		Physics Department					
Electromagnetic Laborato				atory			
Lab Group		Students wh	o hand in the r	report	Stamp control		
Session L	Date						
Turn in d	late						
UNCERTAINTY THEORY.							
Electricity and Magnetism							
Important:							
• In order to perform these exercises, it is essential to have previously studied the document "INTRODUCTION TO MEASUREMENTS AND UNCERTAINTY THEORY".							
• The fitting lines obtained from the least squares method must be plotted in the same graph than the experimental points.							
1. Direct Measurements. Precision Uncertainty. Random error.							
1.1. The following table contains ten values of resistance measured for a resistance R. These values were obtained using a digital multimeter that has a precision of							
$\mathcal{E}_p = 0.1 \ \Omega$ . Find the best approximation for the value of R and estimate the corresponding uncertainty.							
			R±0.1(Ω)				
				-			
				1			
				1			
				1			

R= ΔR= R= ± ()

2. Indirect Measurements. Propagation of Uncertainty.

2.1. The resistance of the previous section is placed in a circuit, in series with an ammeter and a source of voltage V = 4.5V. A voltmeter, placed in parallel to the resistance, measures a voltage drop of --- V. The current flowing through the circuit is --- mA, as measured by the ammeter. Find the value of the resistance R and its corresponding uncertainty making use of Ohm's Law (V=IR). The precision uncertainties for the ammeter and of the voltmeter are 0.1 mA and 0.01 V, respectively.



## 3. Least squares fitting.

**3.1.** The following table shows the values of voltage (V) and the corresponding values of intensity (I) measured when changing the voltage in the circuit of the previous section.

V±0.01 (V)	I±0.0001 (A)



 $\bullet$  Fit the data to a straight line using the least-squares method and determine the value of R

$$\sum_{i=1}^{n} x_{i} = \sum_{i=1}^{n} y_{i} = \sum_{i=1}^{n} x_{i} y_{i} = \sum_{i=1}^{n} x_{i}^{2} = n = \sigma = \sigma$$

**Results of the least squares fit:** 



**3.4.** *Compare the three values obtained for the resistance R during this experiment. Make a critical analysis of the results.*