

ASSIGNMENT 1 SOLUTIONS

Q.1

Each answer is different.

Example for A00123456:

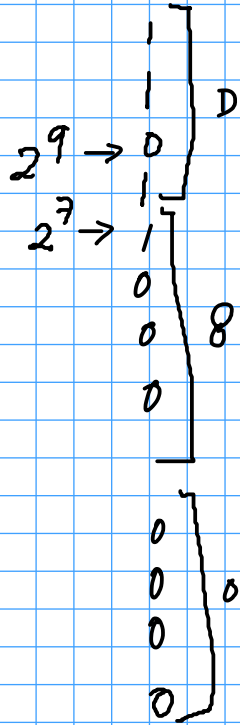
Last 4 characters: '3456'

In network (msbit first):

binary \rightarrow 0000110110000000
hex \rightarrow 0₁₀ 13₁₀ 8₁₀ 0₁₀
0₁₆ D₁₆ 8₁₆ 0₁₆

Convert to binary:

3456
2048 = 2^{11}
1408
1024 = 2^{10}
384
256 = 2^8
128
128 = 2^7
0



With bytes in Little-endian order:

80 0D

in binary:

1000 0000 0000 1101

with bits in each byte ls bit first:

00000001 10110000
01 B0

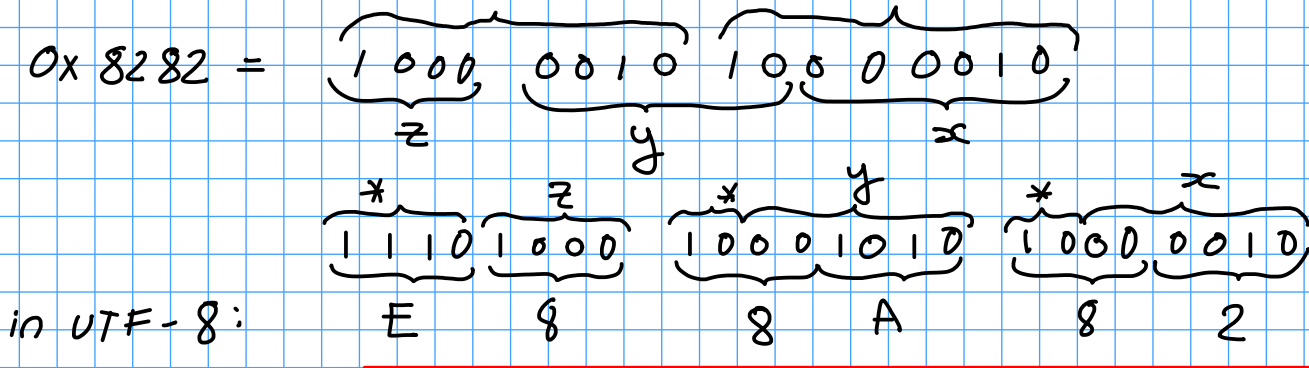
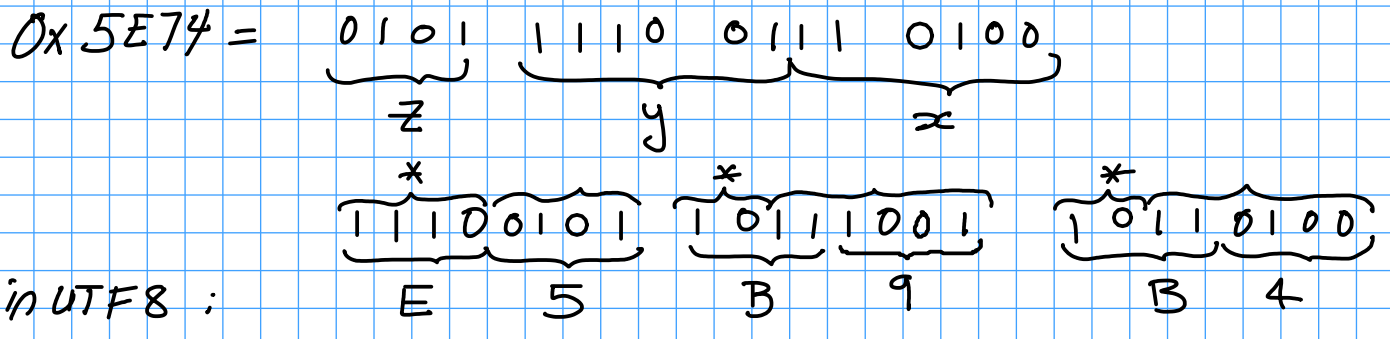
Q.2

From the Unicode standard on
unicode.org:

GREEK CAPITAL LETTER OMEGA = 0x3A9

Q.3

Both values are encoded using the rules in the third line of the table because both are $> 0x07FF$.



