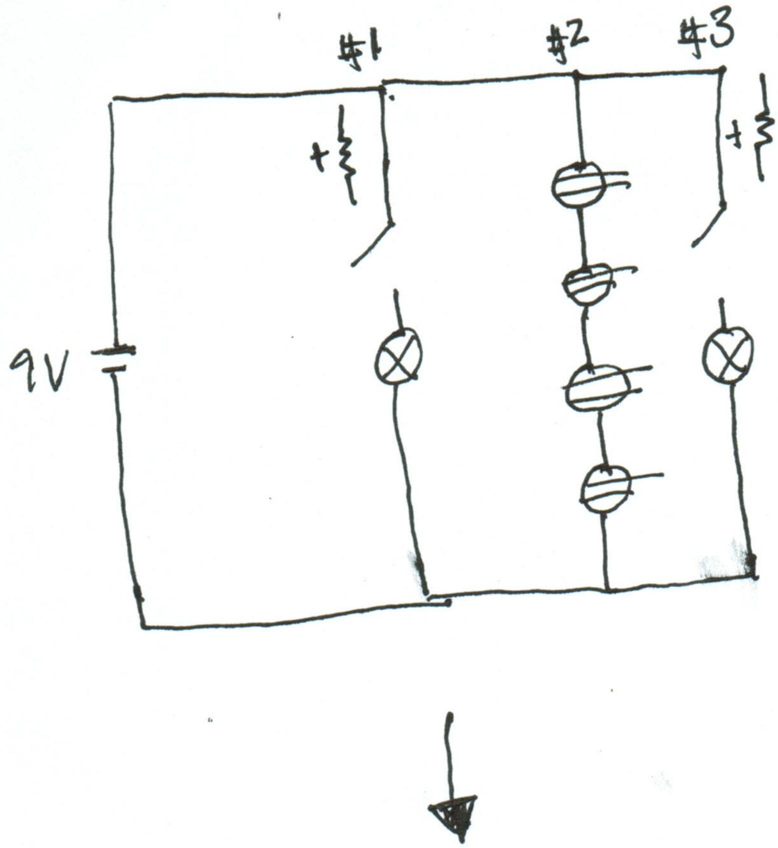
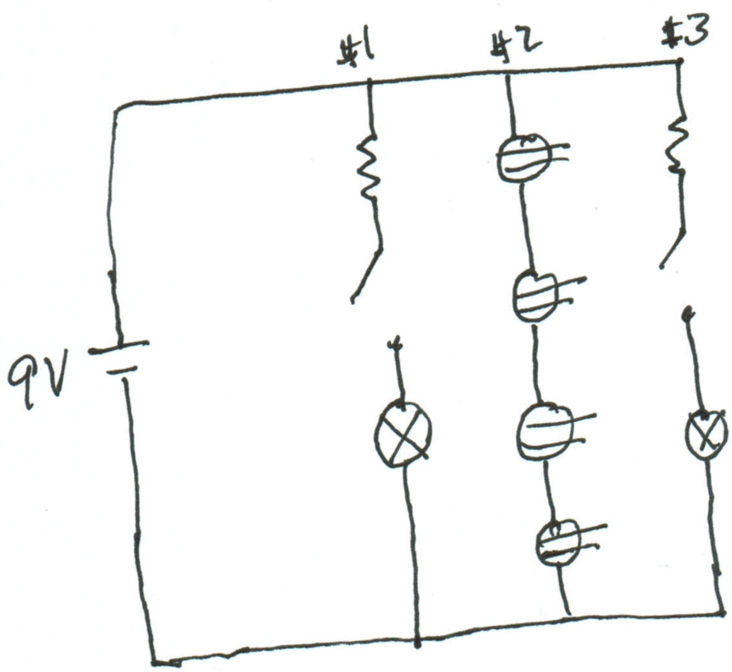
Circuit #1: Bedroom Circuit



Lights can only see 2.5 V or they risk breaking so Branch #3 and #1 must have resistors (this is not the case with household circuits but for this project, if you were to actually build it you would need them)



Strategy

I will Evaluate Branch #1 and #3 as simple series circuits with 1 Resistor and 1 Light and Branch #4 as a series circuit with 4 identical loads in series. Then combine them all in parallel

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VIRP Tables

Branch 1 and 3 VIRP
(Series Circuits)

	Voltage (V)	Current (A)	Resistance (Ω)	Power (W)
Light	2.5	0.3125	8	0.78
Resistor	6.5	0.3125	20.8	2.03
Total	9	0.3125	28.8	2.81

Starting out we only know that the Light will have a voltage drop of 2.5V (more would break it, less may not light it) and a Resistance of 8Ω. We also know the total circuit voltage is 9V.

