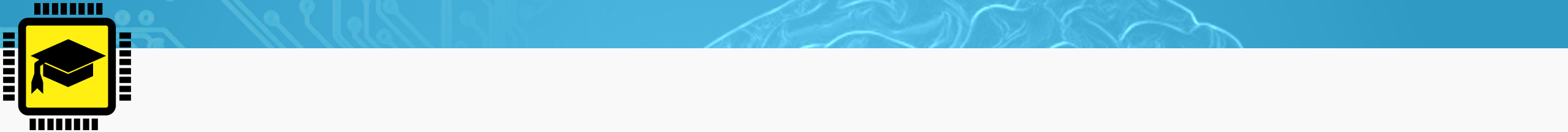




# Structuri de date și algoritmi

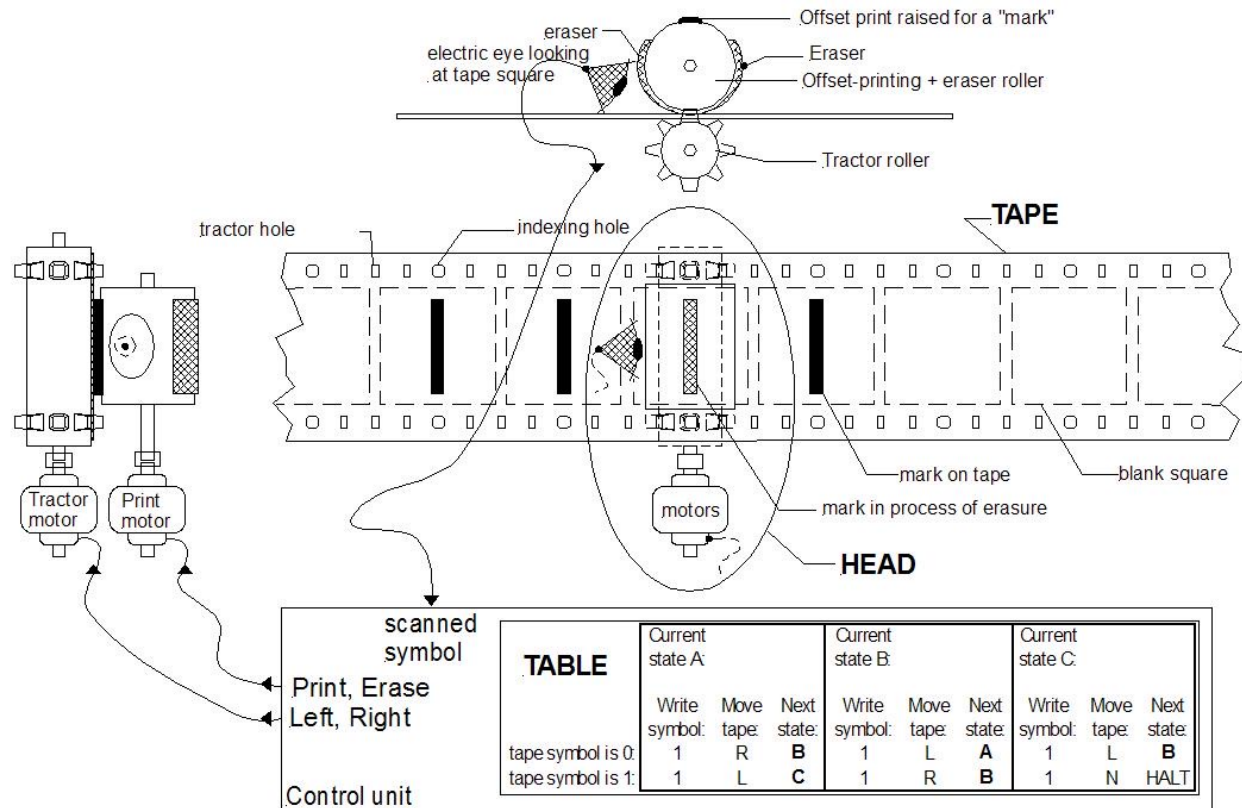
## P vs NP

Lect. Dr. Ing. Cristian Chilipirea – [cristian.chilipirea@mta.ro](mailto:cristian.chilipirea@mta.ro)

