Bölüm 7: Yakınsama Algoritmaları

Algoritmalar

Yakınsama Algoritmaları

- Bazı problemlerin çözümlerini bulmak çok zor veya imkansız olabilir.
- Yakınsama algoritmaları,
  - Mükemmel çözümü bulmak yerine,
  - Orijinal çözüme mümkün olduğunca yakın çözümler üretir.
  - Karmaşık problemler makul bir süre içerisinde çözülebilir.

Yakınsama Algoritmaları

- Polinom zaman karmaşıklığına sahiptir.
- Orijinal çözüme belli bir oran veya yüzde ile yakın çözümler üretir.
- Hesaplama kaynakları kısıtlı olduğunda tercih edilir.
- Terazinin bir kefesine bir ağırlık koyulduğunda,
  - diğer kefeye tam olarak aynı ağırlığı koymak zor olabilir.
  - Bu durumda, çeşitli küçük ağırlıklar kullanılarak,
  - büyük ağırlığa olabildiğince yakın bir denge kurulabilir.

Yakınsama Algoritmalarının Uygulamaları

- Seyir satıcısı (Traveling salesman) problemi:
  - Seyyar satıcının en kısa sürede en fazla müşteriye ulaşmasını sağlayan rotaya karar vermek.
- Sırt çantası (Knapsack) problemi:
  - Çantaya sığacak, maksimum fayda sağlayacak eşyaların seçilmesi.
- İşlemci (Job scheduling) planlama:
  - Bilgisayarda birden fazla sürecin en verimli şekilde yürütülmesi.

Yakınsama Algoritmaları Türleri

- Yakınsama:
  - Orijinal problemin daha basit bir versiyonunu çözülür.
- Açgözlü (Greedy):
  - Her adımda en iyi görünen seçenek seçilerek ilerlenir.
- Yerel Arama (Local search):
  - Mevcut çözüm küçük değişikliklerle iyileştirilir, daha iyi çözüm bulunur.

Seyahat Eden Satıcı Problemi

- Optimizasyon Problemi:
  - Satıcı, bir dizi şehri en kısa mesafede ziyaret etmek istiyor.
- Kombinatoriyel Problemler:
  - Tüm şehirlerin gezilme sırasını belirlemek.
- NP-Zor Problemi:
  - Pratikte çok sayıda şehir için en iyi rotayı bulmak zor olabilir.

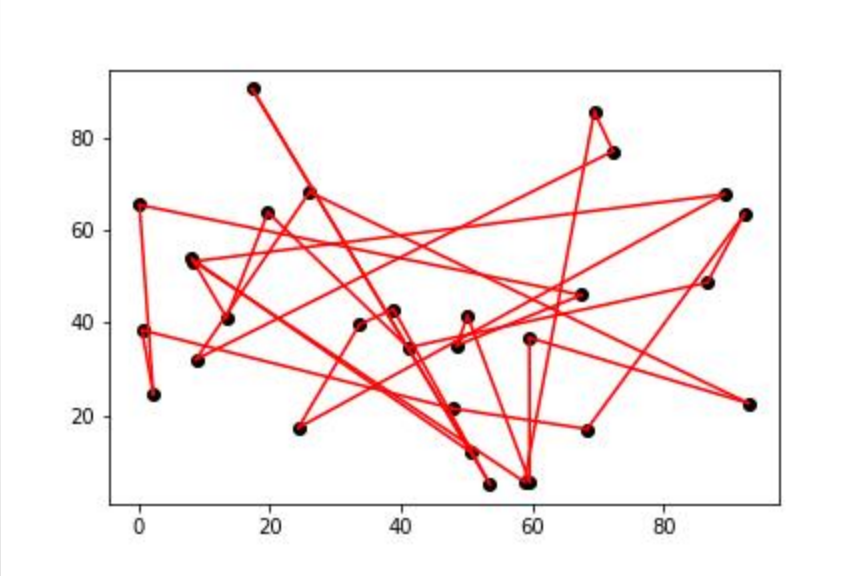
Seyahat Eden Satıcı Problemi

- Şehirler:
  - *n* şehir (örneğin, A, B, C, ...)
- Mesafeler:
  - d_{ij}: i ve j şehirleri arasındaki mesafe

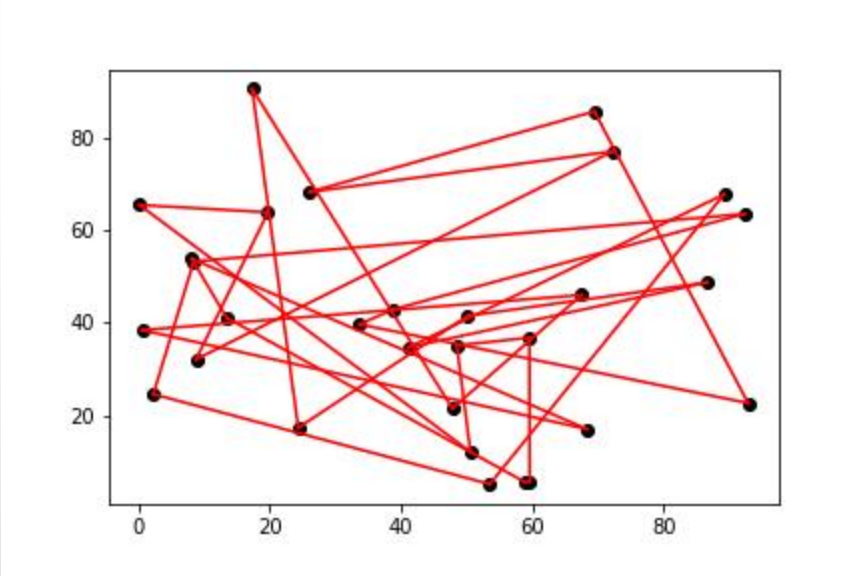
Problemin Çözümü

- Tam Çözüm:
  - Tüm olası rotaları kontrol etmek
- Yaklaşık Çözümler:
  - Heuristik algoritmalar (örneğin, Nearest Neighbor, Genetic Algorithms)
- Optimizasyon Araçları:
  - Simulated Annealing, Ant Colony Optimization..

Traveling Salesman



Traveling Salesman



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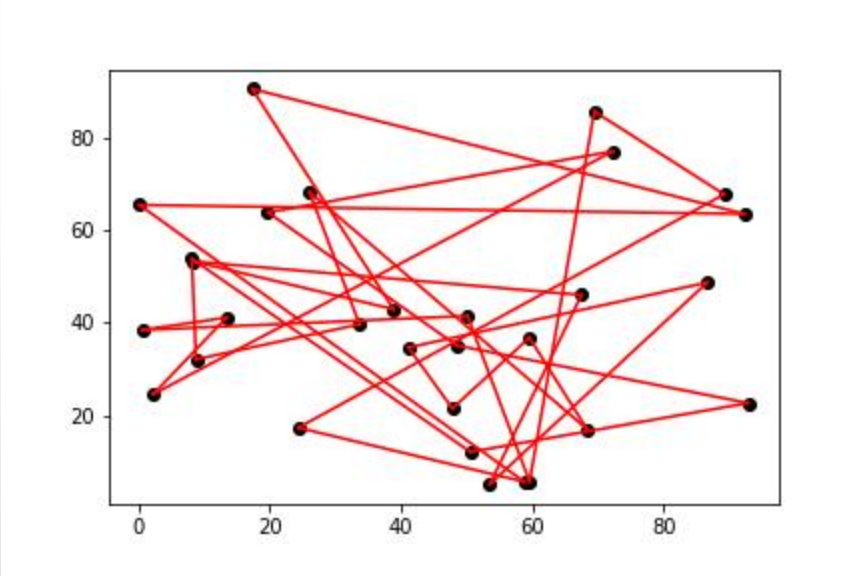

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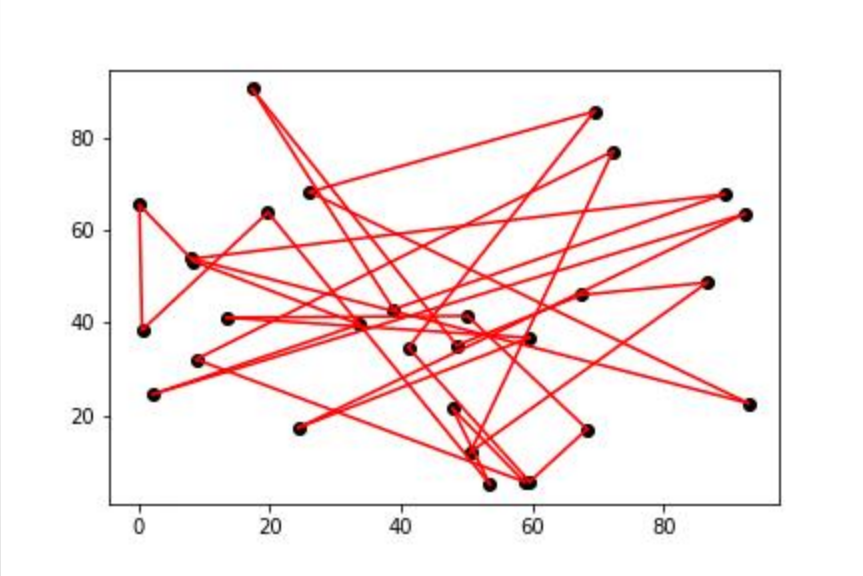

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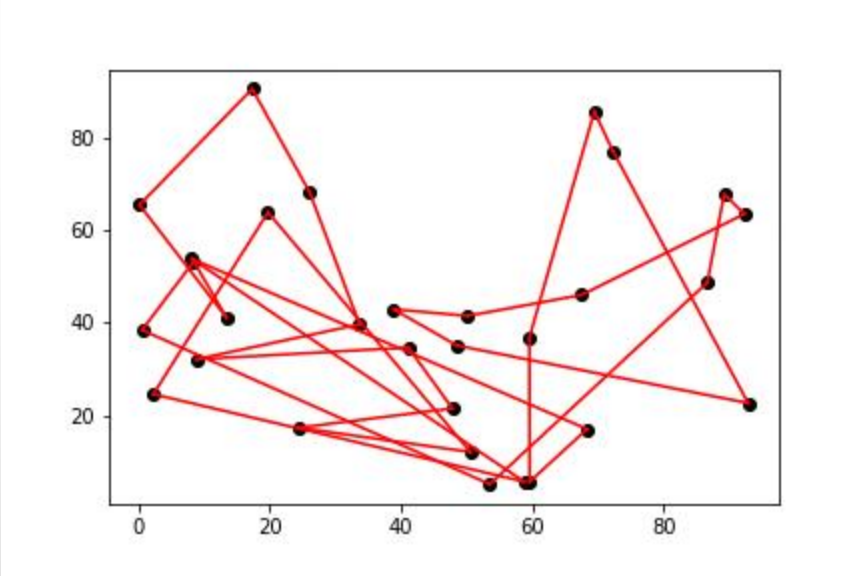

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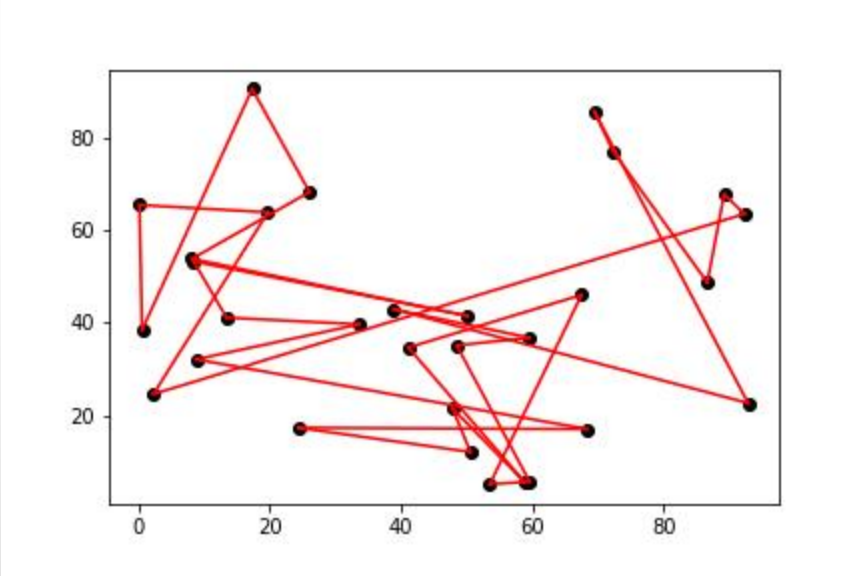

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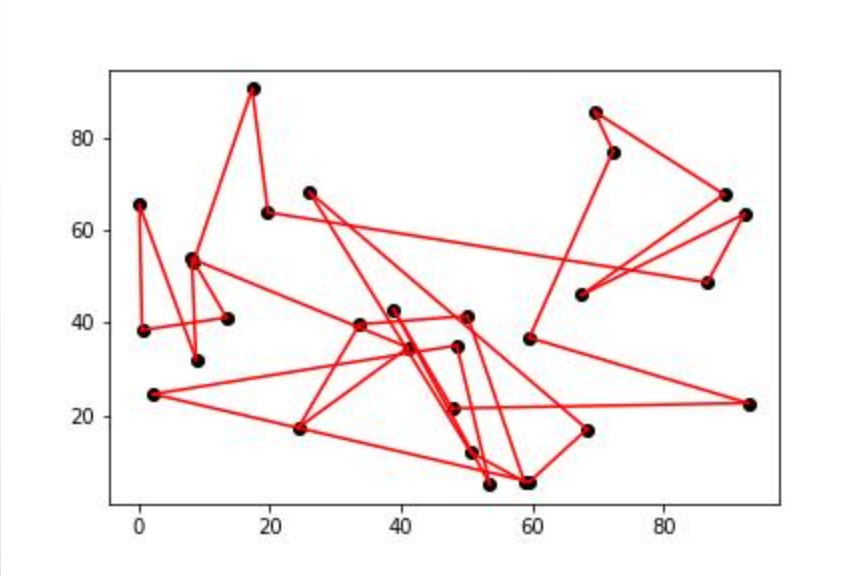