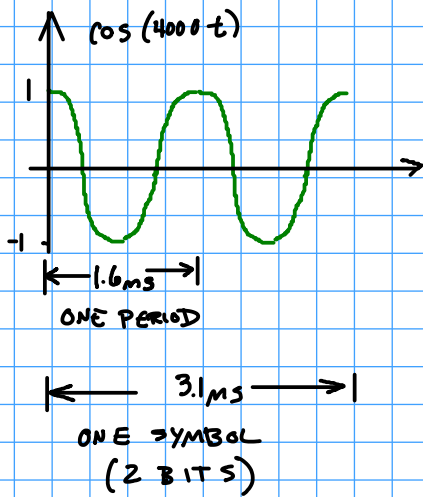
* = defined by UTF-8 encoding rules

Q.4

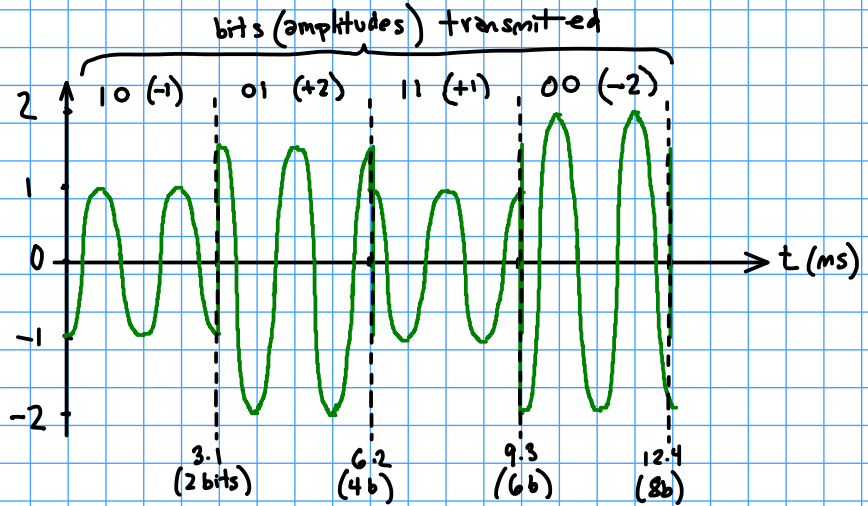
THE FOUR WAVEFORMS DIFFER ONLY IN AMPLITUDE: ± 1 AND ± 2
PERIOD: $\cos(2\pi ft) = \cos(4000t)$ SO $2\pi f = 4000$

$$f = \frac{4000}{2\pi}, \text{ period} = \frac{1}{f} = \frac{2\pi}{4000} \approx 1.6 \times 10^{-3} = 1.6 \text{ ms}$$

ONE SYMBOL
(AMPLITUDE = +1)



MESSAGE
(4 SYMBOLS)



Q.5

information from message = $-\log_2$ (Probability of that message)

$$\begin{array}{r} \text{total messages} = 435 \quad \text{Home} \\ + 109 \quad \text{Work} \\ + 56 \quad \text{Out} \\ \hline 600 \end{array}$$

$$H(\text{Home}) = -\log_2 \left(\frac{435}{600} \right) = 0.46 \text{ bits/message}$$

$$H(\text{Work}) = -\log_2 \left(\frac{109}{600} \right) = 2.5 \text{ bits/message}$$

$$H(\text{Out}) = -\log_2 \left(\frac{56}{600} \right) = 3.4 \text{ bits/message}$$

↑
information

Q.6

Symbol rate = pulse rate (each pulse is a symbol)

$$\frac{1}{2\mu s} = 500 \text{ kHz}$$

[source] data rate = source bit rate

$$= \frac{8 \text{ data pulses}}{10 \text{ transmitted pulses}} \times 3 \text{ bits/pulse} \times 500 \frac{\text{K pulses}}{\text{sec}}$$

$$= 0.8 \times 1.5 \text{ Mb/s} = 1.2 \text{ Mb/s}$$

baud rate = max. transitions/second

= symbol rate (one transition per pulse)

$$= 500 \text{ kHz}$$

throughput = data rate at receiver

= data rate (if no errors) = 1.2 Mb/s

Q.7

<u>voltage level</u>	<u>nearest signal level</u>	<u>bits</u>
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+3

+3

101

-5

-5

001

+3

+3

101

+7.25

+7

111

+6

could be → +5
either → +3

110 } either choice
101 } equally good

bits transmitted = 10100110111110

OR 10100110111101