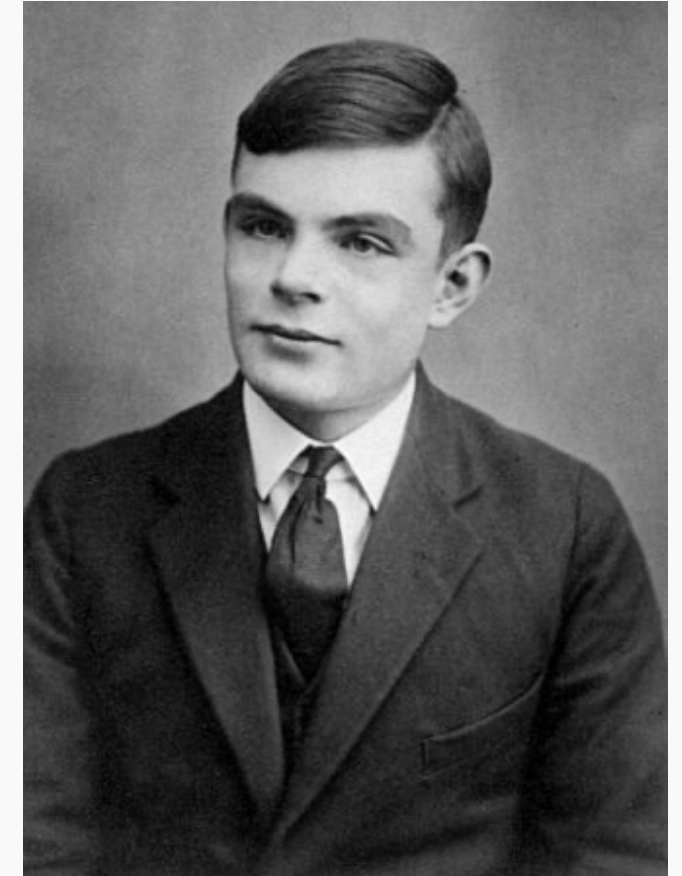




# Turing computable – Turing machine – Turing complete



A fanciful mechanical Turing machine's TAPE and HEAD. The TABLE instructions might be on another "read only" tape, or perhaps on punch-cards. Usually a "finite state machine" is the model for the TABLE.

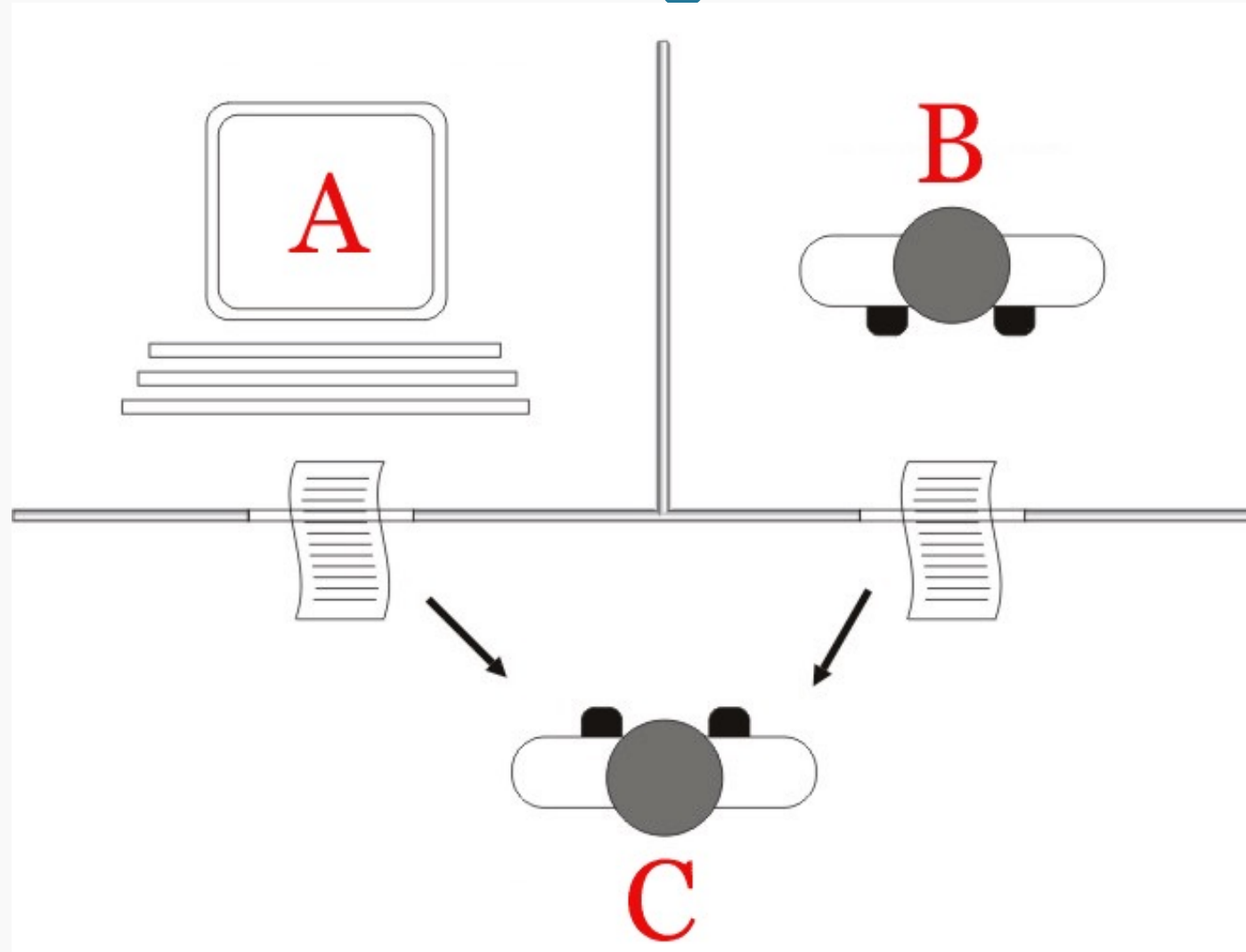


Alan Turing

[https://en.wikipedia.org/wiki/Turing\\_machine\\_gallery](https://en.wikipedia.org/wiki/Turing_machine_gallery)