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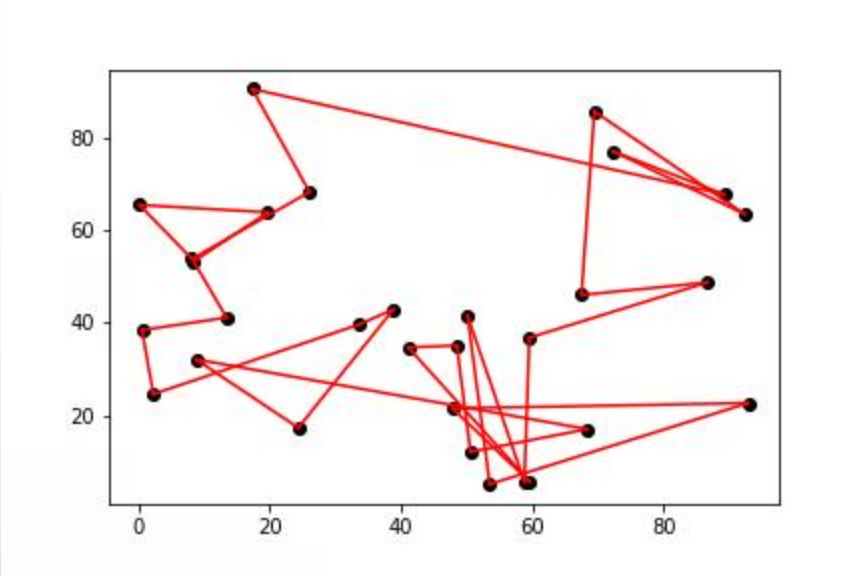

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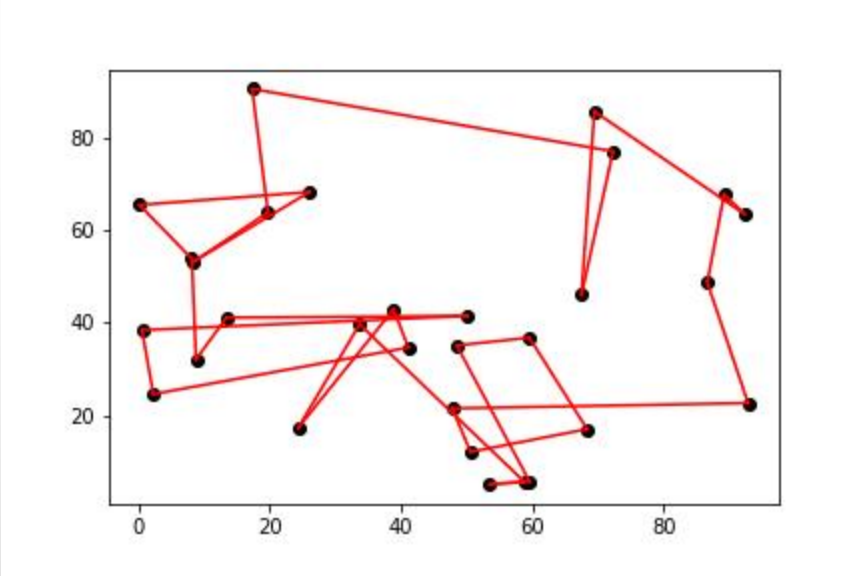

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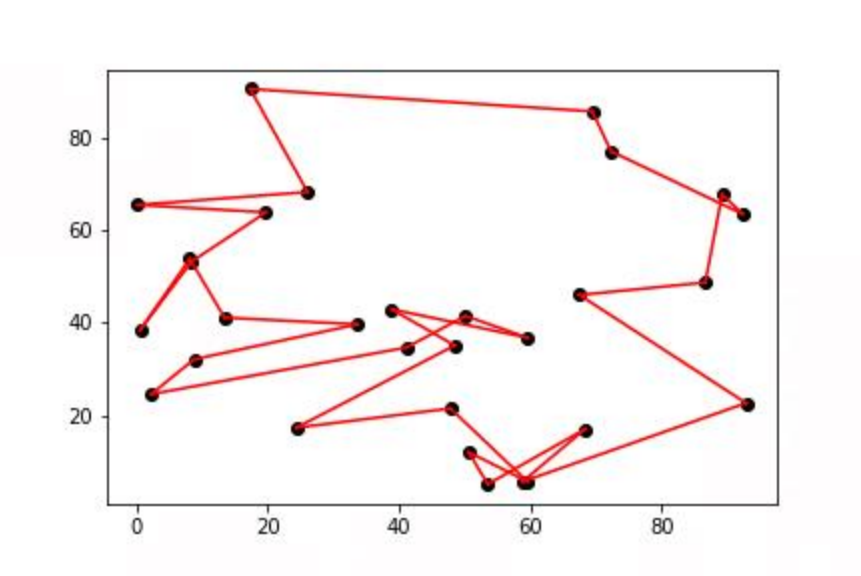

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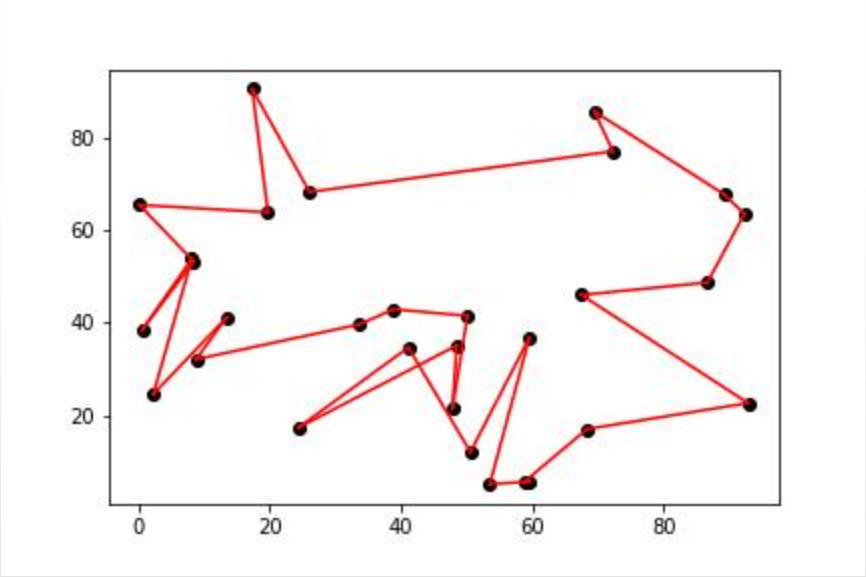

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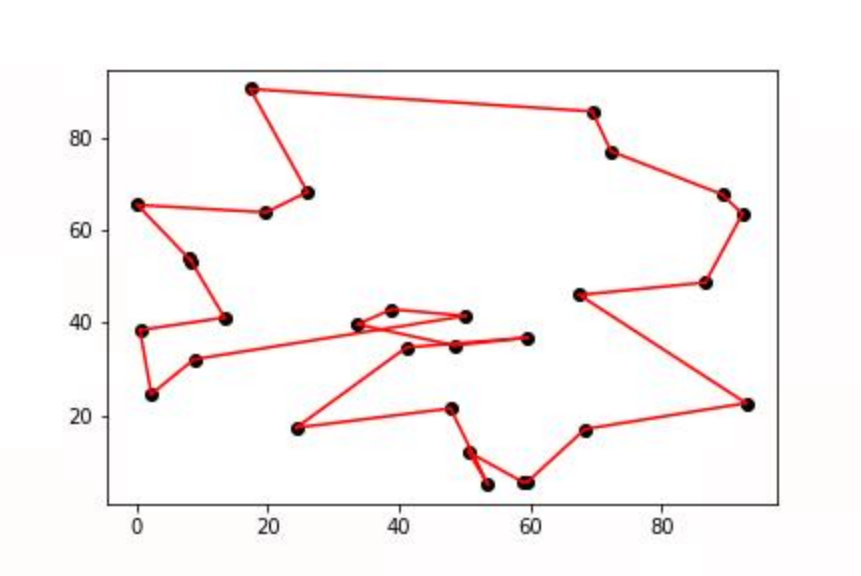

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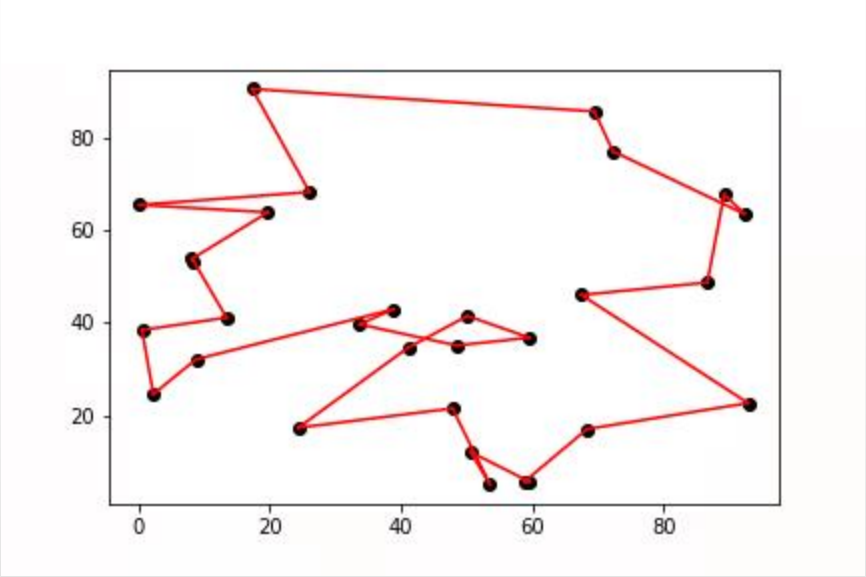

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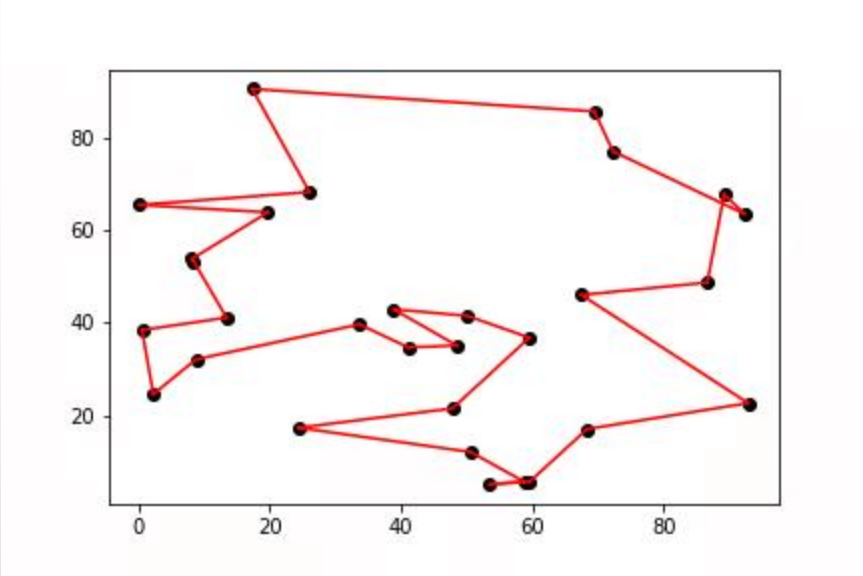

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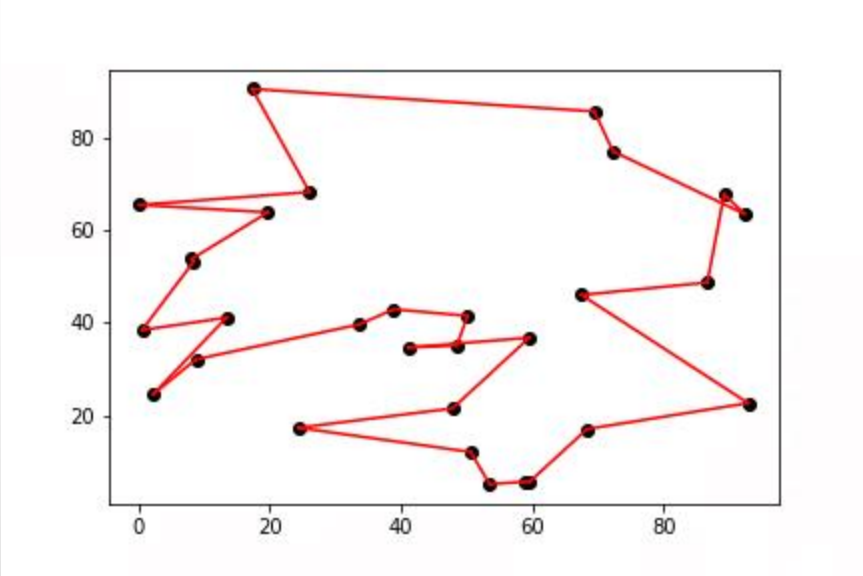

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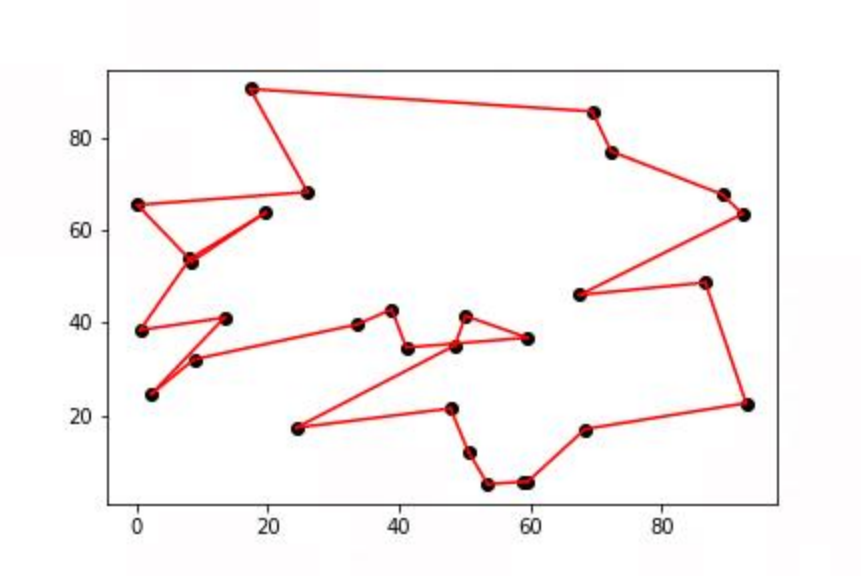

