

## MATH 133 PROBLEM SET 4

IGOR RIVIN, 426 WACHMAN HALL, 1X5010, RIVIN@MATH.TEMPLE.EDU

ABSTRACT. Due Monday, February 27

**Question 1.** Consider the numbers from 1 to 1000. How many of these numbers are divisible by either 7, or 11, or 13?

**Question 2.** Let  $\alpha > 0$  be a real number, and consider the fractional parts of  $\alpha, 2\alpha, \dots, N\alpha$ . (The fractional part of a number is the number minus its integer part, or the part “to the left of the decimal point”). Prove that two of the  $N$  fractional parts differ by less than  $1/N$ .

**Question 3.** Among 18 students in a room, 7 study mathematics, 10 study science, and 10 study computer programming. Also, 3 study mathematics and science, 4 study mathematics and computer programming, and 5 study science and computer programming. One student studies all three subjects. How many students study *none* of the three subjects?

**Question 4.** Recall that the difference  $A \setminus B$  of two sets is the set of elements which are in  $A$  but *not* in  $B$ . Write down the indicator function of  $A \setminus B$  in terms of the indicator functions of  $A$  and  $B$ .

**Question 5.** Recall that the symmetric difference  $A \Delta B$  of two sets is the set of elements which belong to  $A$  or  $B$  but not both. Write down the indicator function of  $A \Delta B$  in terms of the indicator functions of  $A$  and  $B$ .

Hint: Use the results of Question 4.

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*Key words and phrases.* discrete, mathematics, sets, logic, combinatorics, graphs.