Design Engineering – DE 1.3 Electronics

Problem Sheet 5 (Topics 12 - 13)

Key: [A] = easy ...... [E] = hard

1.   [A] How many different symbols can be represented with 4 bits?

2.   [A] In a data transmission system the set of possible symbols is:

{lower-case alphabet} U {upper-case alphabet} U {space, comma, full-stop}

where 'U' denotes the 'union' of two sets. How many bits of information are needed for each symbol?

3.   [B] In the above data transmission system the maximum transmission rate is 9600 bits per second. How long, in seconds, would it take to transmit the message:

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4.   [A] Convert the following decimal numbers into binary. Do not use a calculator.

a) 5   b)   99   c)   1024

5.   [A] Convert the following binary numbers into decimal. Do not use a calculator.

a) 1010   b)   10000000   c)   11111111

6.   [A] Convert the following decimal numbers into hexadecimal. Do not use a calculator.

a)   64   b)   98

7.   [A] Convert the following hex numbers into binary directly without first converting them to decimal. Do not use a calculator.

a) F8   b)   144

8.   [B] Perform the following binary arithmetic:

a) 00110111 + 00110010   b)   1100 + 0100

c) 00110100 - 00001010   d)   0010 – 0111

9.   [A] Give the ASCII code for the letters U and k in both binary a hex representations.

10. [B] Determine the output waveform of the 3-input AND gate as shown below.
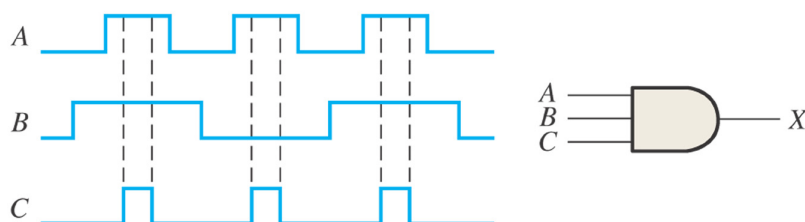
11. [B] Write out the truth table for the function $S = A \cdot B + C \cdot D$.

12. [A] For a 8k x 8 bit RAM chip, how many address and data pins are there?

13. [A] What is the purpose of the Program Counter in a microprocessor?

14. [A] What is the difference between a microprocessor and a microcontroller?