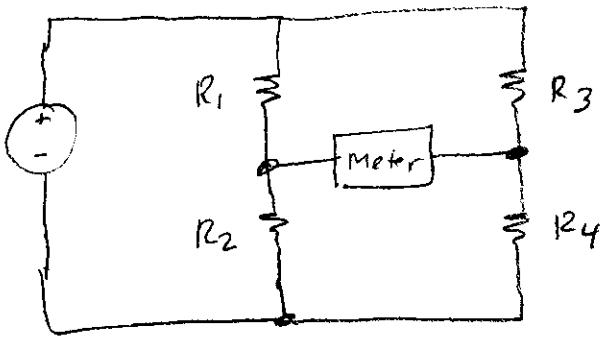
A practical circuit --

The Wheatstone bridge

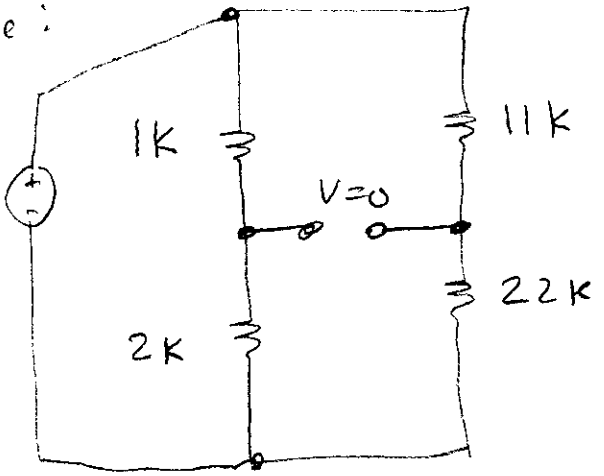
Idea: Use a voltage source and two voltage dividers. Measure between them.



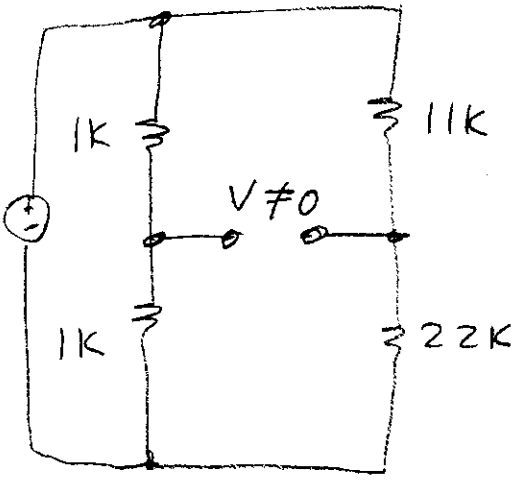
Hw —
p. 478, CH 9
45, 46, 49, 50, 51
56, 57

The meter reads zero when $\frac{R_1}{R_2} = \frac{R_3}{R_4}$

Example:

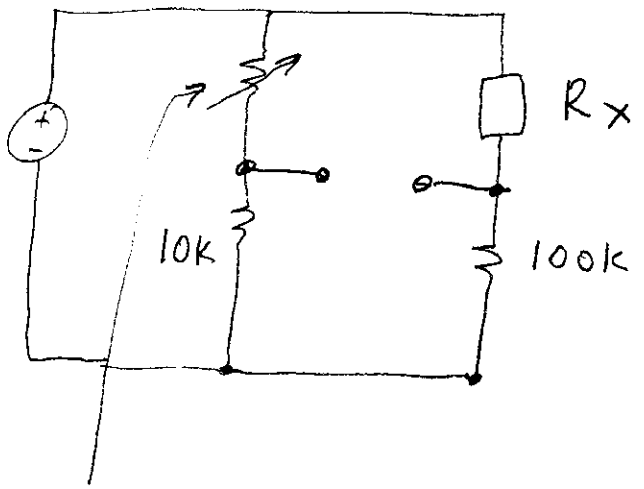


↑ in balance



↑ not in balance

Using it to measure resistance

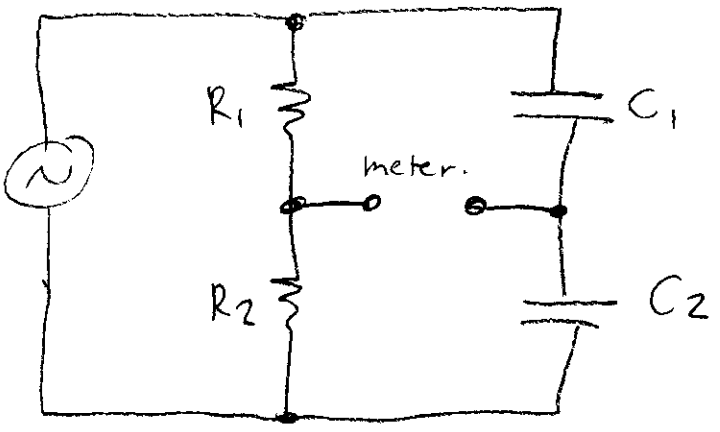


This variable resistor is calibrated--
suppose it is 4.7 K

What is the value of R_x?