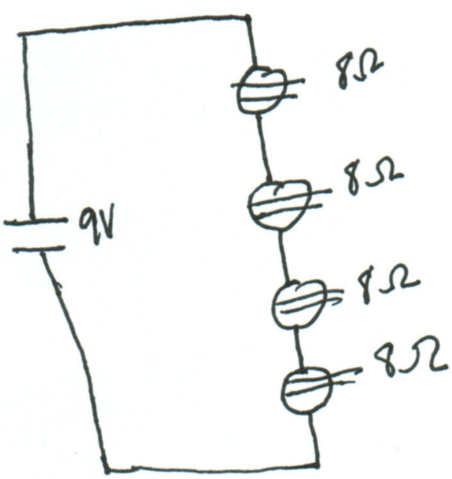
- First we can figure out the Voltage Drop the Resistor must have. → 9V − 2.5V = 6.5V
- Next we can Calculate the Amperage through The Light → OHMs Law → 2.5 = I • 8 → I = 0.3125 A
  V = I • R
- Since it is a series circuit the current is the same through the whole Branch so the Resistor sees 0.3125A as well and the total current in the Branch is 0.3125 A.
- Now we Use OHM's Law to finish the VIR part of the table.
  Resistor → 6.5 = 0.3125 • R → R = 20.8 Ω
  Total Resistance → 9 = 0.3125 • R = 28.8Ω
  (or 8Ω + 20.8Ω = 28.8Ω)
- To Calculate Power we multiply Voltage x Current

Light → 0.3125 x 2.5 = 0.78 W, Resistor = 0.3125 x 6.5 = 2.03,
Total = 9 x 0.3125 = 2.81W (or 0.78 + 2.03 = 2.81W

Branch 2 VIRP Table
(Series Circuit)

	Voltage (V)	Current (A)	Resistance (Ω)	Power (W)
Outlet 1	2.25	0.28125	8	0.63
Outlet 2	2.25	0.28125	8	0.63
Outlet 3	2.25	0.28125	8	0.63
Outlet 4	2.25	0.28125	8	0.63
Total	9	0.28125	32	2.53

Starting out here we know a bit more. If you just have an outlet set it to a resistance of 8Ω. Again this is just simulating the load on the circuit that could be plugged in. We also know that the total Voltage for this branch is also 9V.



- First Total Resistance can be found by adding up the Resistances → $8+8+8+8 = 32\Omega$
- Then Use OHMs Law to Find the total current in the Branch → $9 = I \times 32$ → $I = 0.28125$
- Since this is a series circuit the current is the same in the whole branch.
- Next calculate the Voltage Drop over each Resistor.
  $V = 0.28125 \times 8 = 2.25V$
- Finally Calculate the Power for each outlet and the whole circuit by using $V \times I = P$
  $2.25 \times 0.28125 = 0.63$
  $9 \times 0.28125 = 2.53$ (or 0.63×4)
  ↑ Rounding issues.

Whole Circuit VIRP Table
(Parallel-Series Combination Circuit)

	Voltage (V)	Current (A)	Resistance (Ω)	Power (W)	Acts Like..
Light 1	2.5	0.3125	8	0.78	9 V, 28.8Ω, 0.3125 A, 2.81W
Resistor 1	6.5	0.3125	20.8	2.03	
Light 2	2.5	0.3125	8	0.78	9V, 28.8Ω, 0.3125 A, 2.81W
Resistor 2	6.5	0.3125	20.8	2.03	
Outlet 1	2.25	0.28125	8	0.63	9V, 32Ω, 0.28125 A, 2.53W
Outlet 2	2.25	0.28125	8	0.63	
Outlet 3	2.25	0.28125	8	0.63	
Outlet 4	2.25	0.28125	8	0.63	
Total	**9 V**	**0.90625 A**	**9.931 Ω**	**8.15 W**	

Fill in the Table using the other tables. To get total Current, Resistance, and Power use the totals from each table (indicated in the "Acts like" Column)

Please Remember that Resistance in Parallel is calculated like so:

$$\frac{1}{R_{Tot}} = \frac{1}{28.8} + \frac{1}{28.8} + \frac{1}{32}$$

I converted these to decimals and got

$$\frac{1}{R_{Tot}} = 0.034\overline{72} + 0.034\overline{72} + 0.0315 = 0.1006\overline{94}$$

$$R_{Tot} = \frac{1}{0.1006\overline{94}} \cong 9.931\,\Omega$$

Current in Parallel is additive

$0.3125 + 0.3125 + 0.28125 = 0.90625A$