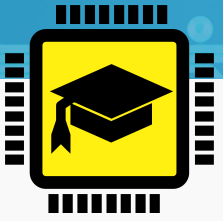


# Turing test

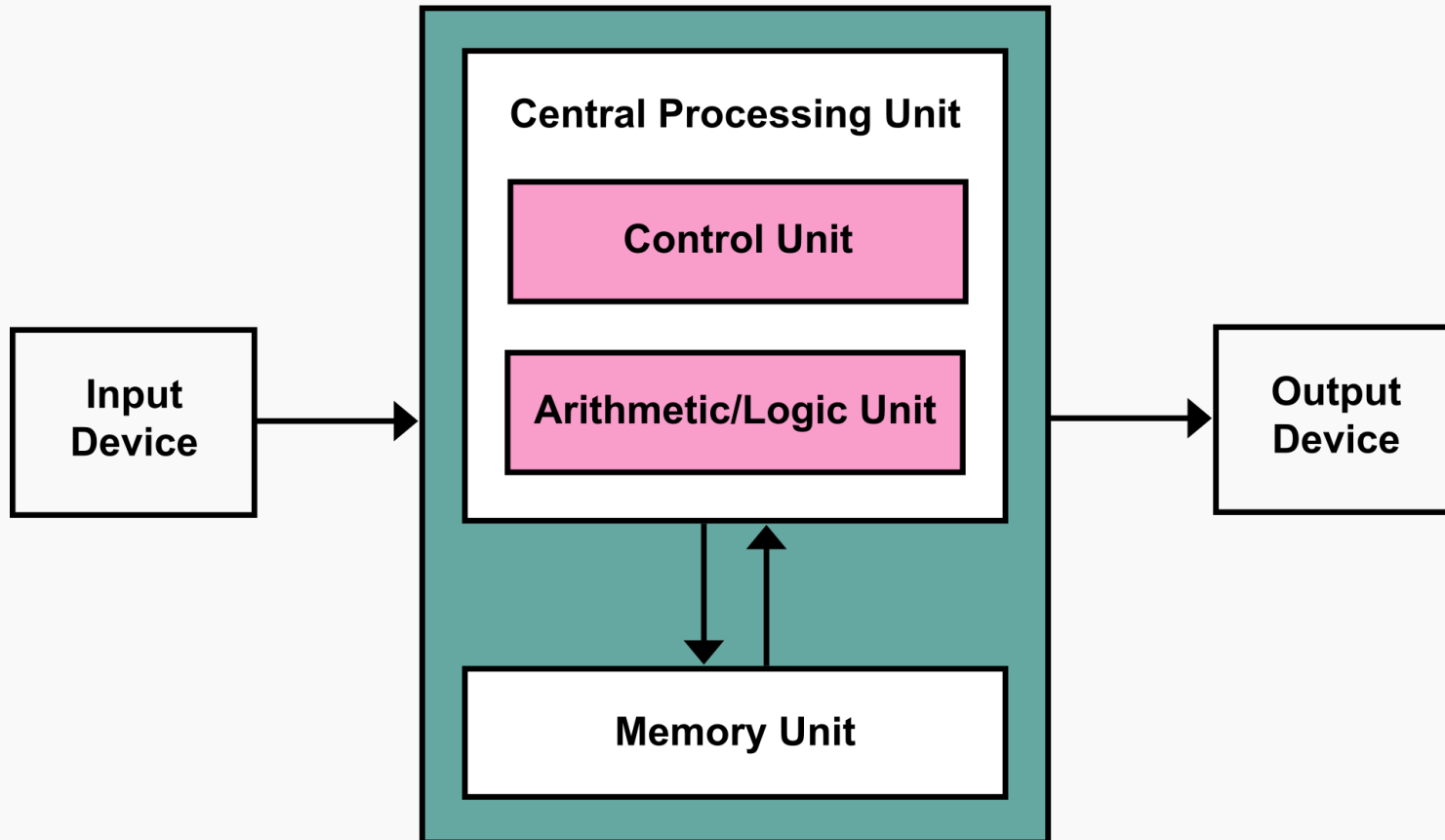


[https://en.wikipedia.org/wiki/Turing\\_test](https://en.wikipedia.org/wiki/Turing_test)





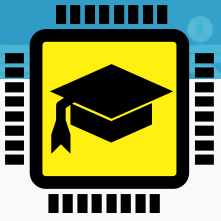
# von Neumann architecture



[https://en.wikipedia.org/wiki/Von\\_Neumann\\_architecture](https://en.wikipedia.org/wiki/Von_Neumann_architecture)

