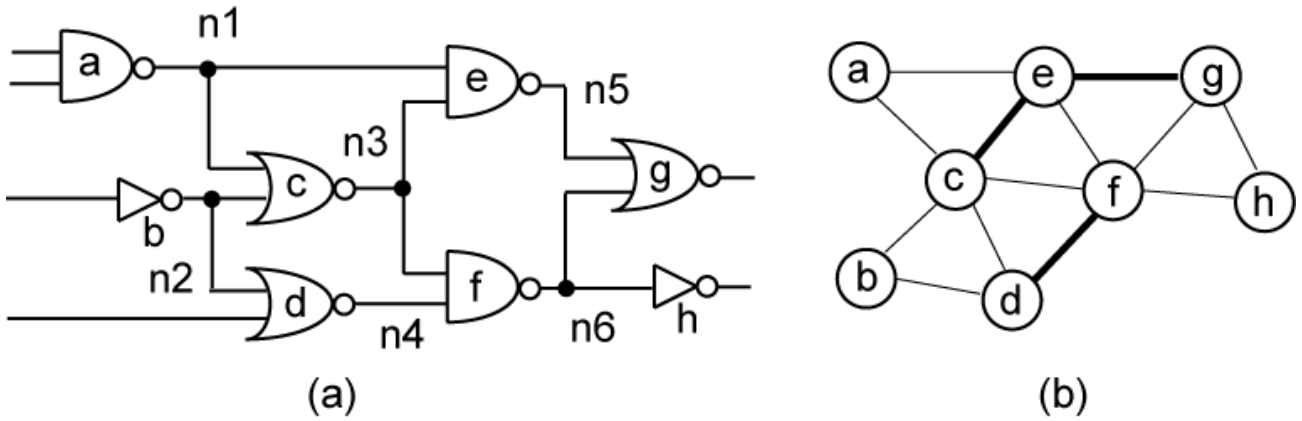
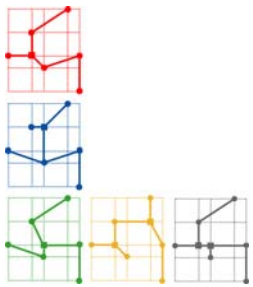
# Kernighan-Lin Algorithm

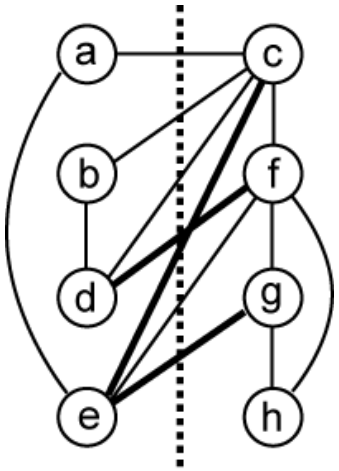
- Perform single KL pass on the following circuit:
  - KL needs undirected graph (clique-based weighting)



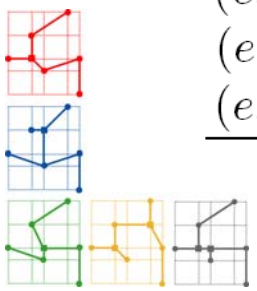



# First Swap

| pair | $E_x - I_x$ | $E_y - I_y$ | $c(x,y)$ | gain |
|---|---|---|---|---|
| $(a,c)$ | $0.5 - 0.5$ | $2.5 - 0.5$ | 0.5 | 1 |
| $(a,f)$ | $0.5 - 0.5$ | $1.5 - 1.5$ | 0 | 0 |
| $(a,g)$ | $0.5 - 0.5$ | $1 - 1$ | 0 | 0 |
| $(a,h)$ | $0.5 - 0.5$ | $0 - 1$ | 0 | -1 |
| $(b,c)$ | $0.5 - 0.5$ | $2.5 - 0.5$ | 0.5 | 1 |
| $(b,f)$ | $0.5 - 0.5$ | $1.5 - 1.5$ | 0 | 0 |
| $(b,g)$ | $0.5 - 0.5$ | $1 - 1$ | 0 | 0 |
| $(b,h)$ | $0.5 - 0.5$ | $0 - 1$ | 0 | -1 |
| $\mathbf{(d,c)}$ | $\mathbf{1.5 - 0.5}$ | $\mathbf{2.5 - 0.5}$ | **0.5** | **2** |
| $(d,f)$ | $1.5 - 0.5$ | $1.5 - 1.5$ | 1 | -1 |
| $(d,g)$ | $1.5 - 0.5$ | $1 - 1$ | 0 | 1 |
| $(d,h)$ | $1.5 - 0.5$ | $0 - 1$ | 0 | 0 |
| $(e,c)$ | $2.5 - 0.5$ | $2.5 - 0.5$ | 1 | 2 |
| $(e,f)$ | $2.5 - 0.5$ | $1.5 - 1.5$ | 0.5 | 1 |
| $(e,g)$ | $2.5 - 0.5$ | $1 - 1$ | 1 | 0 |
| $(e,h)$ | $2.5 - 0.5$ | $0 - 1$ | 0 | 1 |

