HONR238W Homework # 3 –
Due Monday, May 6, 2013

Homeworks will be posted on the web at http://www.astro.umd.edu/~hamilton/HONR238W/. You are welcome to work together on the problems, but try them on your own first for practice, and write them up in your own words. I will have homeworks graded and back to you within a week.

1. Lightbulbs. Three new 100W incandescent lighbulbs in your house are used for 4 hours/day, 2 hours/day, and 30 minute/day with electricity costs of $16, $8, and $2 annually. The old bulbs will live for 2.5 years and cost just 25 cents/bulb to replace. Compact 100W fluorescent bulbs cost $2 each, use about 25% as much energy as incandescent bulbs, and will last for 10 years. Calculate your costs over 10 years for each of the following strategies:
a) Replace all incandescent bulbs with new incandescent bulbs when they burn out.
b) Replace all incandescent bulbs with fluorescent bulbs when they burn out.
c) Replace the high-use bulb with a fluorescent bulb now and the others with fluorescent bulbs when they burn out.
d) Replace all incandescent bulbs with fluorescent bulbs now.

2. Refrigerators. Assume that all of these units are equally in size and convenience. Your refrigerator just died and you are considering two new models. The first is a very energy efficient model that costs $700 and uses $60 of electricity annually. The second is the cheapest model, costing just $400 but using $120 of electricity annually.
a) Calculate the total costs of owning and operating each fridge for its 15-year lifetime. After how many years are your costs equal?
b) Your current fridge originally cost $1000 and uses $180 of electricity per year. If it will actually survive for another three years, should you buy a new one now or wait?
c) If you want a second fridge that will only be used two months a year around the holidays, what is the best strategy? As in b), assume that your current fridge could last a total of three more years. Should you buy one or two new fridges? Which one(s)?

The numbers used above are pretty representative, although it is never easy to predict how long a device will last. CFC lightbulbs are subsidized by power companies and actually can be purchased for significantly less than $1 each. If you are considering replacing a working fridge, use one of those power-measuring devices to calculate its energy usage to determine if it cost effective to replace it. The most efficient refrigerators are freezer-on-bottom models, followed by freezer-on-top models and finally side-by-side models. Adding ice makers and chilled water dispensers dramatically drive up both the cost of a new refrigerator and its overall energy usage.