Homework 4 - Joshua Gould

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Contents

Problem 1

A Pulse code modulation (PCM) signal is a binary signal. The digital PCM is converted from an analog signal. The bandwidth of the analog signal is 1kHz. To convert the analog signal to the digital signal, the voltage of each sampling point is divided into 8 levels.

Problem 1a

What is the baud (symbol rate) for this PCM signal?

```
clc
B = 1; %kHz
n = 3;
L = 2^n;
SR = 2*B;
fprintf('Baud (symbol rate) = %f kHz',SR)
```

```
Baud (symbol rate) = 2.000000 kHz
```

Problem 1b

What is the bit rate for this PCM signal?

```
BR = SR;
fprintf('\nBit rate = %f kHz',BR)
```

```
Bit rate = 2.000000 kHz
```

Problem 1c

What is the minimum bandwidth for a communication system to transmit this PCM signal (in unit of kHz)?

```
MinB = SR/2;
fprintf('\nMinimum Bandwidth for a communication system = %f kHz',MinB)
```

```
Minimum Bandwidth for a communication system = 1.000000 kHz
```

Problem 2 - Textbook 3-21

A multilevel digital communication system sends one of 16 possible levels over the channel every 0.8ms

```
clc
fqs = 0.8; %ms
n = 4;
L = 2^n;
```

Problem 2a

What is the number of bits corresponding to each level ? Or in another word, how many bits in each symbol? Note that the levels in this problem are different from the levels in the last problem. In the last problem, levels are from analog to digital conversion, while in this problem, the digital signal itself is a multilevel signal.

```
R = L*fqs;
fprintf('Number of bits per level = %f bits',R)
```

```
Number of bits per level = 12.800000 bits
```

Problem 2b

What is the baud (symbol rate)?

```
SR = 1/fqs;
fprintf('\nBaud (symbol rate) = %f kHz',SR)
```

```
Baud (symbol rate) = 1.250000 kHz
```

Problem 2c

What is the bit rate?

```
BR = L*fqs;
fprintf('\nBit rate = %f kHz',BR)
```

```
Bit rate = 12.800000 kHz
```

Problem 3

The input of a differential coding signal is 10110010. Begin with the % reference digit “1”, what is the en coded sequence? In your solution, please label, which digit is reference digit, which digits are encoded sequence.

```
clc
Refsignal = 10110010;
Enc = 00101011;
fprintf('Encoded Signal = 00101011 with reference digit highlighted')
```

```
Encoded Signal = 00101011 with reference digit highlighted
```

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