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# COMP90007 Internet Technologies

## Week 4 Workshop

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Semester 2, 2019

# Question 1 (Sampling)

- Consider a telephone signal that is bandwidth limited to 4 kHz.
  - (a) At what rate should you sample the signal so that you can completely reconstruct the signal?
  - (b) If each sample of the signal is to be encoded at 256 levels, how many bits/symbol are required for each sample?
  - (c) What is the minimum bit rate required to transmit this signal?

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## Question 2 (Sampling)

- Is the Sampling theorem true for optical fibre or only for copper wire?

## Question 3 (Max Data Rate)

- Given a noiseless 4 kHz channel, what is the maximum data rate of the communications channel?

## Question 4 (Max Data Rate)

- The bandwidth of a television video stream is 6 MHz. How many bits/sec are sent if four-level digital signals are used? Assume a noiseless channel.

## Question 4 (Max Data Rate)

- The bandwidth of a television video stream is 6 MHz. How many bits/sec are sent if four-level digital signals are used? Now assume a S/N of 20db.

# Question 5

The following character encoding is used in a data link protocol:

A: 01000111

B: 11100011

FLAG: 01111110

ESC: 11100000

Show the bit sequence transmitted (in binary) for the four-character frame payload *A B ESC FLAG*, when each of the following framing methods are used:

- (a) Character count
- (b) Flag bytes with byte stuffing
- (c) Starting and ending flag bytes, with bit stuffing

## Question 6

The following data fragment occurs in the middle of a data stream for which the byte-stuffing algorithm as described in the lecture is used:

*A B ESC C ESC FLAG FLAG D.*

What is the output after stuffing?