

Physics 261  
Homework # 2

1. Faissler, problem 3-2.
2. Faissler, problem 3-4.
3. The textbook unfortunately puts two different currents simultaneously through  $R_2$  in problem 3-5.<sup>1</sup> Please rectify Faissler's blunder by crossing out  $I_3$ , and let  $I_2$  represent the total current through  $R_2$ .
  - (a) Now write the KVL equations for loops 1 and 2 accordingly.
  - (b) Also write the KVL equation for "loop 3", which Faissler has not drawn; it runs around the outside of the entire circuit. Is this really a new equation, or could you have obtained it by combining the equations from loops 1 and 2?
  - (c) Write KCL for nodes 1 and 2. Are these two independent equations, or are they equivalent?
  - (d) Assuming that the voltages and resistances are known, how many unique equations and how many unknowns are there in this problem?
4. A light bulb of resistance  $R$  is placed in series with a 3 V battery and a  $1\ \Omega$  resistor.
  - (a) Show that the power dissipated *in the bulb* is

$$P = \frac{V^2 R}{(R + 1\ \Omega)^2}$$

- (b) Choose the resistance,  $R$ , of the bulb to maximize  $P$ .

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<sup>1</sup>The example given in the chapter (fig. 3-11) is set up the same way. This is confusing but not strictly wrong: Faissler wants the total current through  $R_2$  to be thought of as  $I_2 - I_3$ . However, no clear motivation is supplied for this peculiar choice. Faissler is probably thinking of Mesh Current Analysis (Chapter 5), in which the current in a circuit element may be broken out into two components associated with adjoining loops. But that concept belongs in a later chapter.