You may work in pairs or purely individually for this assignment. Prepare your answers to the following questions <u>in a plain ASCII text file or MS Word document</u>. Submit your file to the Curator system by the posted deadline for this assignment. No late submissions will be accepted. If you work in pairs, list the names and email PIDs of both members at the beginning of the file, and submit your solution under only one PID. No other formats will be graded.

For this assignment, you may (and are encouraged to) work in pairs; if you do so, you must also write your solutions in such a way that it is clear how each member contributed to deriving the solution.

You will submit your answers to the Curator System (<u>www.cs.vt.edu/curator</u>) under the heading `OOC07`.

As you might expect, the problems below may be tricky, and so you should consider them carefully. You should apply some of the concepts covered in the discussion of probability in class. You may also experiment; in fact, that may be useful. You must present your analyses carefully and state your conclusions clearly.

1. [100 points] Your kindly Computer Science instructor summons you to his office. When you arrive, he shows you three boxes, each with a hole in the top through which you can insert your hand. He tells you that each box contains two valuable gems; one box contains two diamonds, one contains two emeralds, and one contains one diamond and one emerald. Of course, there is no way to see what is in any of the boxes.

    You are asked to choose a box. After you have chosen your box, your kindly Computer Science instructor reaches into it and removes one gem; you immediately notice that it is a diamond. Your kindly Computer Science instructor then tells you that you may have both gems from that box if you can correctly answer the question: what is the probability that the other gem in that box is also a diamond. What should you say? Justify your conclusion.

The following two questions will be treated as extra credit work. Each will be weighted 1%.

EC1. [25 points] You have been selected to appear on a game show and you're given the choice of three doors (and will win what is behind the chosen door). Behind one door is a car; behind the others, goats. The car and the goats were placed randomly behind the doors before the show. The rules of the game show are as follows:

    After you have chosen a door, the door remains closed for the time being.

    The game show host, who knows what is behind the doors, now has to open one of the two remaining doors, and the door he opens must have a goat behind it. If both remaining doors have goats behind them, he chooses one (uniformly) at random.

    After opening a door with a goat, the host will ask you to decide whether you want to stay with your first choice or to switch to the last remaining door. Imagine that you chose Door 1 and the host opens Door 3, which has a goat. She then
    asks you "Do you want to switch to Door Number 2?"

    The host opens a door with a goat. Is it to your advantage to change your choice? Justify your conclusion.

EC2. [25 points] You have been selected to appear on a game show and you're given the choice of three doors (and will win what is behind the chosen door). Behind one door is a car; behind the others, goats. The car and the goats were placed randomly behind the doors before the show. The rules of the game show are as follows:

    After you have chosen a door, the door remains closed for the time being.

    The game show host, who knows what is behind the doors, now has to open one of the two remaining doors. The host chooses one of the two remaining doors (uniformly) at random, and opens it. If there is car behind that door, the game is over (you lose).

    If she opens a door with a goat, the host will ask you to decide whether you want to stay with your first choice or to switch to the last remaining door. Imagine that you chose Door 1 and the host opens Door 3, which has a goat. She then asks you "Do you want to switch to Door Number 2?"

    The host opens a door with a goat. Is it to your advantage to change your choice? Justify your conclusion.