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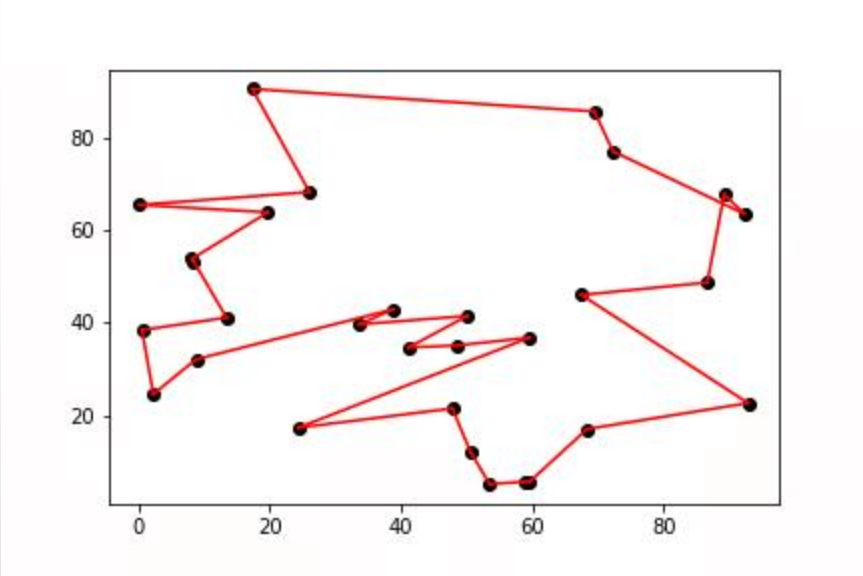

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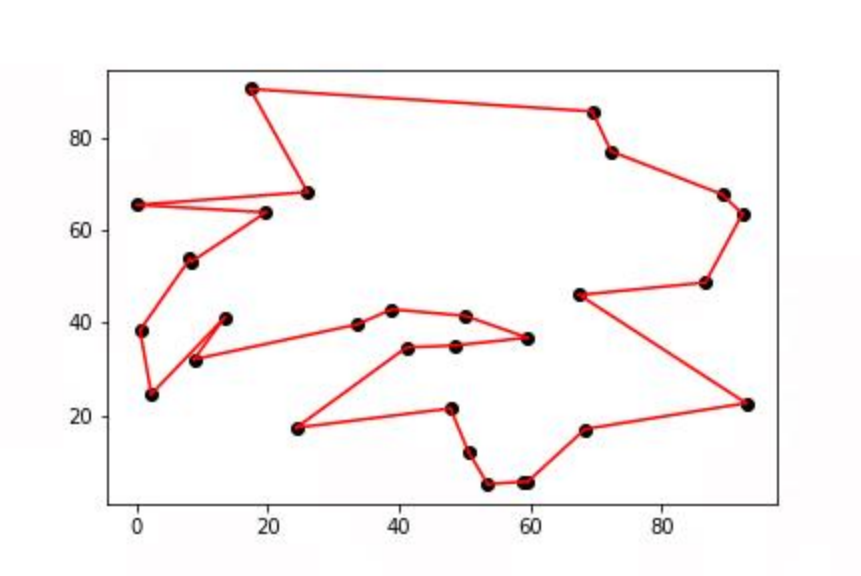

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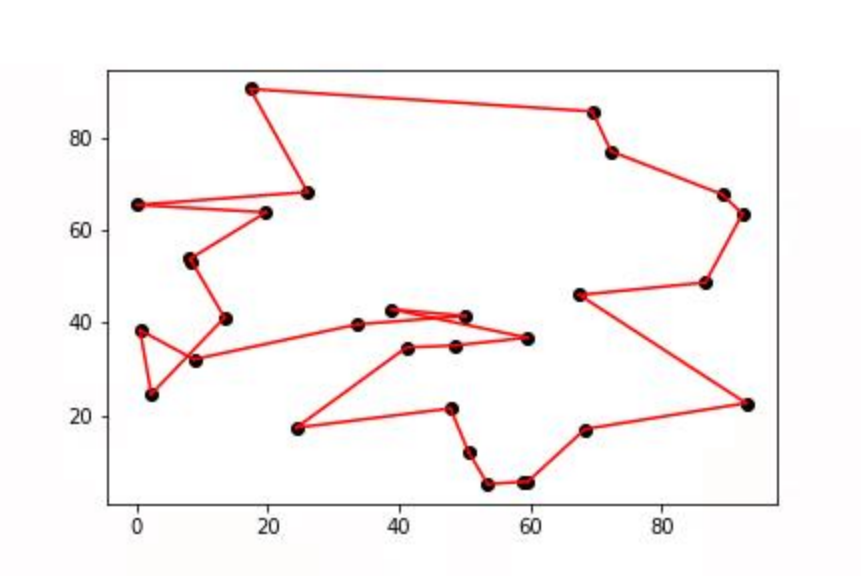

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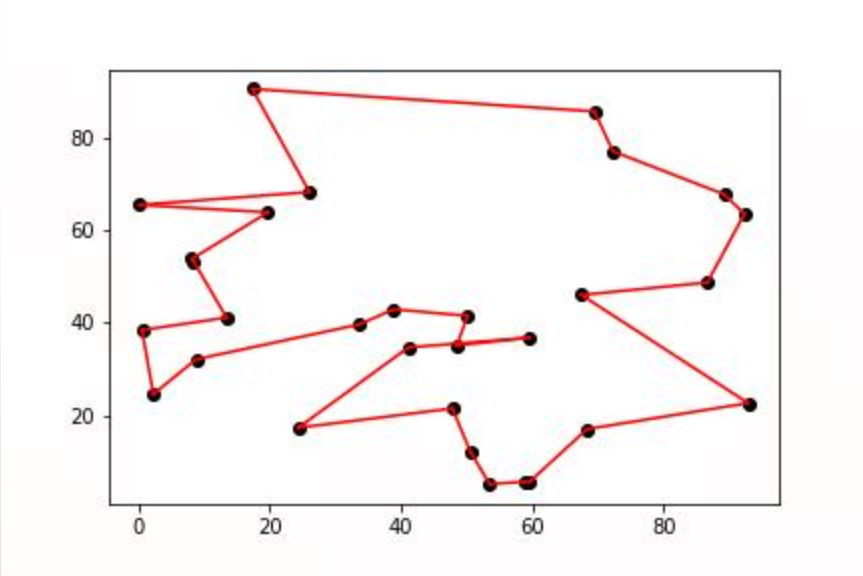

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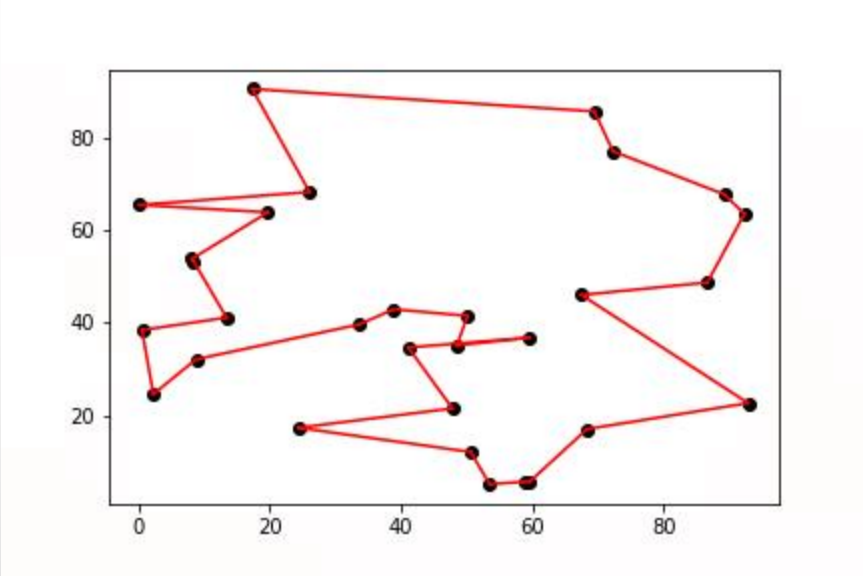

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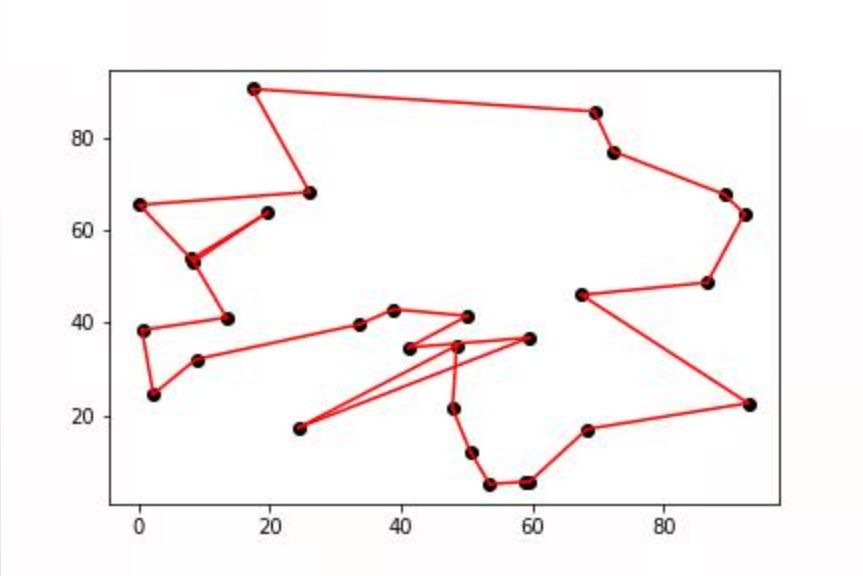

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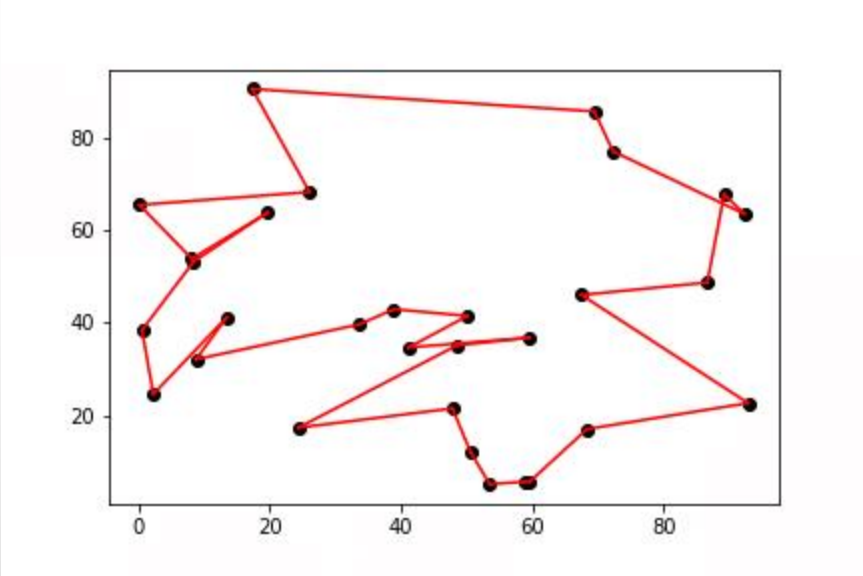

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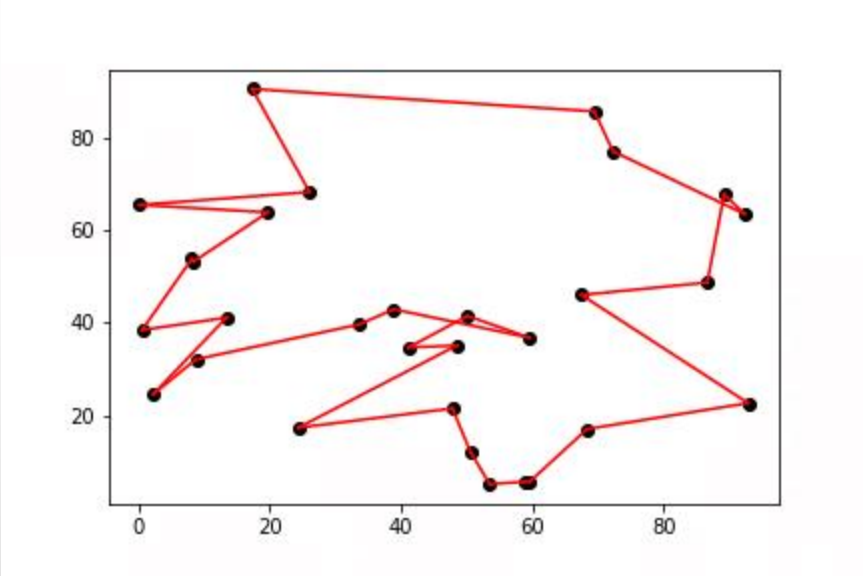

