Problem 1. Graviton production in PYTHIA. Consider the production of RS gravitons at the LHC (process number 391-395 in PYTHIA) and contrast with the production of a $Z'$ resonance of the same mass.

(a) How would you distinguish the two scenarios?
(b) Use PYTHIA to make a plot illustrating your answer from (a).

Problem 2. Online SUSY spectrum calculators. We have learned to use PYTHIA, but both its treatment of the sparticle spectrum and its SUSY model menu are inferior to other existing programs.

(a) Use the tool at

http://kraml.home.cern.ch/kraml/comparison/compare.html

to compare SUSY mass spectra calculated by different programs. How well do the four programs agree?

(b) Now run the MSUGRA option in PYTHIA. How well does PYTHIA agree with the other programs?

(c) Notice that the relic density of the lightest neutralino is among the quoted results in part (a). Change the MSUGRA input parameters until you find a point with the correct relic density ($\Omega h^2 \sim 0.1$).

(d) Check out yet another tool (developed at the University of Florida)

http://www.phys.ufl.edu/supersim/

which allows you to run PYTHIA, ISAJET and HERWIG online. Play with it for at least 5 min. If you have any ideas or suggestions on improving the functionality of the website, please send me an e-mail.