ELEX 2117 Quiz 3 **Paper, Test 1** A00123456 (0)

Show your calculations. Underline or draw a box around your final answer.

1. A memory system uses 16-bit words. The addresses range from `0x0000` to `0x8000`. How many bytes does this memory hold? How many words? Give two answers as decimal (base 10) numbers.

OR $0x8000 - 0x0000 + 1 = 0x8001 = 32769$ bytes

$$\begin{array}{r} 7fff \\ -\ 0000 \\ +\ \quad 1 \\ \hline 0x8000 \text{ bytes} \end{array} = \boxed{32768 \text{ bytes}}$$

16 bits = 2 bytes/word

$\boxed{16384 \text{ words}}$

2. Each IC in a memory holds `0x2000` words. What is the width, in bits, of each IC's address bus?

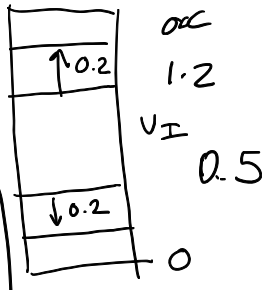
$\log_2 0x2000 = \log_2 8192 = \boxed{13 \text{ bits}}$

3. What type(s) of simulations – *timing* or *functional* or neither – could be done *before* a design was routed? Your answer should be zero, one or two words. Marks will be awarded/deducted for correct/incorrect choices.

$\boxed{\text{functional}}$ (timing simulation requires delays which are only available after routing)

4. A logic family has $V_{IL(max)} = 0.5$ V and $V_{IH(min)} = 1.2$ V. Compute V_{OL} and what V_{OH} that will provide a 0.2 V noise margin for high and low levels. Label each answer and state whether it is a maximum or minimum (e.g. $V_{OH(max)} = 5.2\ V$)

$\boxed{V_{OH(min)} = 1.2 + 0.2 = 1.4}$



oc
1.2
V_I
0.5
0

$\boxed{V_{OL(max)} = 0.5 - 0.2 = 0.3}$

Show your calculations. Underline or draw a box around your final answer.

1. A memory system uses 16-bit words. The addresses range from **`0x0000`** to **`0x4000`**. How many bytes does this memory hold? How many words? Give two answers as decimal (base 10) numbers.

0x3fff
− 0x0000
+ 1
0x4000 = 16384 bytes = 16384 / 2 = 8192 words

2. Each IC in a memory holds **`0x1000`** words. What is the width, in bits, of each IC's address bus?

$\log_2 0x1000 = \log_2 4096 =$ 12 bits

3. What type(s) of simulations – *timing* or *functional* or neither – could be done *before* a design was routed? Your answer should be zero, one or two words. Marks will be awarded/deducted for correct/incorrect choices.

functional (see above)

4. A logic family has $V_{\texttt{IL(max)}} = 0.5$ V and $V_{\texttt{IH(min)}} = 1.2$ V. Compute $V_{\texttt{OL}}$ and what $V_{\texttt{OH}}$ that will provide a 0.3 V noise margin for high and low levels. Label each answer and state whether it is a maximum or minimum (e.g. $V_{\texttt{OH(max)}} = 5.2\ V$)

$V_{OH}(min) = 1.2 + 0.3 = 1.5\ V$

1.5 ↓ 0.3 1.2

$V_{OL}(max) = 0.5 - 0.3 = 0.2\ V$

0.3 ↑ 0.5