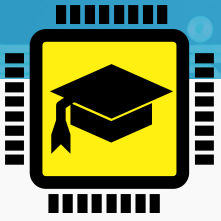


**John von Neumann**



# P

- Aproape toate problemele discutate
- Complexitate de forma  $O(N^k)$

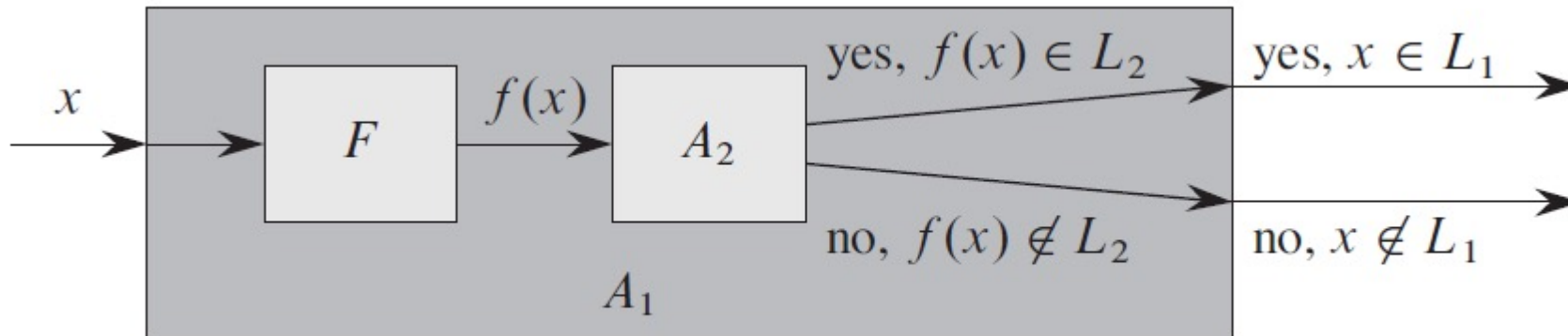
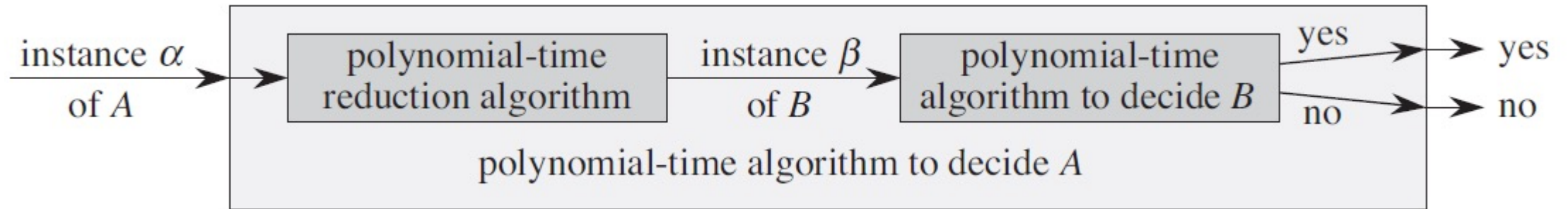


# NP

- Verificabile în timp polinomial
- Multe au timp de execuție superpolinomial
  - ▣ În multe cazuri de forma exponențială  $O(2^N)$

