

COMPUTER SCIENCE 20, SPRING 2012  
DISCRETE MATHEMATICS FOR COMPUTER SCIENCE

Class #26 (Bayes Theorem)

**Homework, due in hard copy Friday 4/13/2012 at 10:10am**

**Please write your TF's name on your homework, and list the names of any students with whom you collaborated.**

1. A student in Monty Hall's probability course falls ill on the Thursday before spring break and has to fly to Florida for emergency medical care. On returning to Cambridge, he arrives in Prof. Hall's office, doctor's note in hand. Prof. Hall invites him to choose one of five envelopes, two containing easy makeup exams, three containing hard ones, and the student takes an envelope.

"Before you start, you might enjoy looking at one of my hard makeup exams – just full of nasty probability problems," says the professor. From among the four remaining envelopes, he selects at random one that he knows to contain a hard exam and opens it.

"Excuse me," says the savvy student, "but the envelope I picked looks a bit smudged. Could I swap it for one of the others?" And he does.

What is the probability that the student has an easy exam after making the swap? \*

2. Sally has a genetic disease which is passed onto her children independently and with probability  $1/2$  (assume there is no way to get this disease other than from one's mother). Sally has one daughter, Miriam. So Miriam has the disease with probability  $1/2$ . What is the conditional probability that Miriam has the disease in the following cases?

(a) Miriam has one child, who does not have the disease.

(b) Miriam has one child with the disease and one child without the disease.

\* Credit: Paul Bamberg / Fun and Games with Discrete Mathematics