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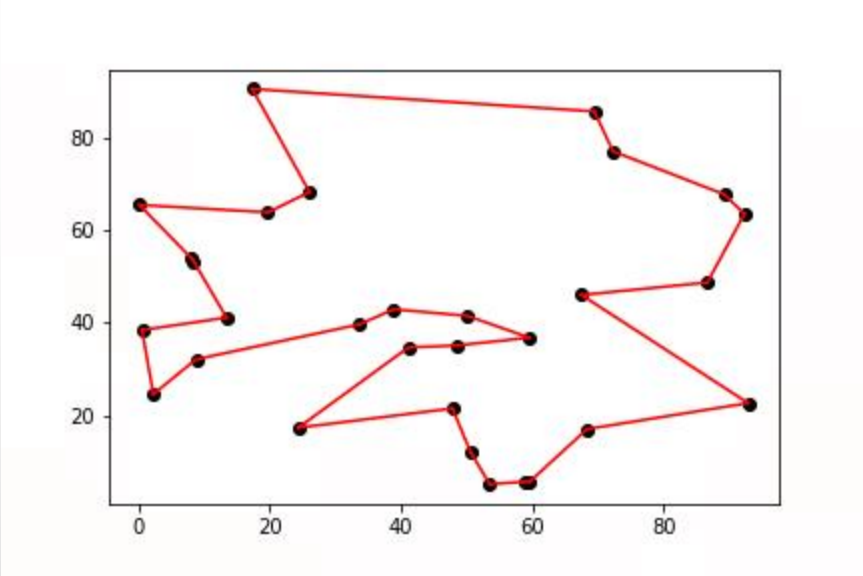
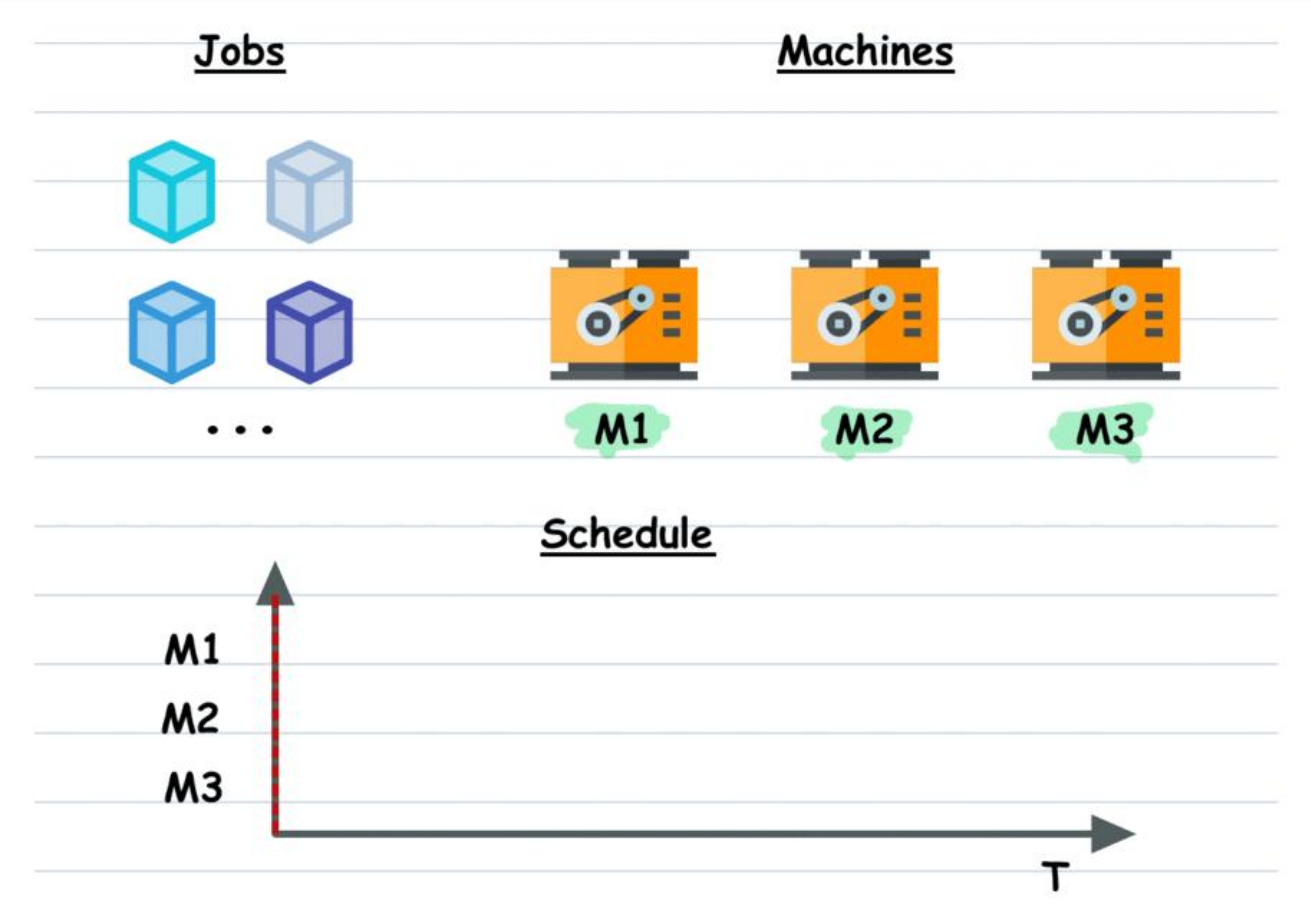


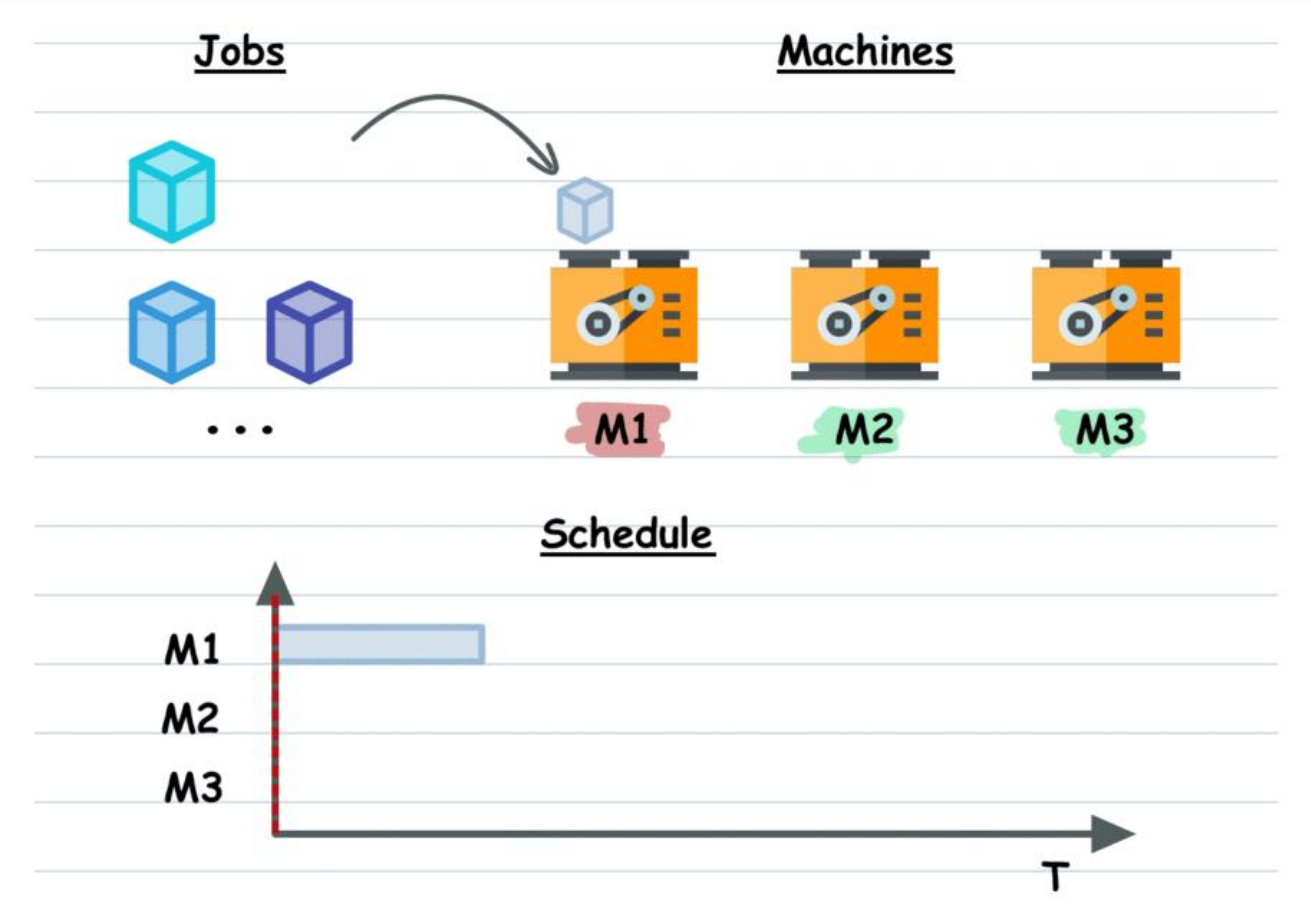
İş Çizelgeleme

- Optimizasyon Problemi:
  - Belirli kaynaklarla (örneğin, işçiler, makineler) işlerin en verimli şekilde planlanması.
- Amaç:
  - İşlerin tamamlanma süresini minimize etmek veya
  - Belirli kriterlere göre optimize etmek.