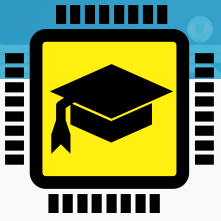


# Reducerea



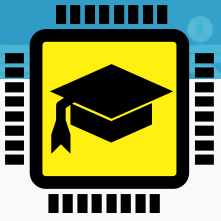
Cormen





# NP-hard

- Oricare problemă din NP-hard poate fi redusă la problema dată

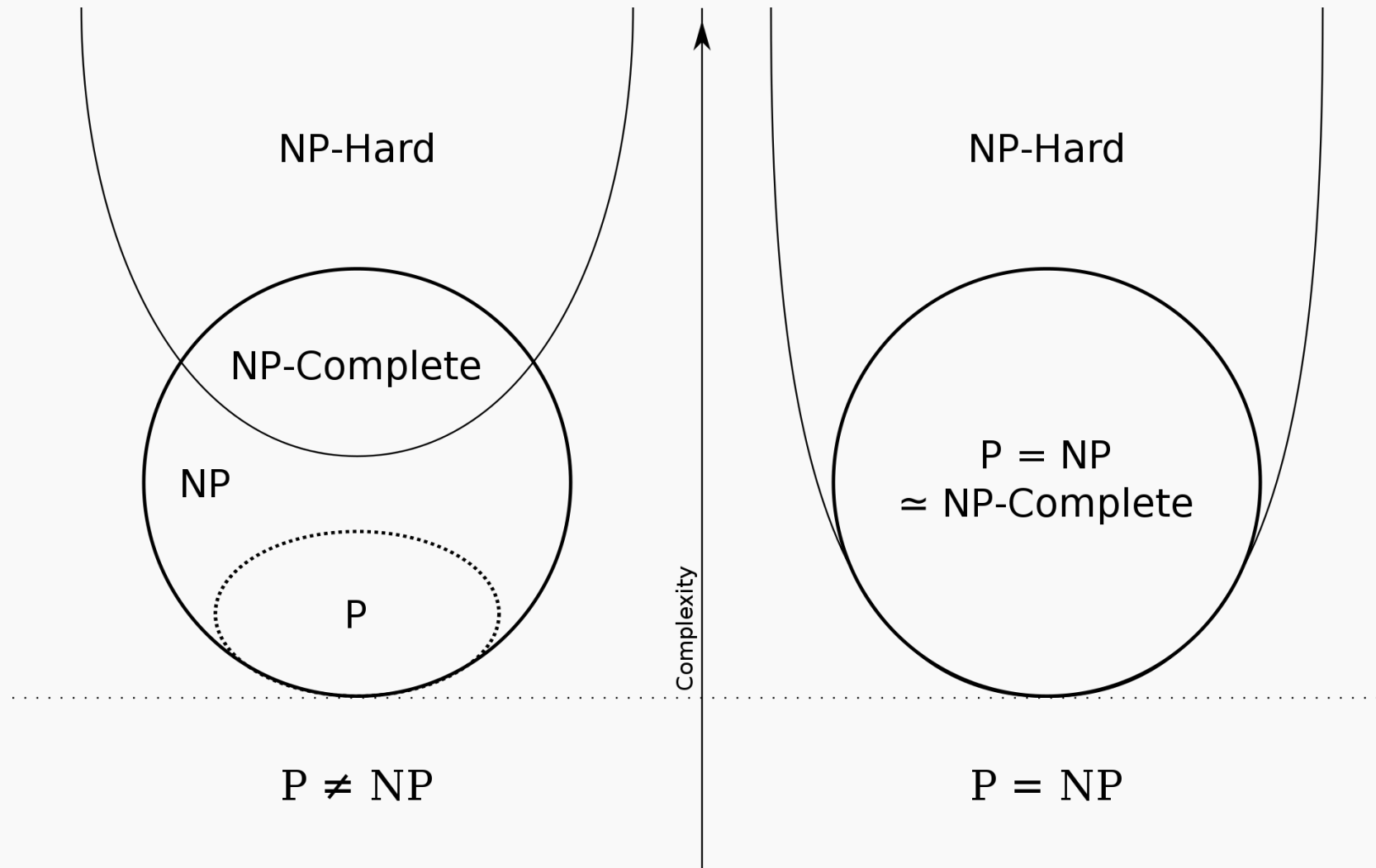


# NP-complete

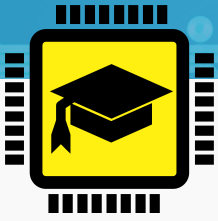
- Problema este în NP
- Orice problemă din NP-hard poate fi redusă la problema dată

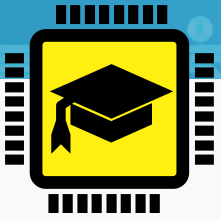


