

## Assignment 4

Due Monday, November 25.

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### Question 1

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Review the datasheet for the Bel Fuse model 08B0-1X1T-01-F RJ-45 jack with integrated isolation transformer (“magnetics”) available on the course web page (under Content/Datasheets).

What is the:

1. impedance ratio?
2. voltage ratio?
3. maximum voltage between primary and secondary windings<sup>1</sup>?
4. common-mode to differential-mode rejection ratio at 100 MHz?
5. depth of the LED and signal pins below the bottom surface of the connector?
6. colour of the orange/green LED when pin 9 is positive (high) and pin 10 is negative (low)?
7. prices<sup>2</sup> in quantities of 1 and 1000 (specify the distributor)?

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### Question 2

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You are using an open-collector bus whose capacitance to ground is 100pF. What is the maximum resistance of the pull-up resistor if the RC time constant is to be less than 1  $\mu$ s? Assuming the pull-up voltage is 5 V, that the circuit is constantly pulled low (to 0V), and a cost of electricity of \$0.15 per kilowatt-hour, how much will the electricity consumed by this pull-up resistor cost over a period of 10 years?

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### Question 3

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Draw the output of a 4B5B encoder for an input of 0x0F (see Table 24-1 on page 188 of IEEE Standard 802.3-2008. Table 24-1 is available on the course web

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<sup>1</sup>The term Hi-Pot stands for “High Potential” and is the maximum voltage to which insulation is tested.

<sup>2</sup>You will have to go to the manufacturer’s web site, find a (US) distributor and look up the prices on the distributor’s web site.

page under Content/Standards. The full 802.3-2008 standard is available from: [IEEE 802.3 Standards](#).

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### Question 4

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HDLC (Hierarchical Data Link Control) framing is used by many legacy<sup>3</sup> protocols. One example is the signalling format used by fax machines. An HDLC frame to request retransmission of the previous page (RTN for “Re-Train Negative”) would consist of an HDLC frame consisting of:

1. an 8-bit address field with value 0xFF
2. an 8-bit control field with value 0xC0
3. an 8-bit information field with value 0x33
4. a 16-bit CRC field with value 0x07C6 (not necessarily the correct value)

Write out the values of the bits making up the HDLC frame including start and end flags and stuffed bits.

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<sup>3</sup>“Legacy” means a protocol that has largely been superseded but is still in use and supported.