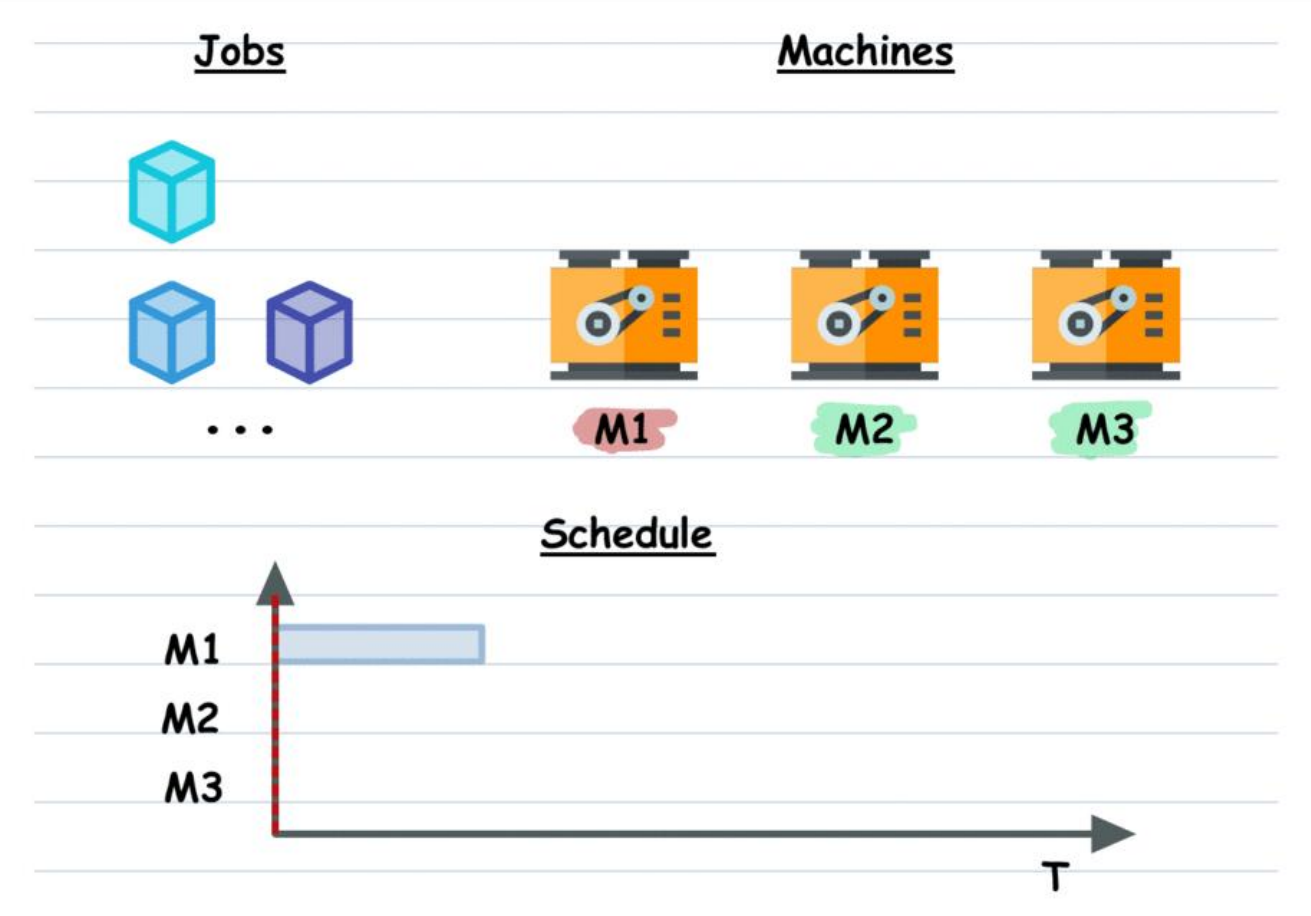
Job Scheduling



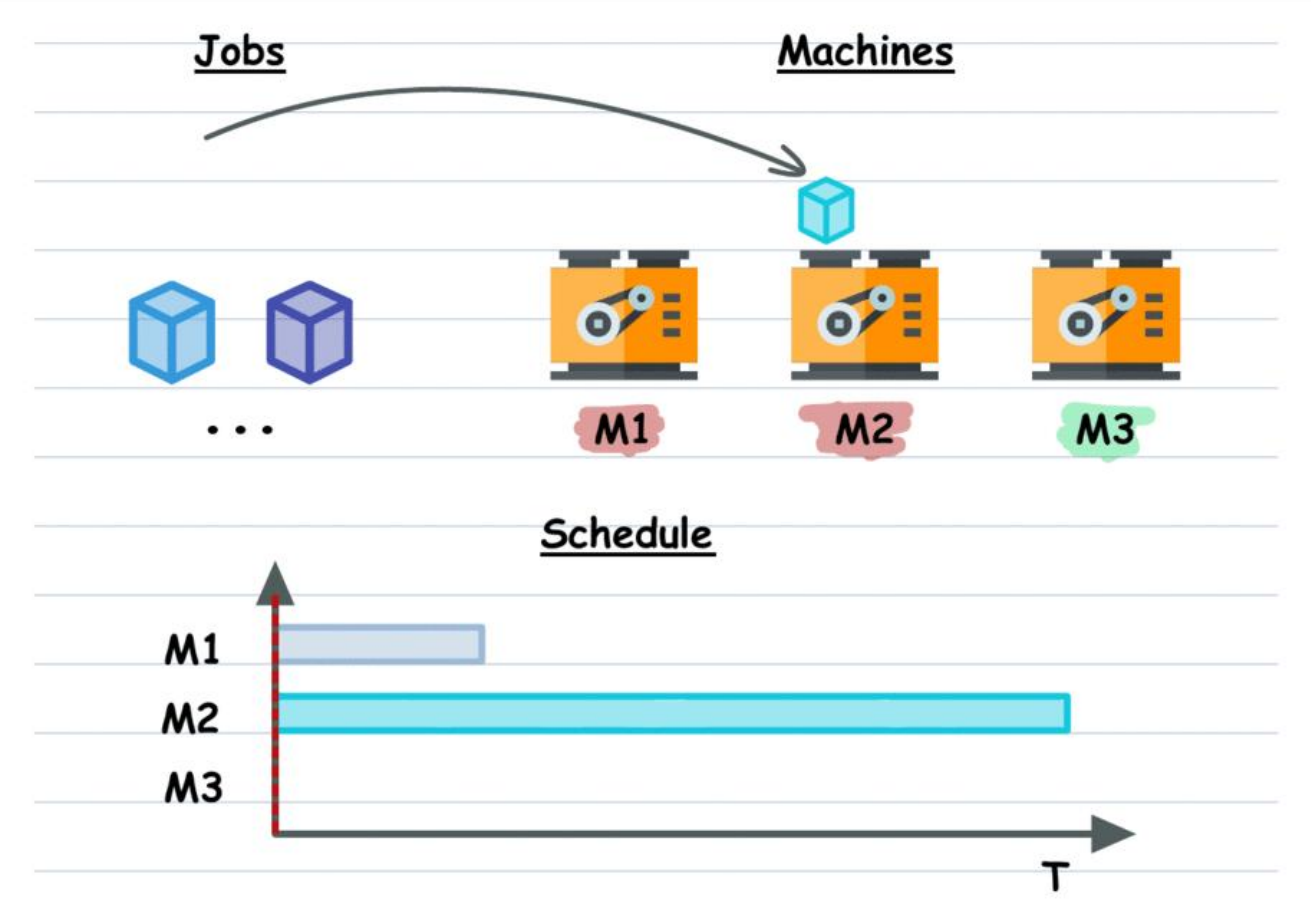
Job Scheduling



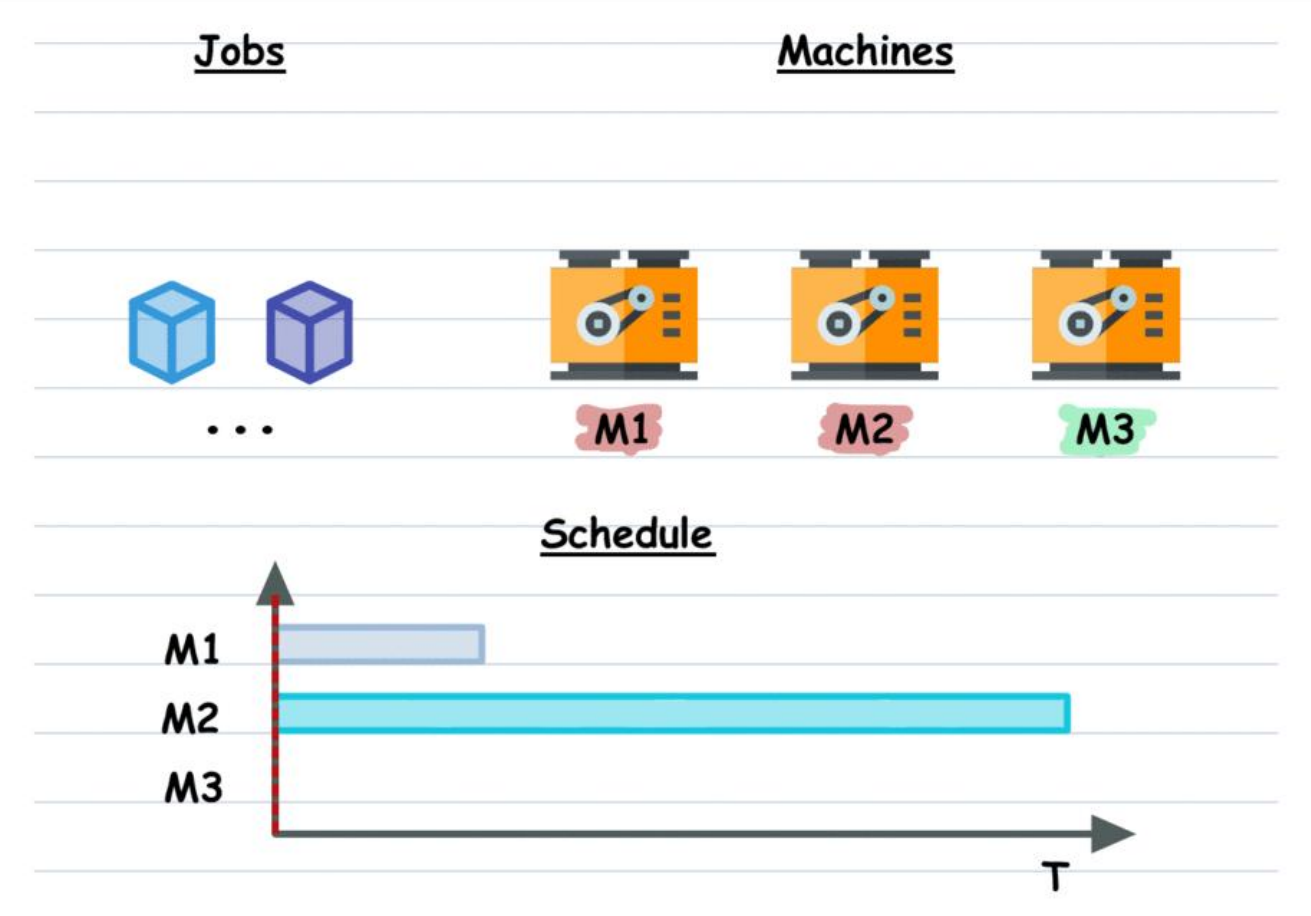
Job Scheduling



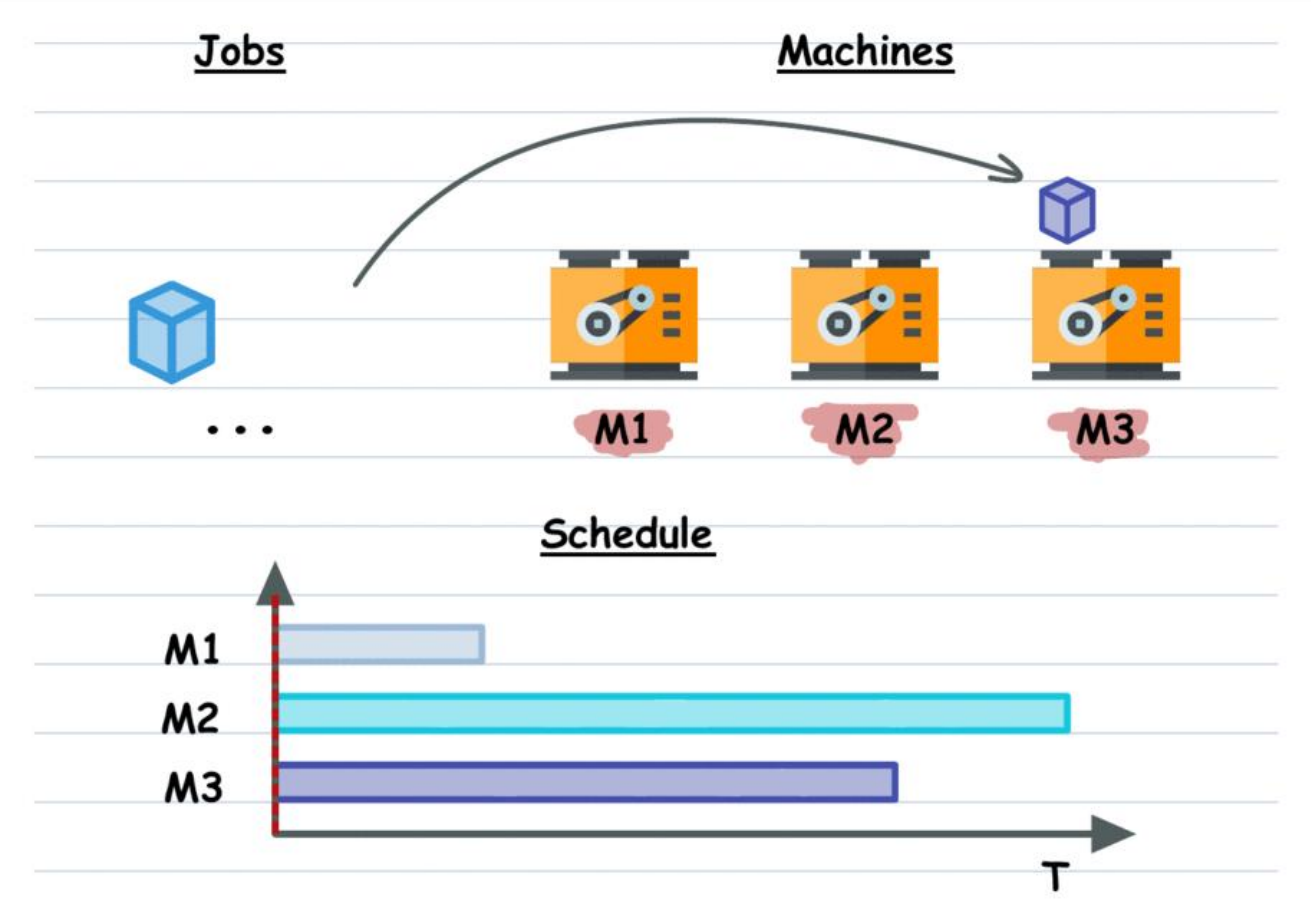
Job Scheduling



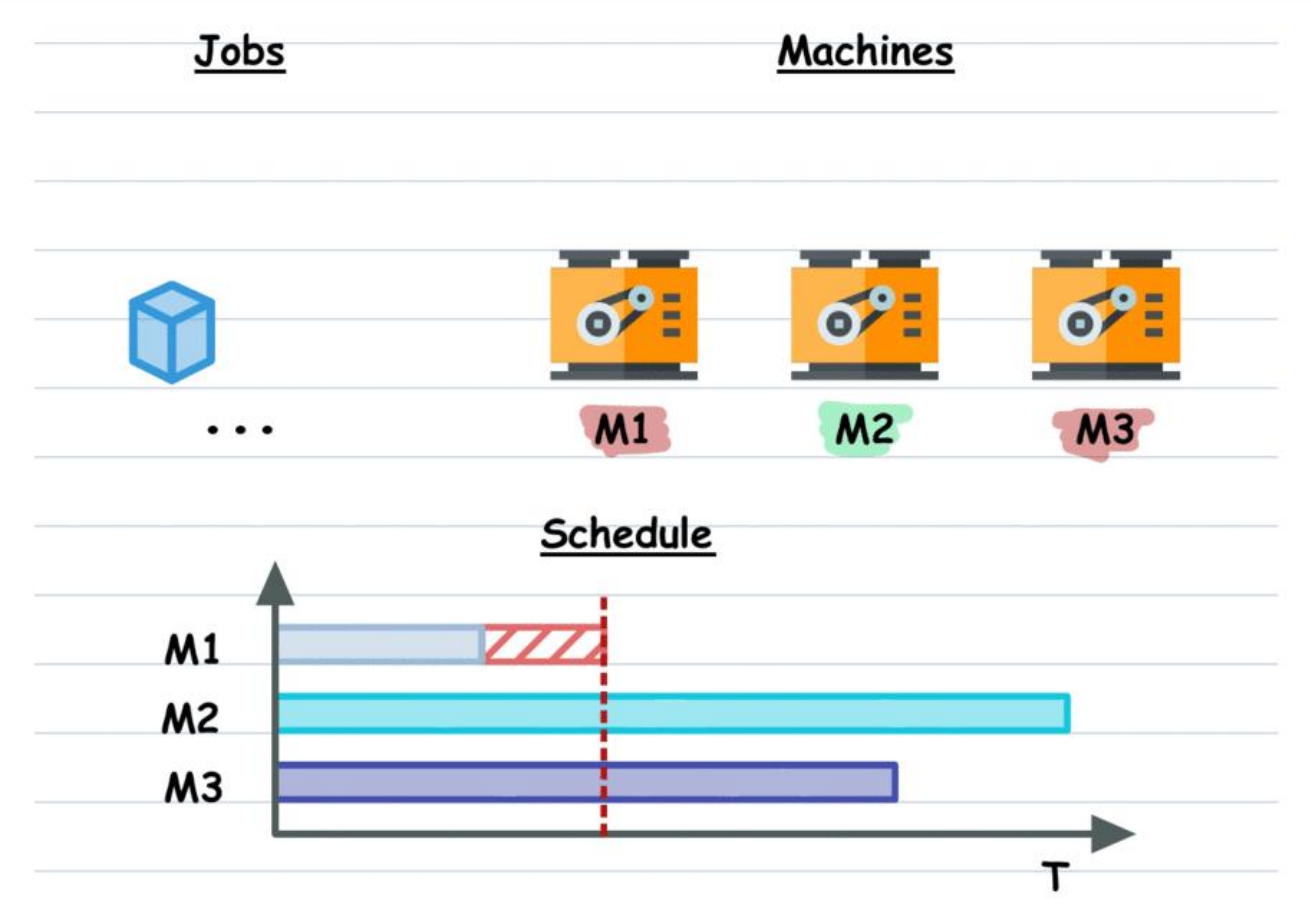
Job Scheduling



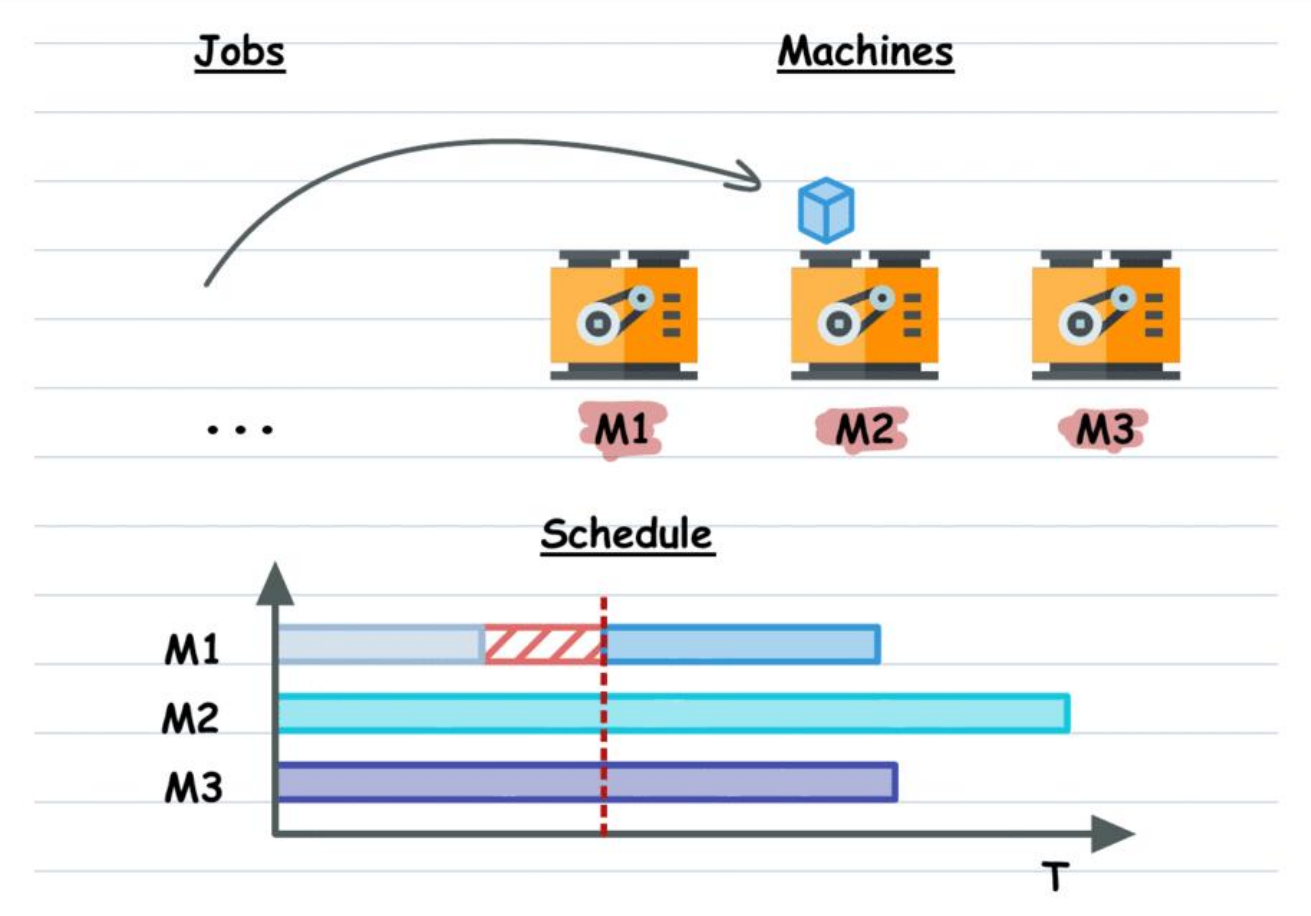
Job Scheduling



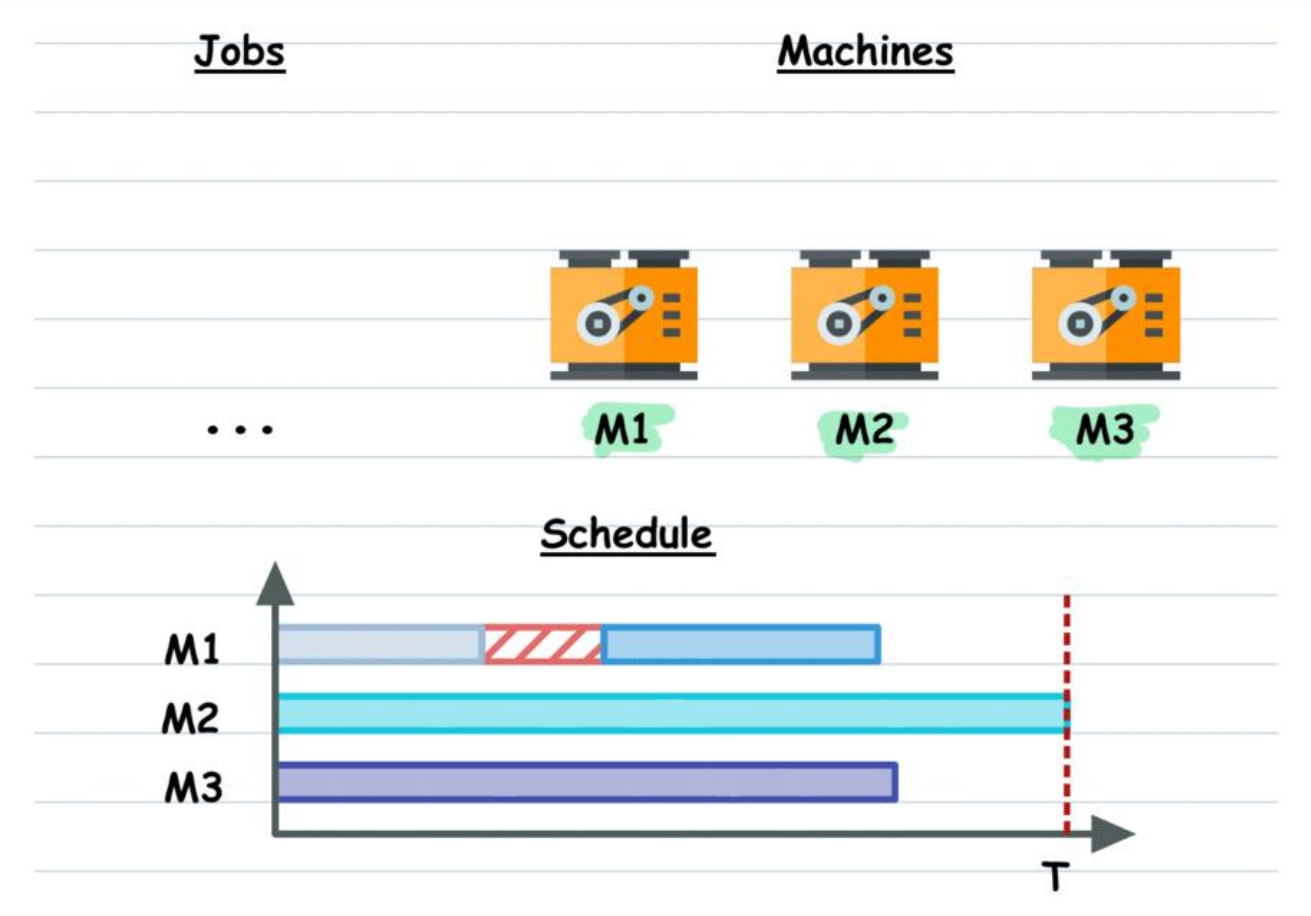
Job Scheduling



Job Scheduling



Job Scheduling



Job Scheduling

Job ID	Profit	Deadline
3	40	2
4	30	2
1	20	4
2	10	1

-1	-1	-1	-1

Job Scheduling

Job ID	Profit	Deadline
3	40	2
4	30	2
1	20	4
2	10	1

-1	3	-1	-1

Profit = 40

Job Scheduling

Job ID	Profit	Deadline
3	40	2
4	30	2
1	20	4
2	10	1

4	3	-1	-1

Profit = 40 + 30

Job Scheduling

Job ID	Profit	Deadline
3	40	2
4	30	2
1	20	4
2	10	1

4	3	-1	1

Profit = 40 + 30 + 20

Job Scheduling

Job ID	Profit	Deadline
3	40	2
4	30	2