# P vs NP



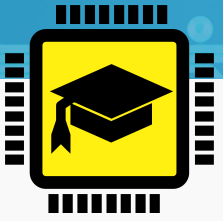
[https://en.wikipedia.org/wiki/P\\_versus\\_NP\\_problem](https://en.wikipedia.org/wiki/P_versus_NP_problem)



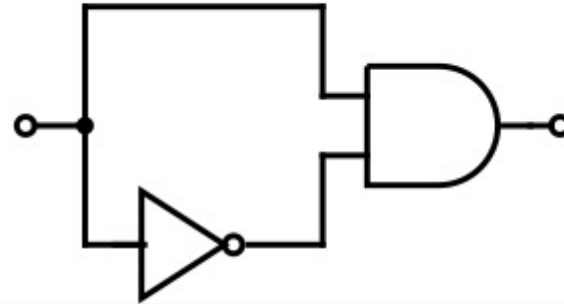


# Probleme





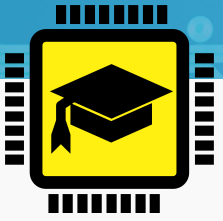
# Circuit SAT



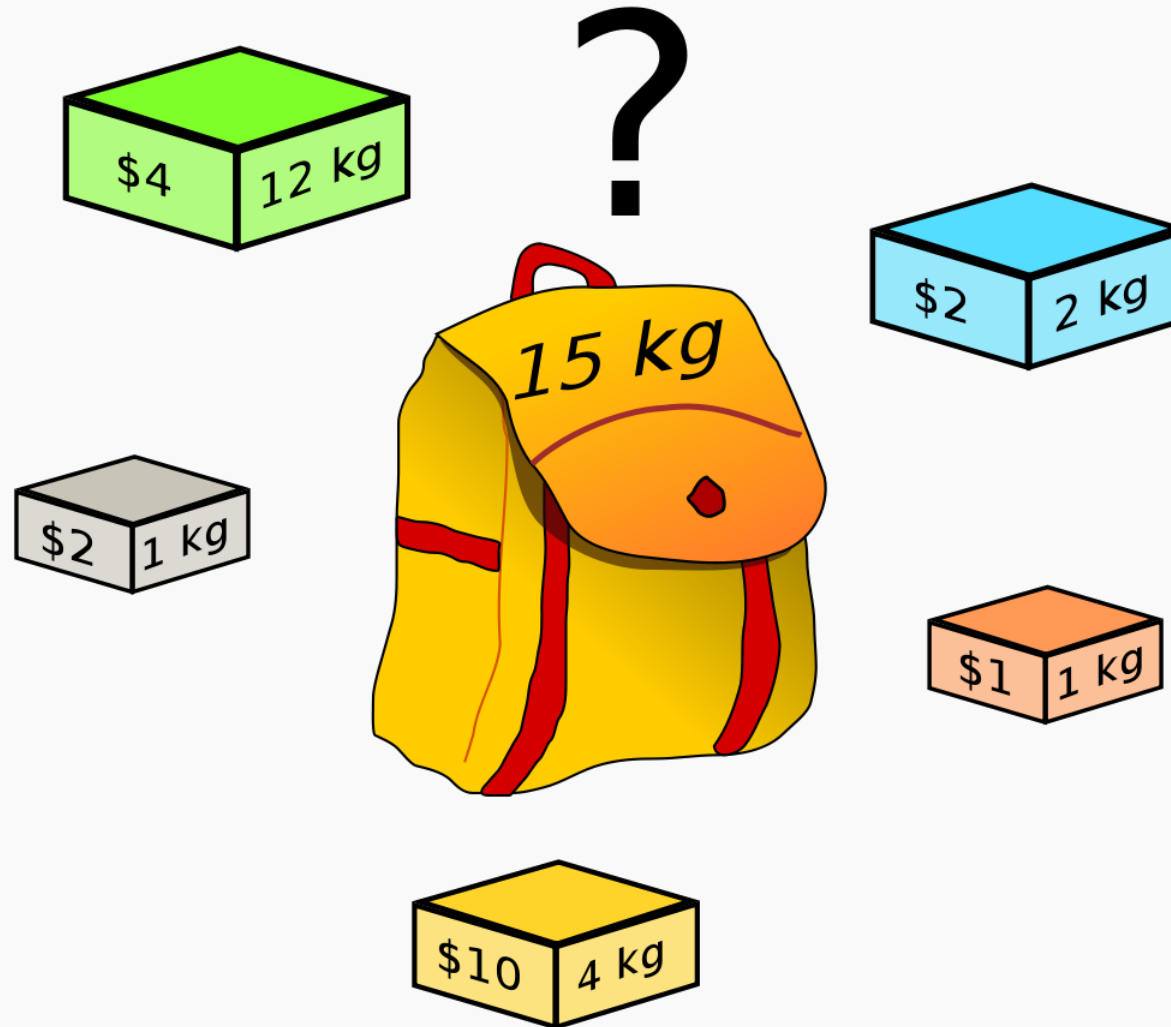
The circuit on the left is satisfiable but the circuit on the right is not.

