18.600 Recitation 2

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Problem 1. Pick a card at random from a deck of cards. Let A be the event that the card is red. Let B be the event that the card is hearts or spades. Let C be the event that the card is hearts or clubs. Are the events A, B, and C mutually independent? Are they pairwise independent?

Problem 2. There are n students living in a dorm at MIT. After an exhausting exam in 18.600, the students all return to the dorm in a state of bleary-eyed confusion, and each independently at random chooses one of the n dorm rooms and goes to sleep. (More than one student may end up in the same room.) What is the probability that no one ends up in their own room?

Problem 3. Here is a question asked on Wall Street job interviews. (This is the original formulation; the macabre tone is not unusual for such interviews.)

"Lets play a game of Russian roulette. You are tied to your chair. Heres a gun, a revolver. Heres the barrel of the gun, six chambers, all empty. Now watch me as I put two bullets into the barrel, into two adjacent chambers. I close the barrel and spin it. I put a gun to your head and pull the trigger. Click. Lucky you! Now Im going to pull the trigger one more time. Which would you prefer: that I spin the barrel first or that I just pull the trigger?

Problem 4. An insurance company classifies people as either "high risk", "medium risk", or "low risk". The probability that a person of high, medium, and low risk, respectively, is involved in an accident in a given year is 50%, 15%, and 5%. The probability that a randomly chosen person is of high, medium, and low risk, respectively, is 20%, 30%, and 50%.

(a) What is the probability that a randomly chosen person had an accident in a given year?

(b) Given that a person had an accident, what is the probability that they are person of high risk?

Problem 5. Suppose 8 percent of men and 0.5 percent of women are colorblind. A colorblind person is chosen at random. What is the probability of this person being male? Assume that there are an equal number of males and females. What if the population consisted of twice as many males as females?

Optional Problem. A new employee checks the hats of n people at a restaurant, forgetting to put claim check numbers on the hats. When customers return for their hats, the checker gives them back hats chosen at random from the remaining hats. What is the probability that no one receives the correct hat?