More Complex Capacitor Circuit

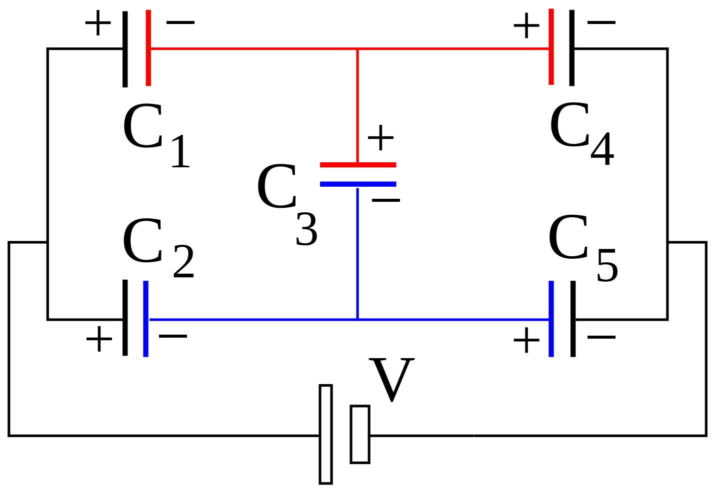
No two capacitors are in parallel or in series.
Solution requires different strategy:

- zero charge on each conductor (here color coded),
- zero voltage around any closed loop.

Specifications: $C_1, \ldots, Q_5, V$.
Five equations for unknowns $Q_1, \ldots, Q_5$:

- $Q_1 + Q_2 - Q_4 - Q_5 = 0$
- $Q_3 + Q_4 - Q_1 = 0$
- $\dfrac{Q_5}{C_5} + \dfrac{Q_3}{C_3} - \dfrac{Q_4}{C_4} = 0$
- $\dfrac{Q_2}{C_2} - \dfrac{Q_1}{C_1} - \dfrac{Q_3}{C_3} = 0$
- $V - \dfrac{Q_1}{C_1} - \dfrac{Q_4}{C_4} = 0$

Equivalent capacitance: $C_{eq} = \dfrac{Q_1 + Q_2}{V}$



(a) $C_m = 1\text{pF}$, $m = 1, \ldots, 5$ and $V = 1\text{V}$:

$$C_{eq} = 1\text{pF}, \; Q_3 = 0,$$

$$Q_1 = Q_2 = Q_4 = Q_5 = \frac{1}{2}\text{pC}.$$

(b) $C_m = m\,\text{pF}$, $m = 1, \ldots, 5$ and $V = 1\text{V}$:

$$C_{eq} = \frac{159}{71}\text{pF}, \; Q_1 = \frac{55}{71}\text{pC}, \; Q_2 = \frac{104}{71}\text{pC},$$

$$Q_3 = -\frac{9}{71}\text{pC}, \; Q_4 = \frac{64}{71}\text{pC}, \; Q_5 = \frac{95}{71}\text{pC}.$$