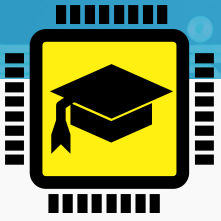


[https://en.wikipedia.org/wiki/Circuit\\_satisfiability\\_problem](https://en.wikipedia.org/wiki/Circuit_satisfiability_problem)

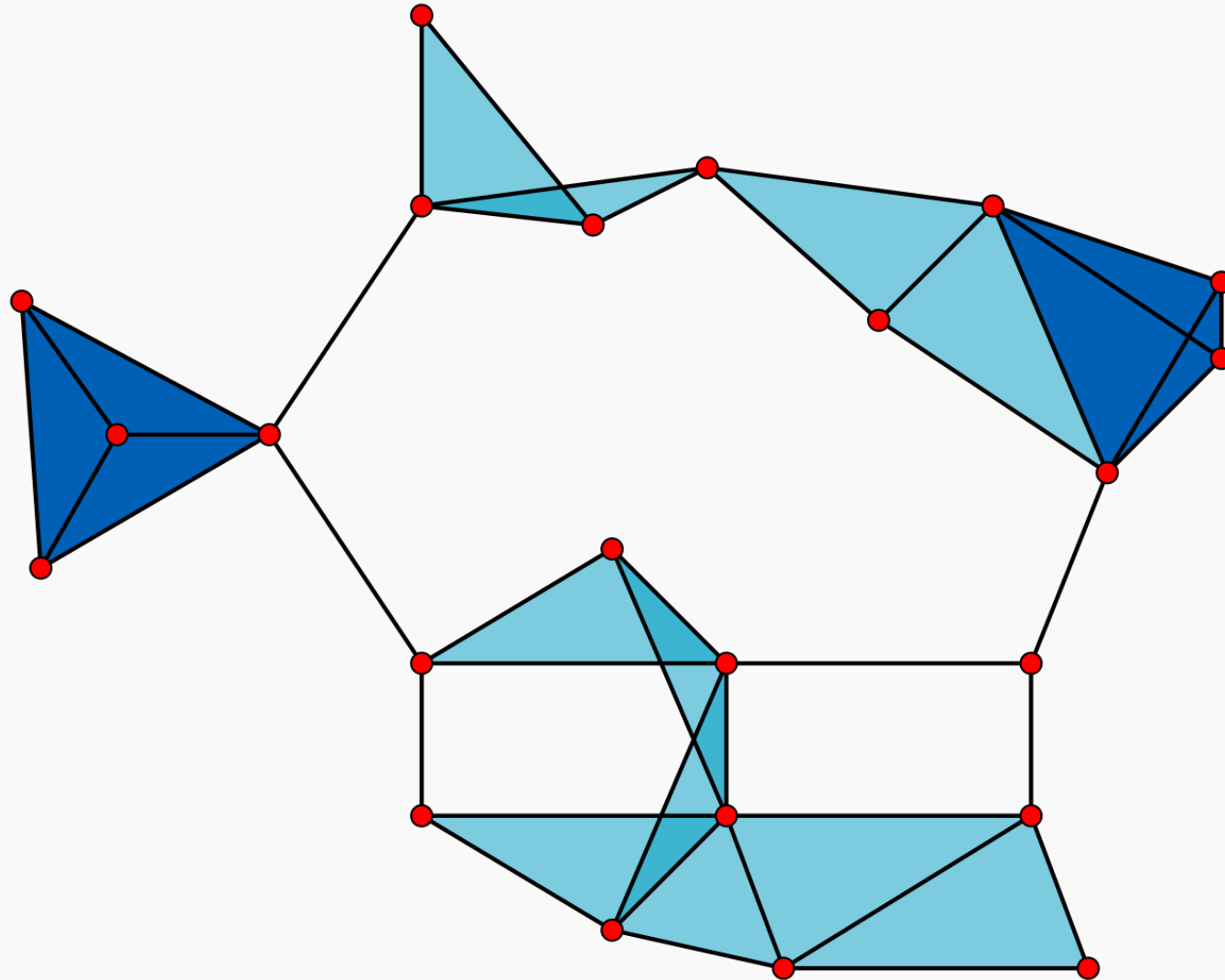


# Knapsack





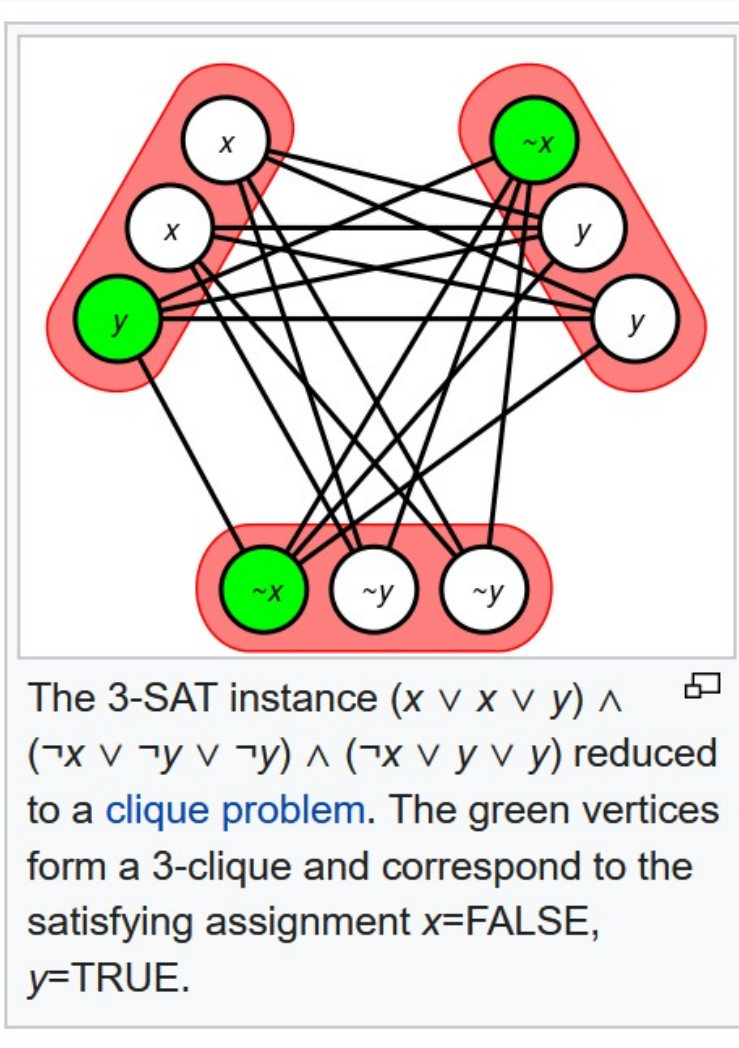
# Clici



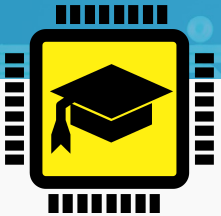
[https://en.wikipedia.org/wiki/Clique\\_\(graph\\_theory\)](https://en.wikipedia.org/wiki/Clique_(graph_theory))



# Boolean satisfiability problem (SAT)



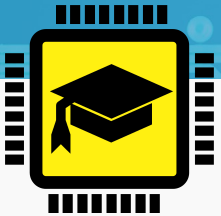
[https://en.wikipedia.org/wiki/Boolean\\_satisfiability\\_problem](https://en.wikipedia.org/wiki/Boolean_satisfiability_problem)



# Subset sume

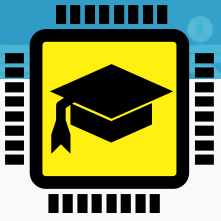
- Dându-se un set de numere întregi și o valoare (număr întreg) se cere să se determine dacă există un subset de numere care însumate au aceea valoare.





# Partiționare

- Se dă un set de numere. Să se separe acest set în două subseturi astfel încât însumarea valorilor celor două subseturi au aceeași valoare.

