1. The space between two concentric metal spheres with radii a and b is filled with a material of resistivity ρ, see Fig. (1). A potential difference is set up between the inner and the outer spheres so that current flows radially outward from the inner sphere. Find the resistance of this arrangement.

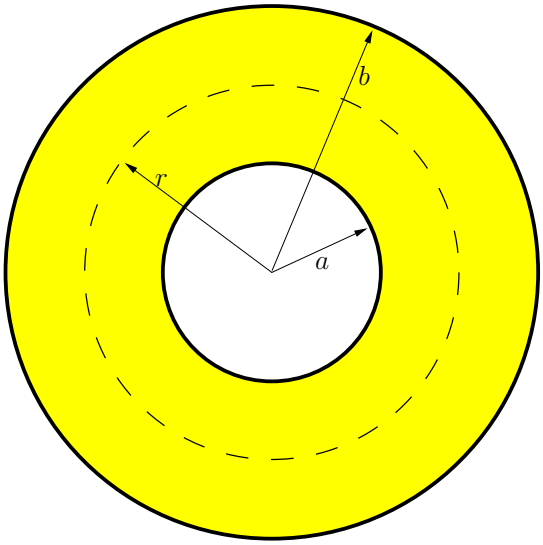

Figure 1: Two concentric spheres are shown in a cross-section view.

Ans: $R = \frac{\rho}{4\pi}\left(\frac{b-a}{ab}\right)$

2. A resistor circuit is shown in Fig. (2). Please follow the directions given in the figure.

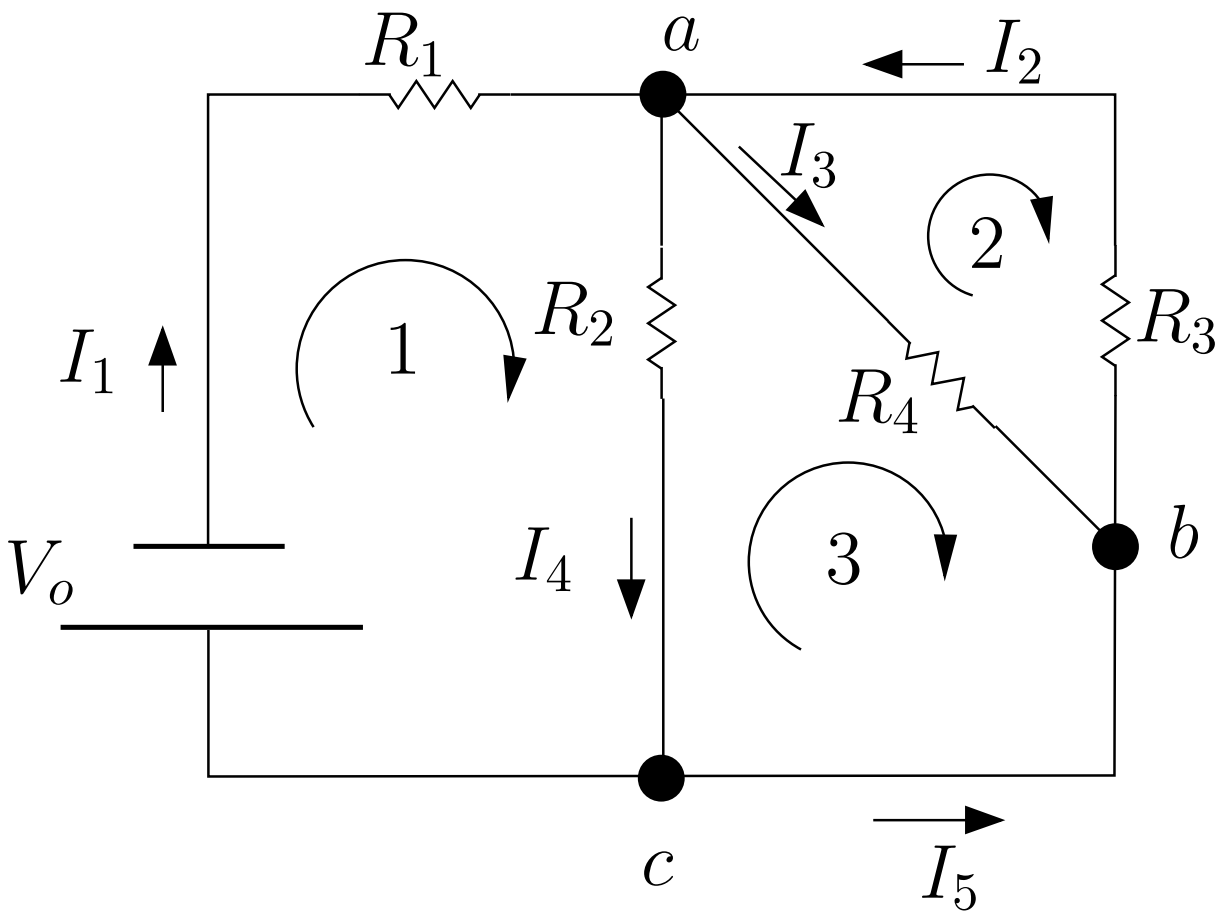

Figure 2: A resistor network is shown.

(a) Find R_{eq}.
Ans: $R_{\text{eq}} = R_1 \perp R_5$, where $R_5 = R_2 \| R_3 \| R_4$

(b) Write down enough equations so you can solve for all unknown currents shown in Fig. (2). Do NOT solve the equations.
Ans: see solutions

3. An RC circuit is shown in Fig. (5). The capacitor is initially uncharged and at time $t = 0$, the switch is closed.

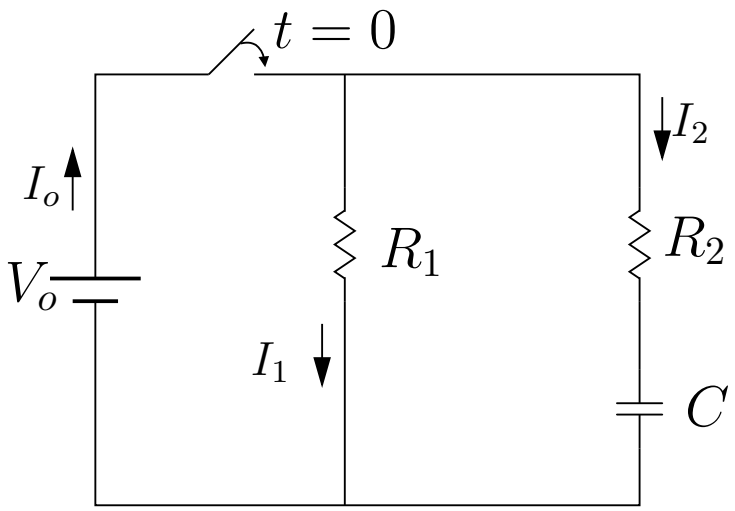

Figure 5: The switch is closed at time $t = 0$ and the capacitor is initially uncharged.

(a) Starting with Kirchhoff's rules, derive an expression for I_1.
Ans: $I_1 = \frac{V_o}{R_1}$

(b) Starting with Kirchhoff's rules, derive an expression for I_2.
Ans: $I_2 = \frac{V_o}{R_2} e^{-\frac{t}{R_2 C}}$

(c) Starting with Kirchhoff's rules, derive an expression for I_o.
Ans: $I_o = \frac{V_o}{R_1} + \frac{V_o}{R_2} e^{-\frac{t}{R_2 C}}$