

**Math 431 First Evening Exam**  
Version B

Room B123, 5:00pm - 6:00pm, October 8, 2004  
Márton Balázs

**NAME:**

1. (35 points) In my neighborhood, 70% of the residents have a car, 60% have bicycle, but 10% don't have car nor bicycle. What percentage of the residents have both car and bicycle?

**2.** (35 points) It turns out that my friend and I are boarding on the same plane. We are both travelling on economy class, and this plane has 15 single and 15 double (a total of 45) economy seats. Assuming the seat assignments happened completely randomly, what is the probability that I will sit next to my friend on a double seat?

**3.** I have 36 spokes on each wheel of my bike. On a long trip, assume that each spoke breaks independently of any other, with probability 0.002. I have to interrupt my journey if I have more than one spoke broken on any of my wheels (but I can continue with one spoke broken on the front wheel and one on the rear wheel).

- (a) (20 points) What is the probability that I will have at most one broken spoke on my front wheel during the journey?
- (b) (20 points) What is the probability that I have to interrupt my journey?

4. 1% of the population has an illness which is tested with 90% accuracy for ill people, and 95% accuracy for healthy people.

- (a) (25 points) Given that I test positive, what is the probability that I'm ill?
- (b) (25 points) After my first, positive test they repeat it. What is the probability that it comes out again positive?
- (c) (**Bonus question**, only try when all other problems are solved, additional 5 points) After  $n$  tests, all resulting positive, what is the probability that I'm ill? What is the limit of this formula as  $n \rightarrow \infty$ ?