ELEX 3525 Quiz 1 **Paper, Test 1** A00123456 (0)

Show your work and underline your final answer. Numeric answers must include units. Books, notes and calculators allowed. No other electronic devices allowed.

1. (a) A 'scope uses 10 bits to quantize each sample. For a typical waveform, what is the approximate quantization SNR?

B = 10

quantization SNR $\simeq$ 6B dB = $6 \cdot 10 =$ 60 dB

(b) The 'scope can sample at up to 1 GHz. What is the maximum frequency of an input signal that could be accurately sampled?

$f_s \geq 2 \cdot f_{max}$ $\quad$ 1 GHz $\geq 2\, f_{max}$

$f_s = 1$ GHz $\quad$ $f_{max} \leq$ 500 MHz

2. What sequence of bits would be transmitted if the 16-bit value 0x4321 were to be transmitted in little-endian order, most-significant-bit first?

0x4321

m.s. byte, l.s. byte

little endian order: 0x21, 0x43

in binary: 0010 0001, 0100 0011

l.s. bit first: 1000 0100 $\quad$ 1100 0010

3. What sequence of bytes would be used to encode the Russian (Cyrillic) character з ("ze") which has a Unicode code point of U+437 (hex 0x437) ?

0x437 = 100 0011 0111 (11 non-zero bits)

Scalar Value	First Byte	Second Byte	Third Byte
00000000 0xxxxxxx	0xxxxxxx		
00000yyy yyxxxxxx	110yyyyy	10xxxxxx	
zzzzyyyy yyxxxxxx	1110zzzz	10yyyyyy	10xxxxxx

← encode using this row

100 0011 0111 → 110 10000 $\quad$ 10 11 0111

y x $\quad$ first byte $\quad$ second byte

= 0xd0 $\quad$ = 0xb7

0xd0, 0xb7

Show your work and underline your final answer. Numeric answers must include units. Books, notes and calculators allowed. No other electronic devices allowed.

1. (a) A 'scope uses 8 bits to quantize each sample. For a typical waveform, what is the approximate quantization SNR?

$B = 8$

quantization $SNR \simeq 6B\ dB = 6 \cdot 8 = \underline{48\ dB}$

(b) The 'scope can sample at up to 2 GHz. What is the maximum frequency of an input signal that could be accurately sampled?

$f_s \geq 2 \cdot f_{max}$ $\quad 2\ GHz \geq 2\ f_{max}$

$f_s = 2\ GHz$ $\quad \underline{f_{max} \leq 1\ GHz}$

2. What sequence of bits would be transmitted if the 16-bit value 0x1234 were to be transmitted in little-endian order, most-significant-bit first?

0x 12 34

m.s. byte ↖ l.s. byte

little endian order: 0x34, 0x12

in binary: 0011 0100, 0001 0010

m.s. bit first: $\underline{0011\ 0100, 0001\ 0010}$

3. What sequence of bytes would be used to encode the Russian (Cyrillic) character д ("de") which has a Unicode code point of U+434 (hex 0x434) ?

0x434 = $\underline{0100\ 0011\ 0100}$ (11 non-zero bits)

Scalar Value	First Byte	Second Byte	Third Byte
00000000 0xxxxxxx	0xxxxxxx		
00000yyy yyxxxxxx	110yyyyy	10xxxxxx	
zzzzyyyy yyxxxxxx	1110zzzz	10yyyyyy	10xxxxxx

encode using this row ←

100 0011 0100

y x

prefix

$\underline{110\ 10000}$ $\quad \underline{10\ 11\ 0100}$

first byte $\quad$ second byte

$= 0xd0$ $\quad = 0xb4$

$\underline{0xd0, 0xb4}$