

BE1010 – Fall 2004

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Quiz # 6 (15 minutes. Open book & course webpage)

Choose only one problem and solve!

- I. (10 points) What is the resistance of a Lego temperature sensor at room temperature (72°F)?

$$^{\circ}\text{C} = (^{\circ}\text{F}-32) \times (5/9) = (72-32) \times (5/9) = 22.22^{\circ}\text{C}$$

$$R_{\text{aw}} = 785 - [(^{\circ}\text{C}) \times 8] = 785 - [22.22 \times 8] = 785 - 177.77 = 607.22$$

$$R_{\text{sensor}} = [10,000 \times R_{\text{aw}}]/[1023-R_{\text{aw}}] = [10,000 \times 607.22]/[1023-607.22] = 14,608\Omega$$

- II. (10 points) The 1250 RPM limit on the rotation speed of a Lego rotation sensor can be derived from the fact that the rotation sensor increments 16 times in one turn and that the RCX reads its sensor value once every 3msec. Do the math to derive the 1250 rpm limit.

$$3\text{msec}=0.003\text{sec}$$

$$(0.003\text{sec/measurement}) \times (16 \text{ measurements/revolution}) = 0.048 \text{ sec/revolution}$$

$$\text{We want revolutions per MINUTE. So: } [60\text{sec/min}]/[0.048\text{sec/rev}] = 1250 \text{ rev/min(RPM)}$$

(2 bonus points) What can you say about the usefulness of the RCX sensor reading of a rotation sensor, which is driven at 1300 RPM?

Being that the sensor will be rotating faster than the sampling limit, there will be missed counts and the sensor will become less accurate. However the loss of accuracy is not extremely large and therefore it is still useful for a variety of applications where perfect accuracy is unnecessary.