ITS 323 – QUIZ 2 (ITA) ANSWERS

First name: _____ Last name: _____

ID: _____ Total Marks: _____

out of 8.5

Question 1 [3 marks]

a) What is the bandwidth of a signal that can be decomposed into five sine waves with frequencies at 0, 20, 50, 100, and 200 Hz?

Answer: 200 Hz

b) What is the bit rate for a signal in which 10 bits last 20μs?

Answer: 500 kb/s

c) *Circle the correct words*: Making a telephone call over the ordinary fixed-line telephone network is an example sending [Analog / Digital] data over a [Analog / Digital] signal.

Answer: Analog, Analog

d) Consider the following two signals:

$S1 = (4/\pi)\,[\sin(2\pi ft) + (1/3)\sin(2\pi(3f)t)]$

$S2 = (4/\pi)\,[\sin(2\pi ft) + (1/3)\sin(2\pi(3f)t) + (1/5)\sin(2\pi(5f)t)]$

If our transmission system supports the bandwidth of 8kHz, which signal (S1 or S2) provides the highest data rate?

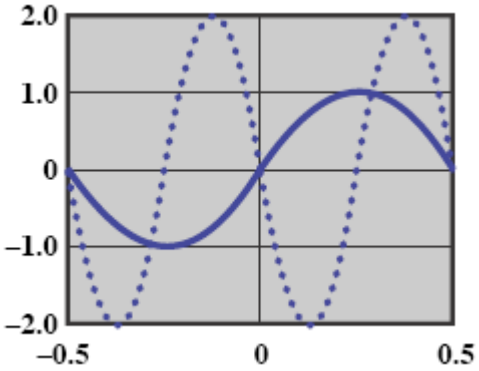
Answer: S1

e) From your answer of part (d), although the signal you selected provides the highest data rate, what is a disadvantage of the signal (compared to the other lower data rate signal)?

Answer: More errors

Question 2 [1.5 mark]

If the solid curve of the figure below represents $\sin(2\pi t)$, what does the dotted curve represent? That is, the dotted curve can be written in the form $A \sin(2\pi ft + \phi)$; what are A, f, and ϕ?



Answer:

A: _____2_____

f: _____2_____

ϕ: _____ π _____

Question 3 [2 marks]

Given a channel with an intended capacity of 20Mb/s, the bandwidth of the channel is 4MHz. What signal-to-noise ratio is required to achieve this capacity?

Answer:

$C = B \log_2 (1 + SNR)$

$20Mb/s = 4MHz \log_2 (1 + SNR)$

$5 = \log_2 (1 + SNR)$

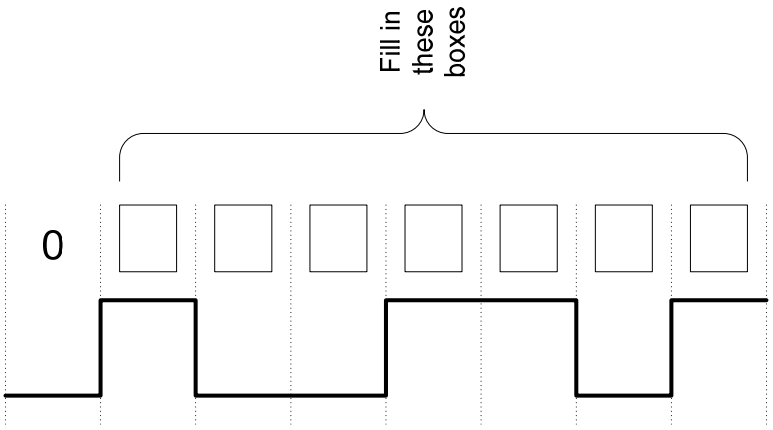
$1 + SNR = 2^5$

$SNR = 31$

(and in dB, $SNR_{dB} = 10 \log_{10} (31) = 14.9dB$)

Question 4 [2 marks]

If the **Non-Return-to-Zero Invert on ones (NRZI)** encoding scheme is used, complete the bit pattern that the following signal represents. (That is, fill in the boxes).



Answer: 1101011