Order-of-Magnitude Physics – Problem Set 1

Guidelines:

- If a question is ill-defined, it is your responsibility to quantify it.
- Please cite any resources used. If you get the information off the web, cite the website.

Problem 1. Put Your Money Where Your Mouth Is

Estimate the sizes (in dollars) of the following industries in the United States:

- K–12 Education
- Entertainment (excluding sports)
- Sports
- Restaurant

Problem 2. Astronomy Job Market

What percentage of people who graduate with Ph.D.s in astrophysics take up faculty positions in one of the top 10 largest (as judged by the size of the school's astronomy budget) research universities in the United States?

Problem 3. Thalassaemia

As reported by Judith Tan of Singapore's Straits Times, Dec 7 2005:

Thalassaemia is an inherited blood disorder. Those who have thalassaemia-major have a shortage of hemoglobin and need a blood transfusion every month to stay alive. Victims do not live past childhood unless they receive a bone marrow transplant.

Those who have thalassaemia-minor carry the gene but do not express it. They can pass the gene to their children but otherwise lead normal lives. The rules for passing the gene are the usual ones: if both parents have thalassaemia-minor, their children have a 25% chance of having thalassaemia-major, a 50% chance of having thalassaemia-minor and a 25% chance of not carrying the gene at all. If only 1 parent has thalassaemia-minor, offspring have a 50% chance of having thalassaemia-minor and 50% chance of not carrying the gene at all.

Worldwide, about 10^5 children are born each year with thalassaemia-major.

What is the probability that you have thalassaemia-minor?

Problem 4. Bailing Out the Big Three

Justify the size of the bailout package promised to United States automakers in 2008.

Problem 5. Ask Your Own Question

Ask an OOM question of your own. You don't have to answer it.