1	20	4
2	10	1

4	3	-1	1

Profit = 40 + 30 + 20 + 0*

*cannot be performed

Düğüm Kapsama

- Kapsama Problemi:
  - Bir çizgenin tüm kenarlarını kapsayacak en az sayıda düğümü seçme.
- Amaç:
  - Tüm kenarları en az düğümle kapsayan kümeyi bulmak.

Düğüm Kapsama

- Çizge:
  - Düğümler: A, B, C, D
  - Kenarlar: (A, B), (A, C), (B, C), (B, D), (C, D)
- Düğüm Kapsama Kümesi:
  - {A, B, C}

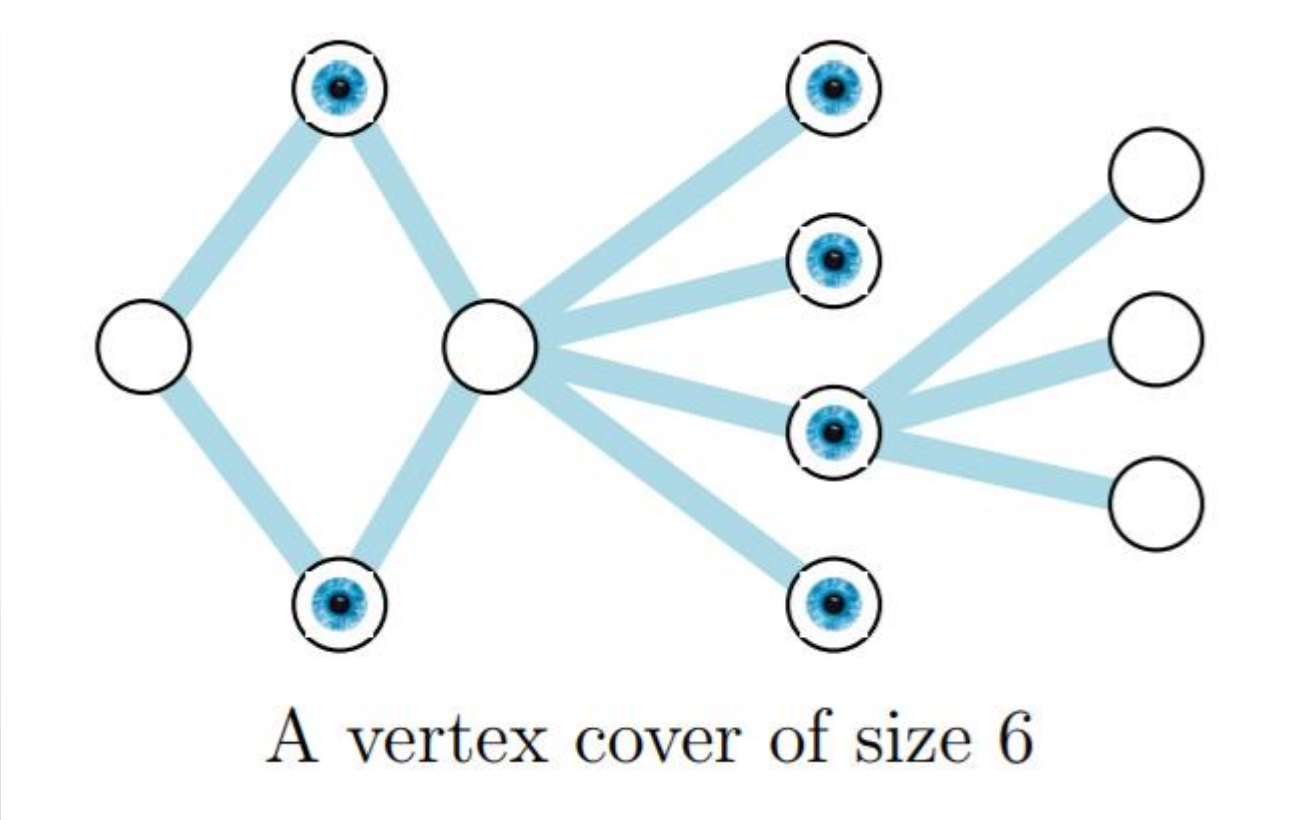
Çözüm

- Tam Çözüm:
  - Tüm olası düğüm kümelerini kontrol etmek.
- Yaklaşık Çözümler:
  - Greedy algoritmalar, Approximation algoritmaları, ...
- Optimizasyon Araçları:
  - Lineer Programlama, Branch and Bound, ...

Düğüm Kapsama Algoritması

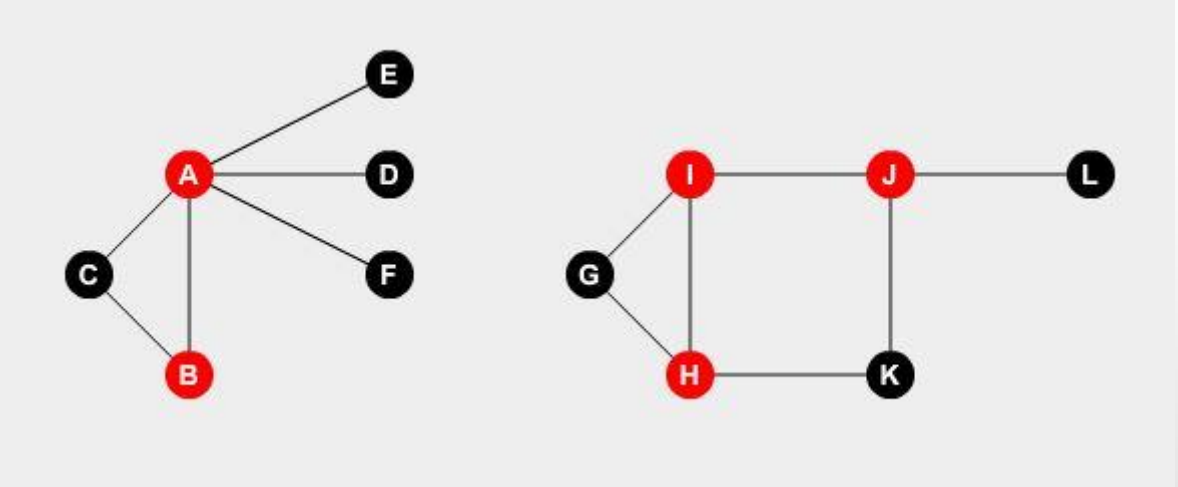
- Başlangıçta boş bir kapsama kümesi oluştur.
- Bir kenarı kapsayan düğümlerden birini seç ve kapsama kümesine ekle.
- Tüm kenarlar kapsayana kadar tekrarla.