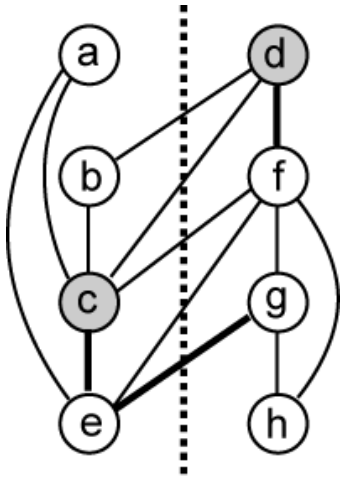


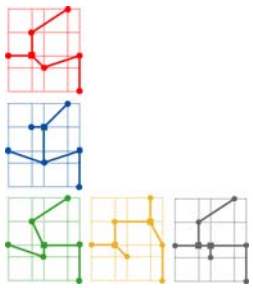
initial partitioning



# Second Swap

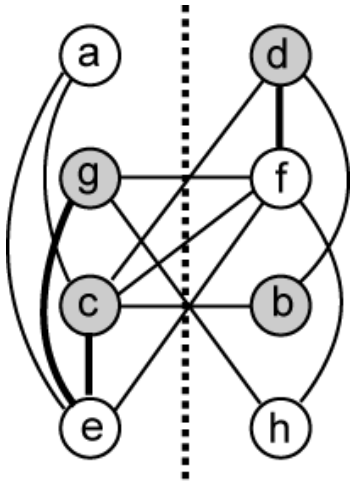
| pair | $E_x - I_x$ | $E_y - I_y$ | $c(x,y)$ | gain |
|---|---|---|---|---|
| $(a,f)$ | $0-1$ | $1-2$ | 0 | -2 |
| $(a,g)$ | $0-1$ | $1-1$ | 0 | -1 |
| $(a,h)$ | $0-1$ | $0-1$ | 0 | -2 |
| $(b,f)$ | $0.5-0.5$ | $1-2$ | 0 | -1 |
| $\mathbf{(b,g)}$ | $\mathbf{0.5-0.5}$ | $\mathbf{1-1}$ | **0** | **0** |
| $(b,h)$ | $0.5-0.5$ | $0-1$ | 0 | -1 |
| $(e,f)$ | $1.5-1.5$ | $1-2$ | 0.5 | -2 |
| $(e,g)$ | $1.5-1.5$ | $1-1$ | 1 | -2 |
| $(e,h)$ | $1.5-1.5$ | $0-1$ | 0 | -1 |

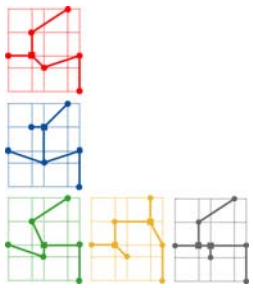


# Third Swap

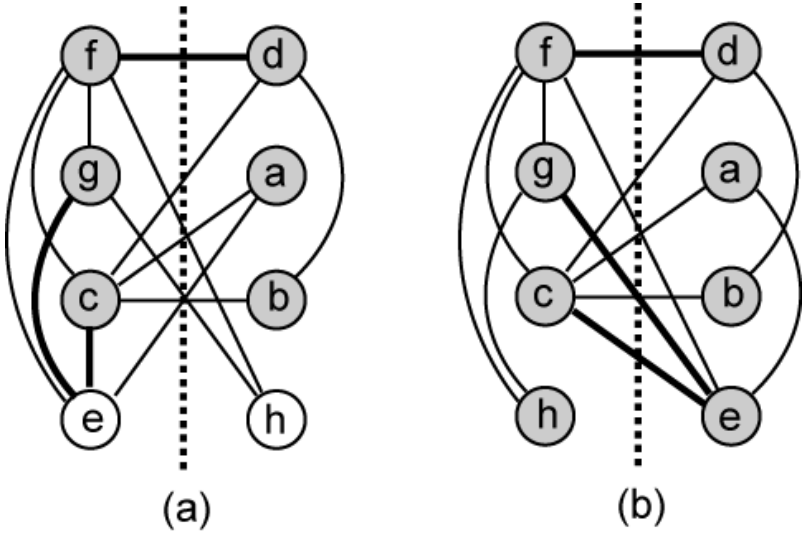
| pair | $E_x - I_x$ | $E_y - I_y$ | $c(x,y)$ | gain |
|---|---|---|---|---|
| $\boldsymbol{(a,f)}$ | $\mathbf{0-1}$ | $\mathbf{1.5-1.5}$ | $\mathbf{0}$ | **-1** |
| $(a,h)$ | $0-1$ | $0.5-0.5$ | $0$ | -1 |
| $(e,f)$ | $0.5-2.5$ | $1.5-1.5$ | $0.5$ | -3 |
| $(e,h)$ | $0.5-2.5$ | $0.5-0.5$ | $0$ | -2 |

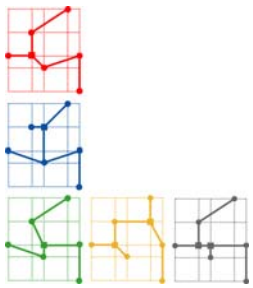


# Fourth Swap

- Last swap does not require gain computation



# Summary

- Cutsize reduced from 5 to 3
  - Two best solutions found (solutions are always area-balanced)

| $i$ | pair | $gain(i)$ | $\sum gain(i)$ | cutsize |
|---|---|---|---|---|
| 0 | - | - | - | 5 |
| **1** | $(d, c)$ | **2** | **2** | **3** |
| **2** | $(b, g)$ | **0** | **2** | **3** |
| 3 | $(a, f)$ | -1 | 1 | 4 |
| 4 | $(e, h)$ | -1 | 0 | 5 |