To measure capacitance

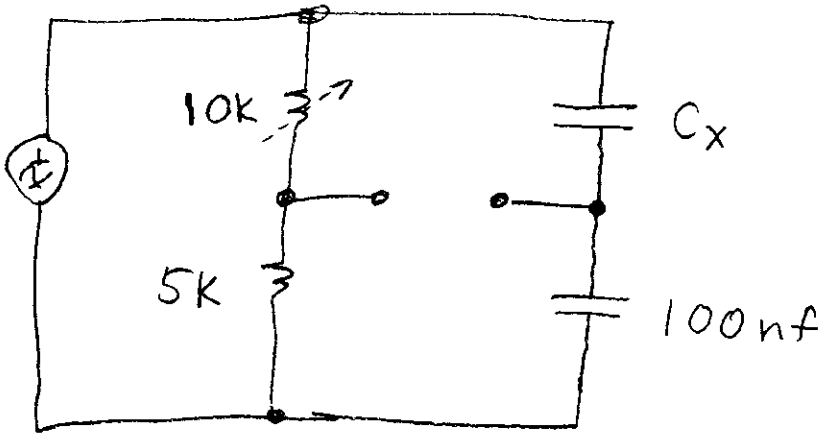
Make one leg out of capacitors ..



in balance when $\frac{R_1}{R_2} = \frac{C_2}{C_1}$

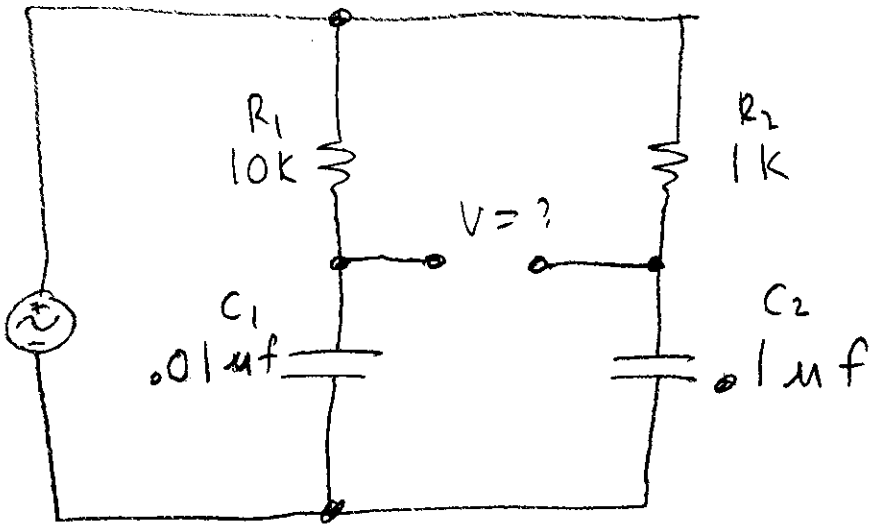
↑ note inversion.

Example:



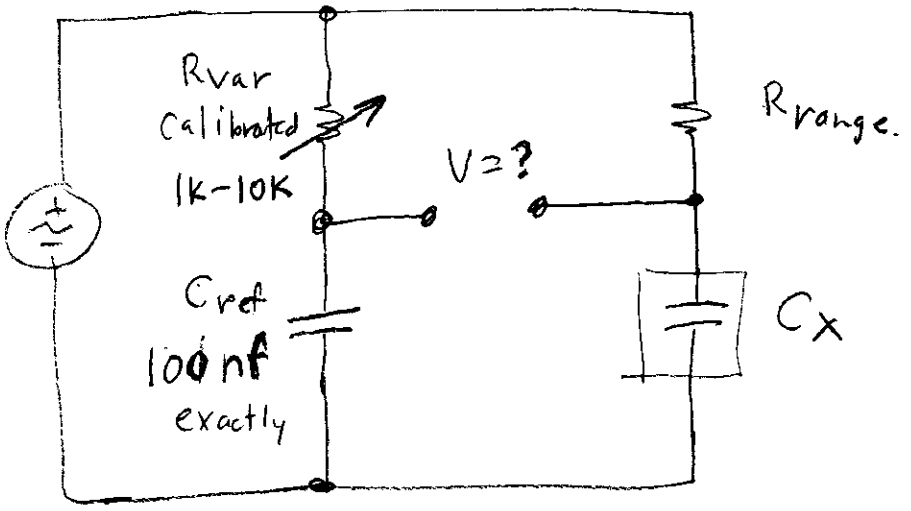
The bridge is in balance.
What is C_x ?

There are other configurations:



$V = 0$ when $\frac{R_1}{C_1} = \frac{R_2}{C_2}$

→ can measure large range of capacitor with one precision capacitor



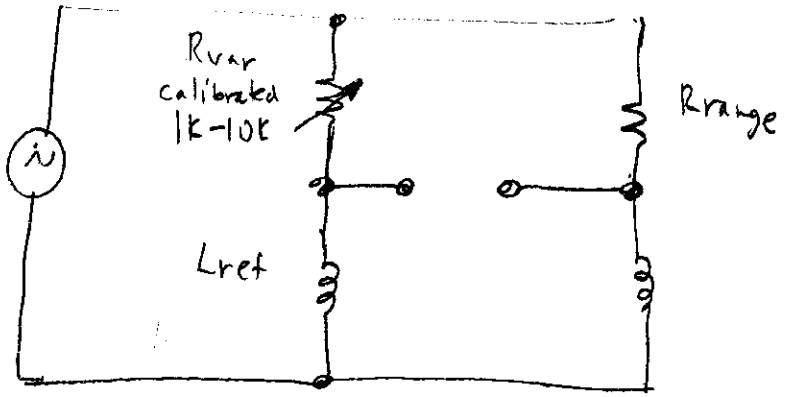
Set R_{range} to: 1Ω, 10Ω, 100Ω, 1K, 10K, 100K, 1Meg, 10 meg (decades) exactly.

What is the value of C_x?

R_{range}	R_{var}	C_x
10K	10K	100nF
10K	1K	10 nF
10K	5K	50 nF
100K	5K	
1Meg	5K	
10 Meg	5K	
1K	5K	
100Ω	5K	
10Ω	5K	
1Ω	5K	

Measuring inductors

The obvious way --



Using a capacitor --