

**Probability 201-1-2391 ASSIGNMENT 10**  
**Inequalities and limit laws**  
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**Problem 1**

The number of people that arrive at the bank branch per day is distributed Poisson,  $P(100)$ . Give an estimate for the probability that tomorrow less than 121 people will arrive at this bank branch and more than 79. Use Chebyshev's inequality.  $p(79 < X < 121) = 341/441$ .

**Problem 2**

A balanced coin is tossed 280 times. Let  $X$  be the number of H's in the first 200 tosses, and let  $Y$  be the number of H's in the last 80 tosses. Prove that:

$$p(X \leq Y + 50) \leq \frac{7}{20}.$$

**Problem 3**

We want to prepare a sample in order to know what is the proportion of people with blue eyes in the total population. Determine using Chebyshev's inequality the size of the sample to be taken if we want that in probability greater than or equals to 0.9 the experimental proportion of the blue eyes people to be within 0.01 away (at most) from the actual proportion.  $n \geq 25000$ .

**Problem 4**

There are 80 stair steps in the building leading up to the roof. At each stage a man throws a dice and climbs a number of steps which equals to the number shown on the face of the dice (except maybe at the end of the stairs). He can do that at most 20 times. Give an estimate using Chebyshev's inequality to the probability that the man will make it to the roof.  $P(X \geq 80) \leq 7/24$ .

### Problem 5

Give an estimate, using normal approximation, to the probability that in a 1000 tosses of a coin with a probability 0.2 for an H, we will get at least 180 H's.  $P(Y \geq 179.5) = 1 - \Phi(-20.5/\sqrt{160}) = 0.9747$ .

### Problem 6

Solve problem 3 above again, using the normal approximation.  $P \geq 0.95$ .