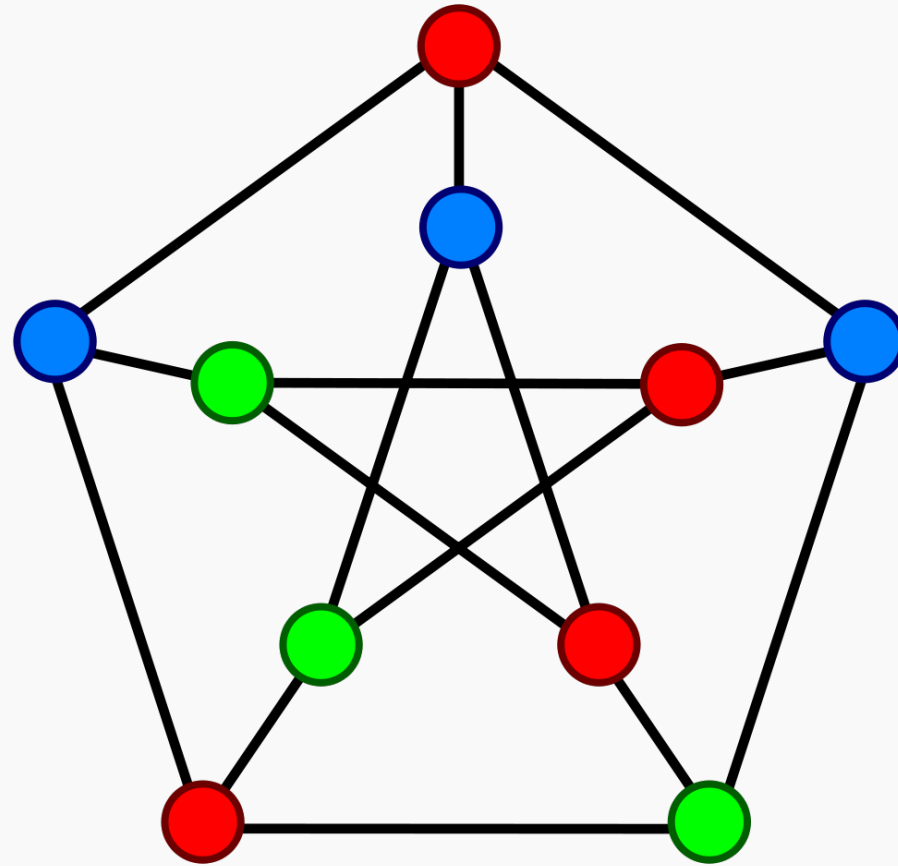


# Drum maxim

- Care este cel mai lung drum între două noduri?



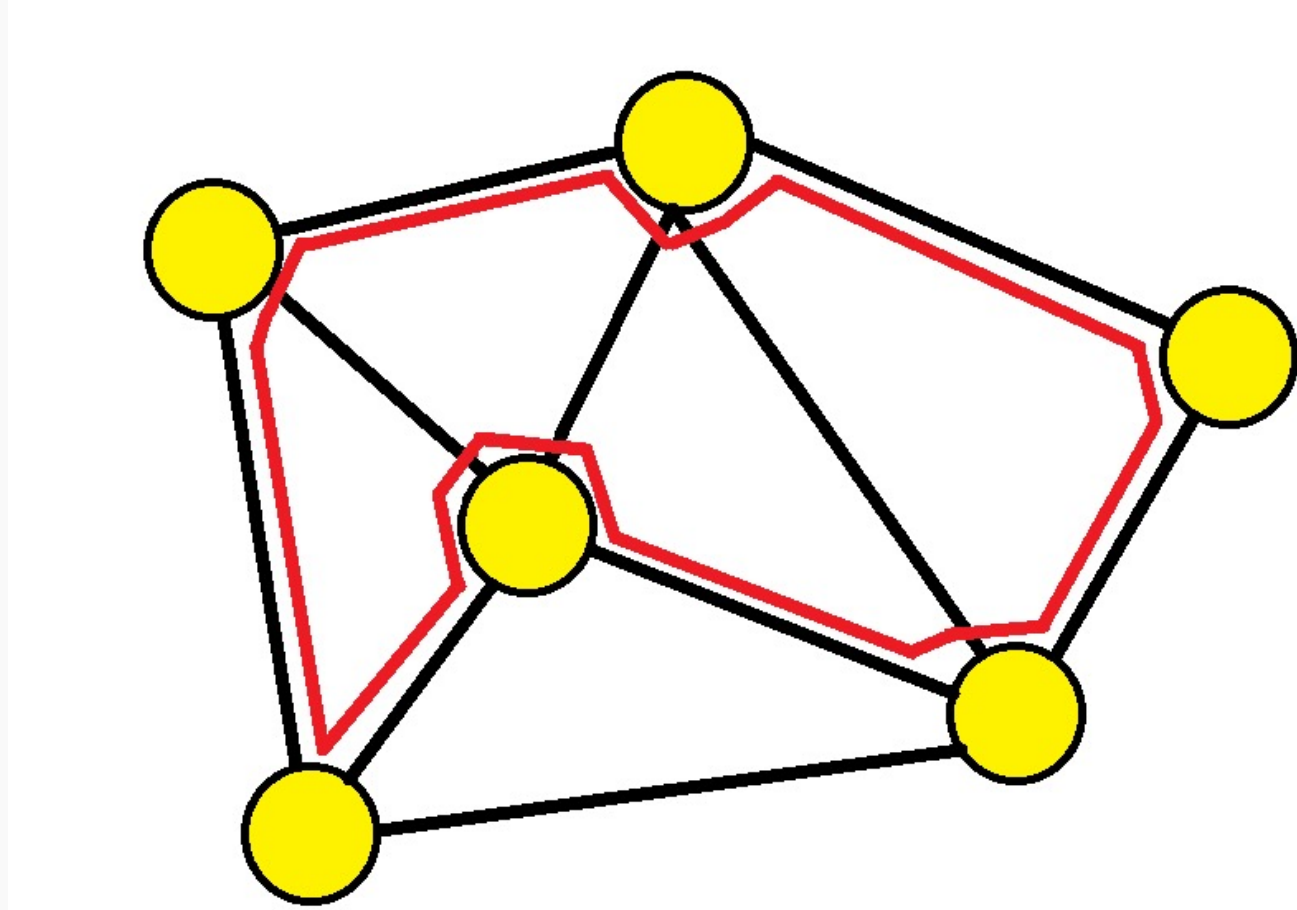
# Colorare graf



[https://en.wikipedia.org/wiki/Graph\\_coloring](https://en.wikipedia.org/wiki/Graph_coloring)



# Ciclu Hamiltonian



[https://en.wikipedia.org/wiki/Hamiltonian\\_path](https://en.wikipedia.org/wiki/Hamiltonian_path)



# Traveling salesman



<https://towardsdatascience.com/animating-the-traveling-salesman-problem-56da20b95b2f>