Vertex Cover

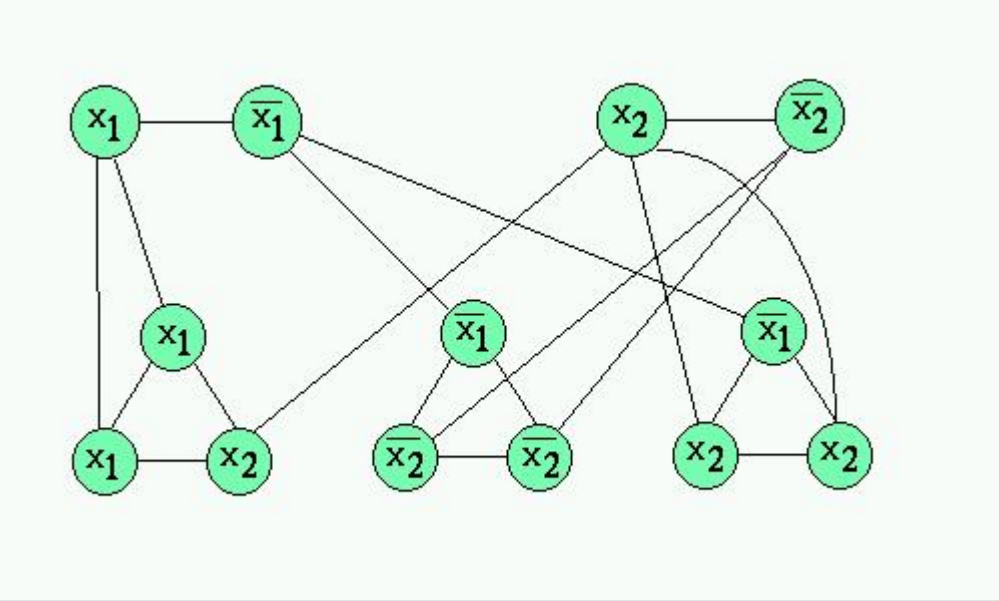


A vertex cover of size 6

Vertex Cover



Vertex Cover



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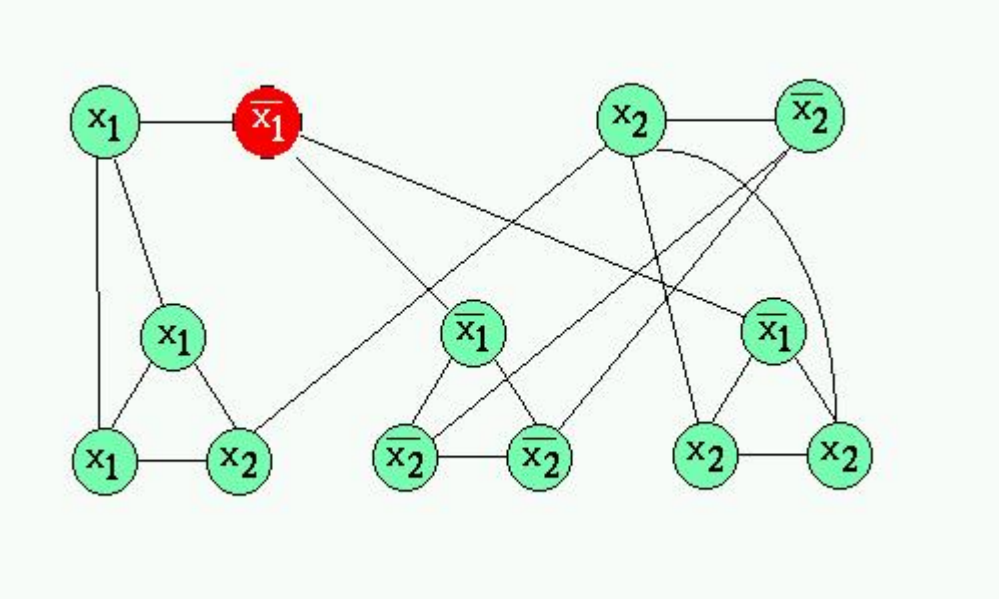

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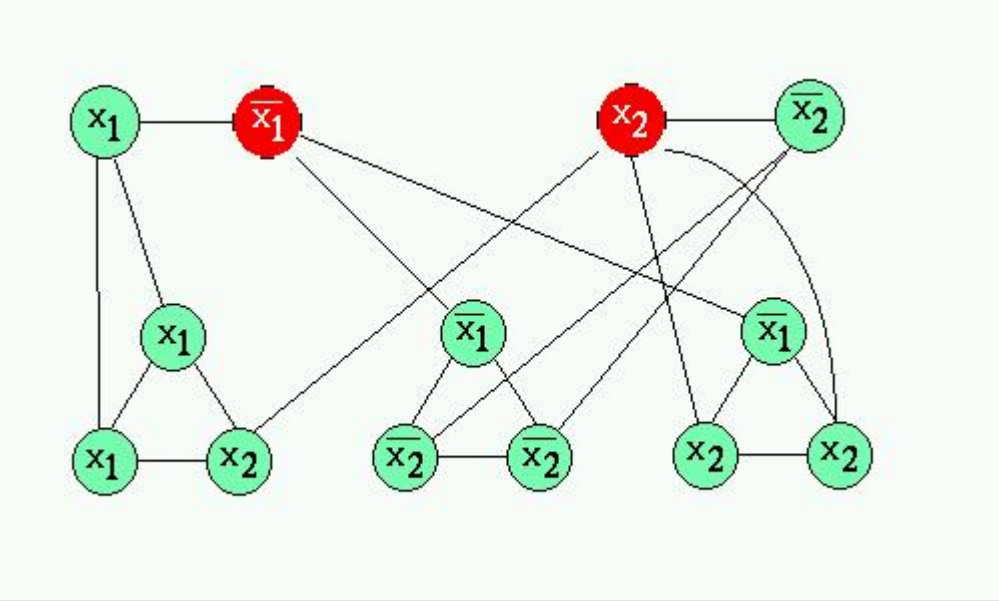

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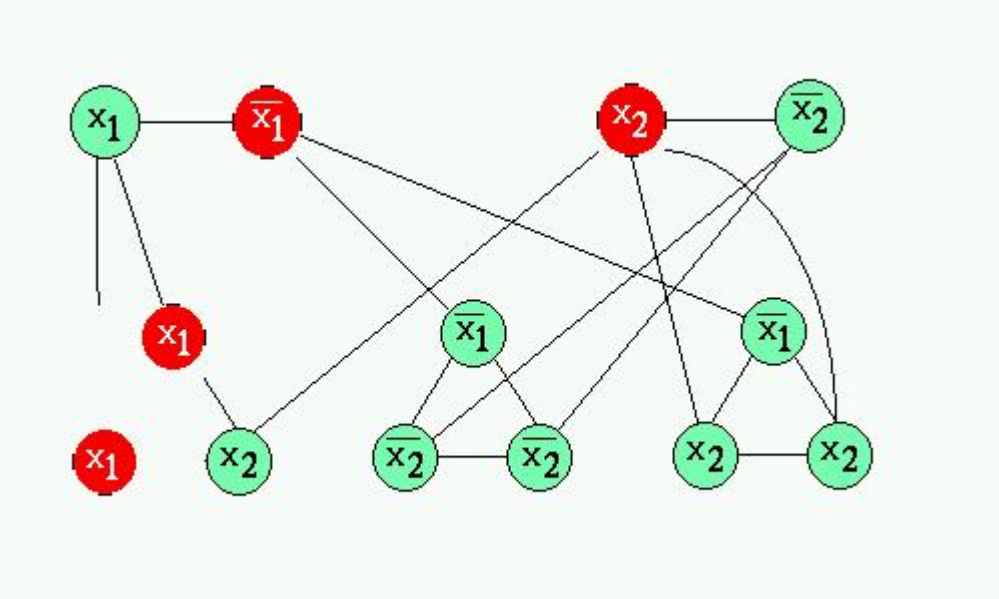

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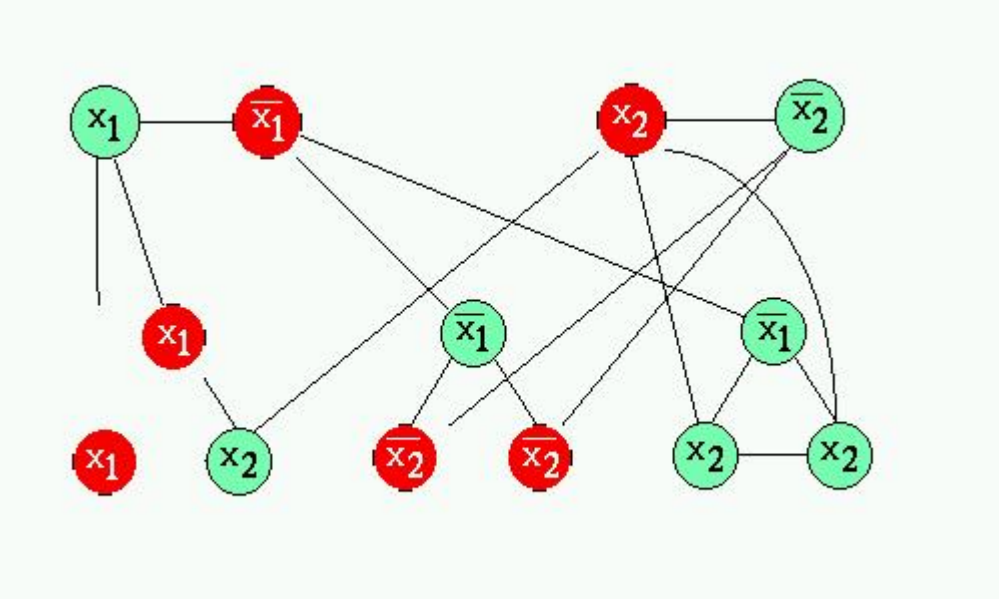

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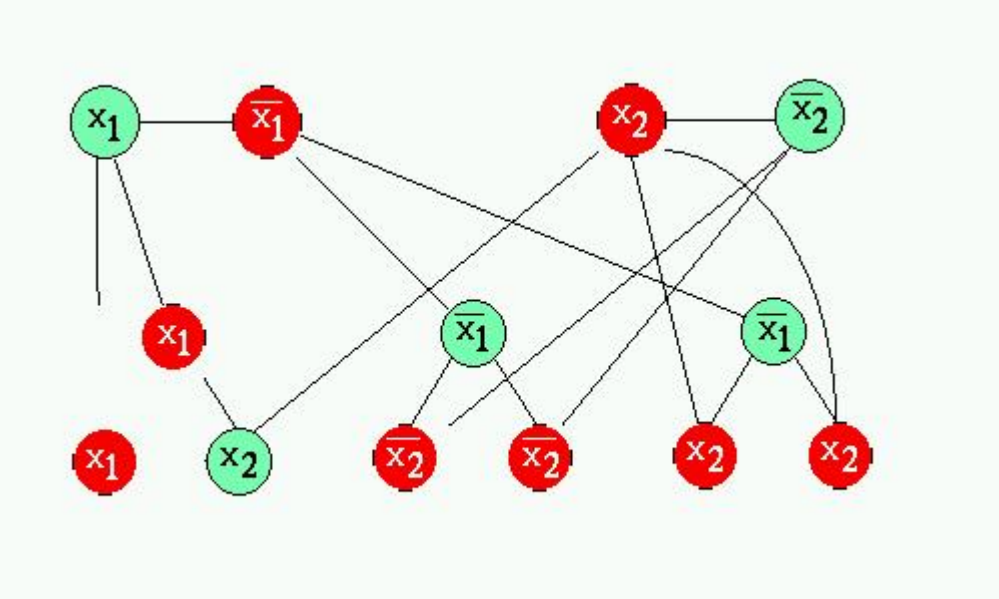


