint: voice contains several frequency components.*



i) a → whispering ✓
 B → Talking ✓
 C → shouting ✓

ii) ~~This is because the rate has dynamic range.~~ There will be clipping of some part of the signal as you approach full load. ∴ you must leave room for the peaks. This will reduce the average signal level.

5. The following illustration represents quantizing bins for the grading eggs. What is the range of error (in grams) when the large egg is assumed to be exactly 59 grams? How many binary bits are required to represent the "quantized" egg sizes shown? (2 pts)



a) ±3g ✓
 B) 2 bits ✓

6. How many minutes of music can be stored on a 1.5 megabyte floppy disk if 16 bit quantization is used at a sampling rate of 44.1 kHz. Assume monaural recording. (1 pt)

1.5 meg = 1024 bytes

END

1 byte = 8 bits

$$(1.5 \text{ Megabytes}) (1024 \text{ bytes/Megabyte}) (8 \text{ bits/byte}) = 12.288 \times 10^3 \text{ bits}$$

$$\text{need 16 bits } \therefore \frac{12.288 \times 10^3 \text{ bits}}{16 \text{ bits}} = \frac{768}{44.1 \text{ kHz}} = 0.0175$$