Assignment #2: Bell's Inequalities (due Lec #5)

1. In the experimental situation described in part II of handout #1, it is possible to set up the particle generator in such a way, and to choose values a and b for θ_1 and values c and d for θ_2 in such a way, that the following facts obtain:

When θ_1 = a and θ_2 = c, particles 1 and 2 sometimes both go up.

When θ_1 = a and θ_2 = d, particles 1 and 2 never both go up.

When θ_1 = b and θ_2 = c, particles 1 and 2 never both go up.

When θ_1 = b and θ_2 = d, particles 1 and 2 never both go down.

Explain, informally but clearly, why these facts are paradoxical in much the same way as are the statistics that exhibit the violations of Bell's Inequalities.

2. One quite commonly encounters something like the following opinion about the experimental violations of Bell's Inequalities, and what their import is: "What these violations show—indeed, *all* that they show—is that no deterministic hidden-variables reconstruction of the predictions of quantum mechanics is possible. So much the better for quantum mechanics!"

Evaluate this opinion, as follows: First explain what a deterministic hidden-variables reconstruction of the predictions of quantum mechanics would be. Then answer these questions: Do the experimental violations of Bell's Inequalities show that no such reconstruction is possible? Is that *all* that they show? Of course, don't just answer "yes" or "no"; spend some time justifying your answers!