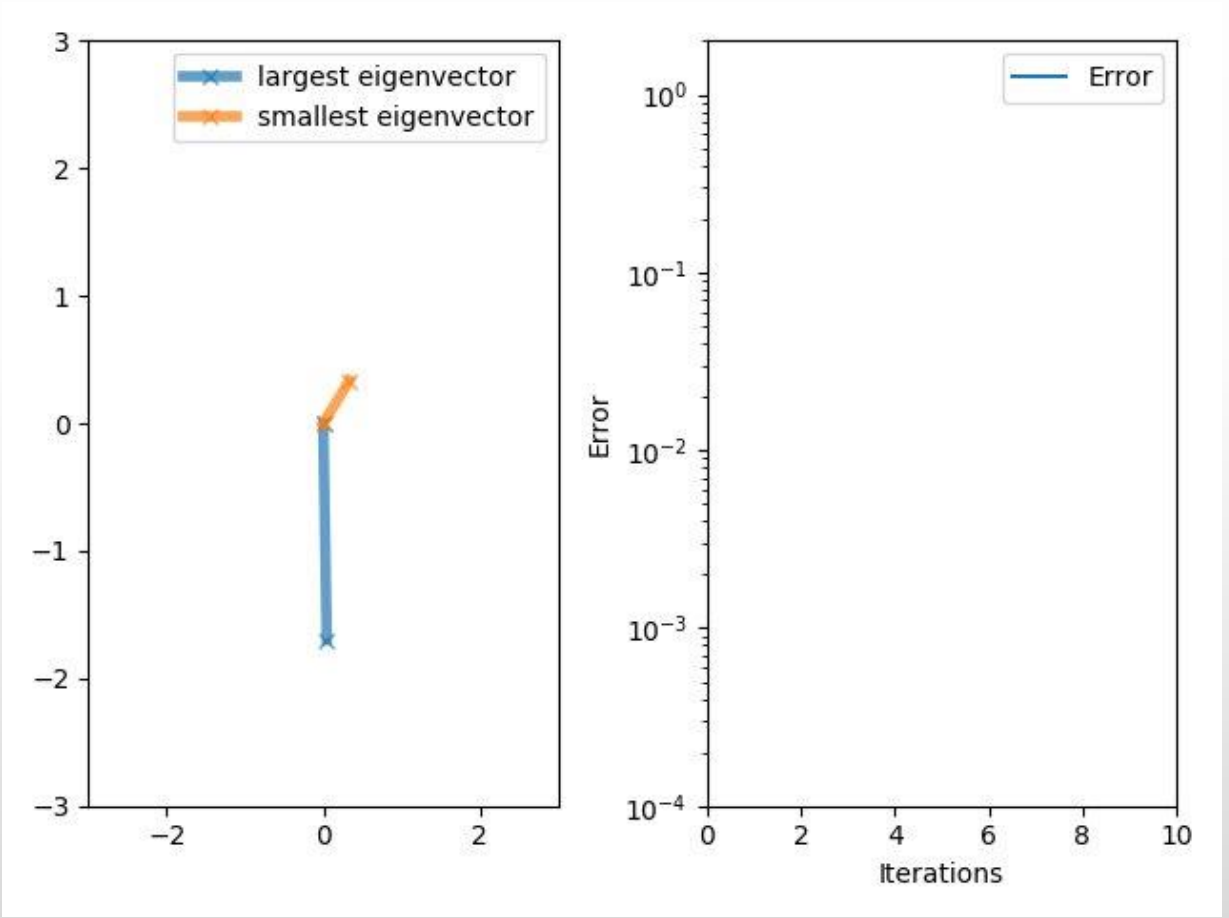
Power Iteration Algoritması

- Bir matrisin en büyük (mutlak değeri en büyük) özdeğerini ve buna ait bir özvektörü yaklaşık olarak hesaplamak için kullanılan iteratif bir yöntem.
- Bir matrisin özdeğerlerinin kesin bir şekilde hesaplanması yerine, sadece en büyük özdeğer ve buna ait bir özvektörün yaklaşık bir tahminini sağlar.
- Büyük boyutlu matrislerde etkilidir.

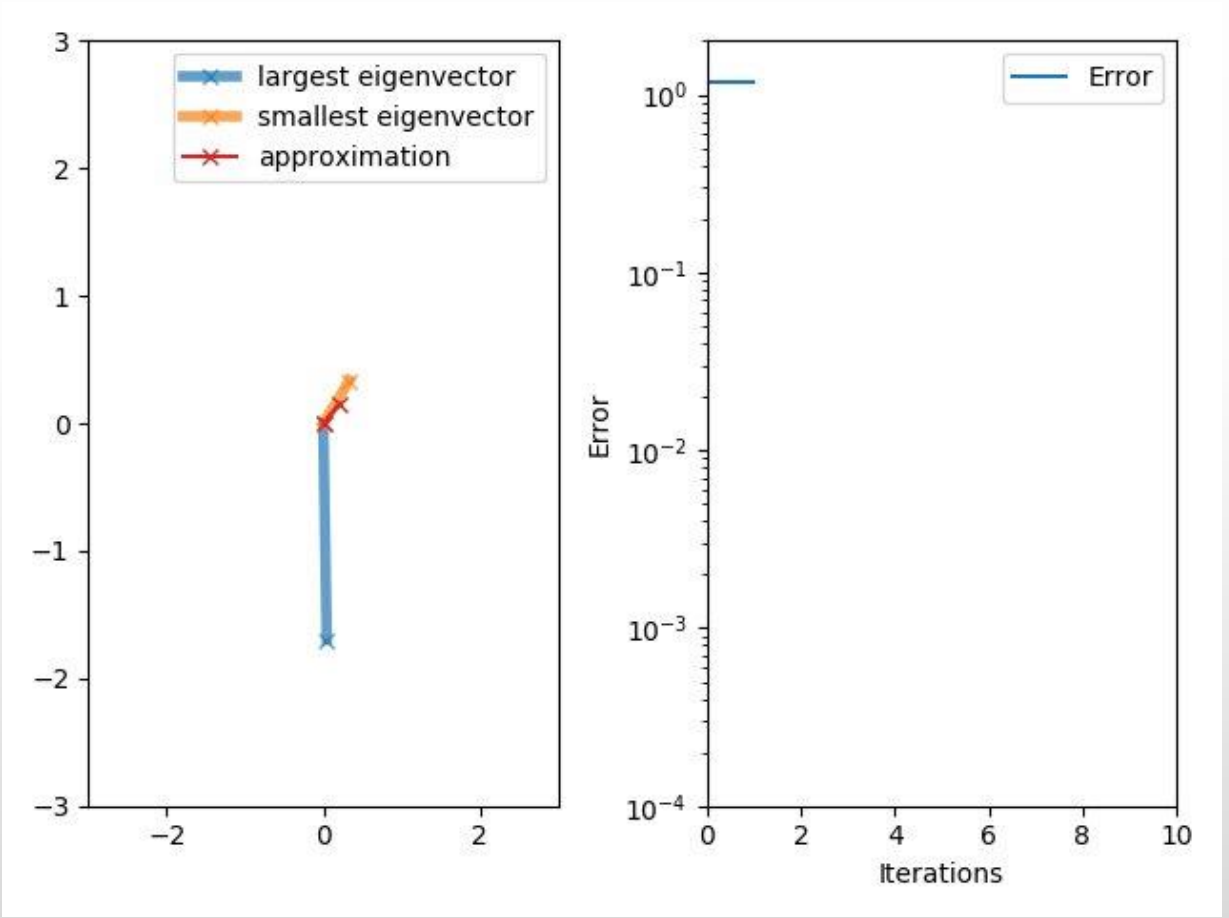
Power Iteration Algoritması

- İlk olarak, bir matris belirlenir ve rastgele bir başlangıç özvektörü seçilir.
- Başlangıç özvektörü, matrisle çarpılarak yeni bir özvektör elde edilir.
- Yeni vektör, normu (uzunluğu) 1'e normalleştirilir.
- Bu işlem, istenilen değer kez tekrarlanır.
- Matrisin en büyük özdeğeri ve bu özdeğere ait özvektör bulunmuş olur.

Power Iteration Algoritması



Power Iteration Algoritması



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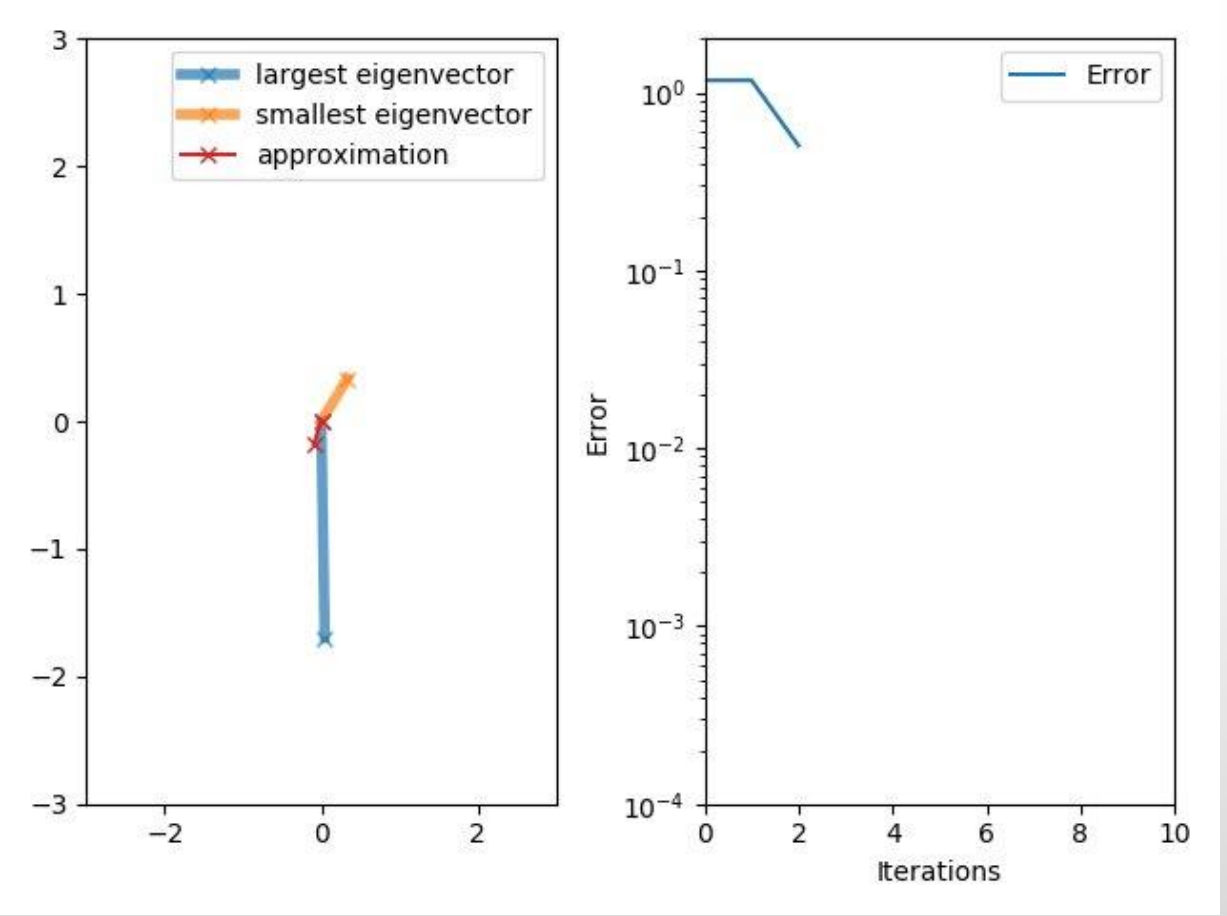

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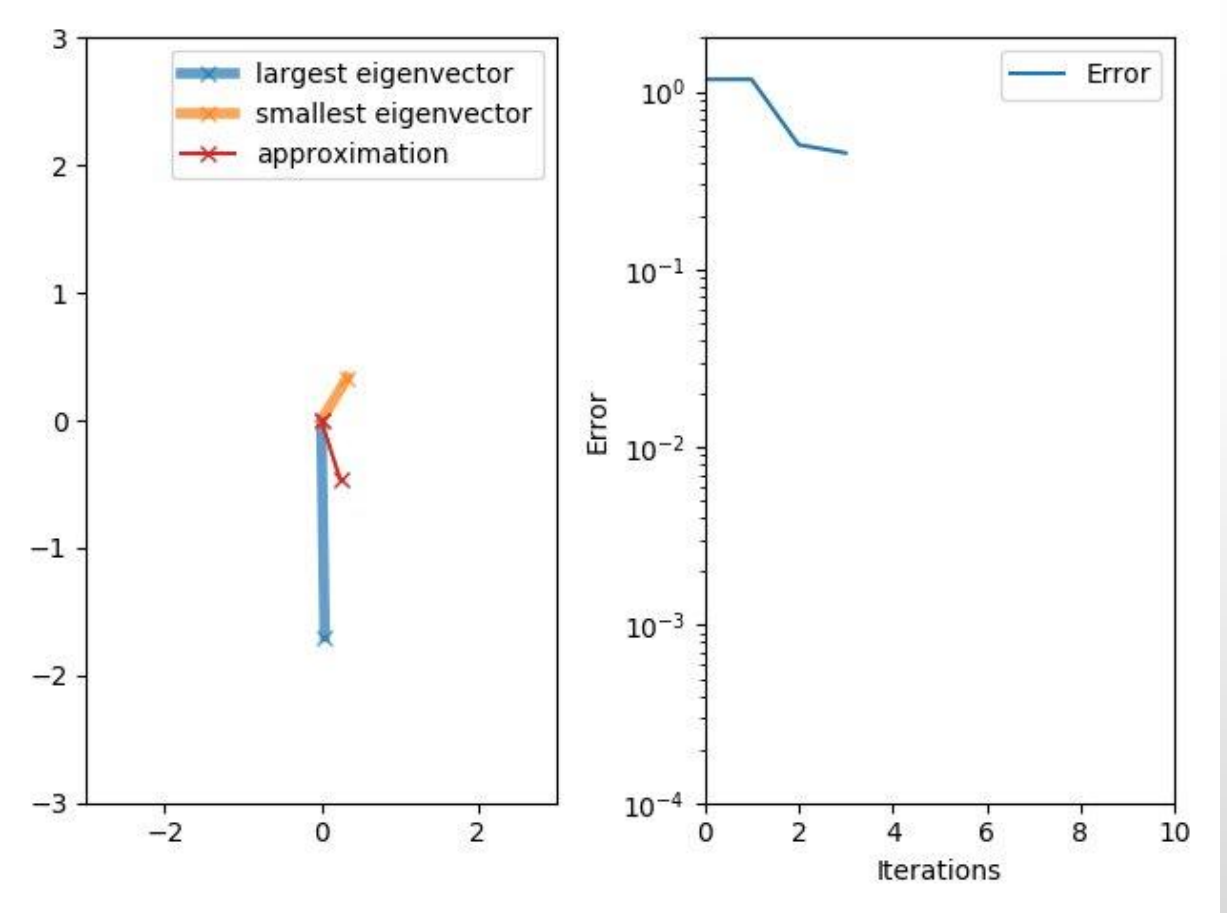

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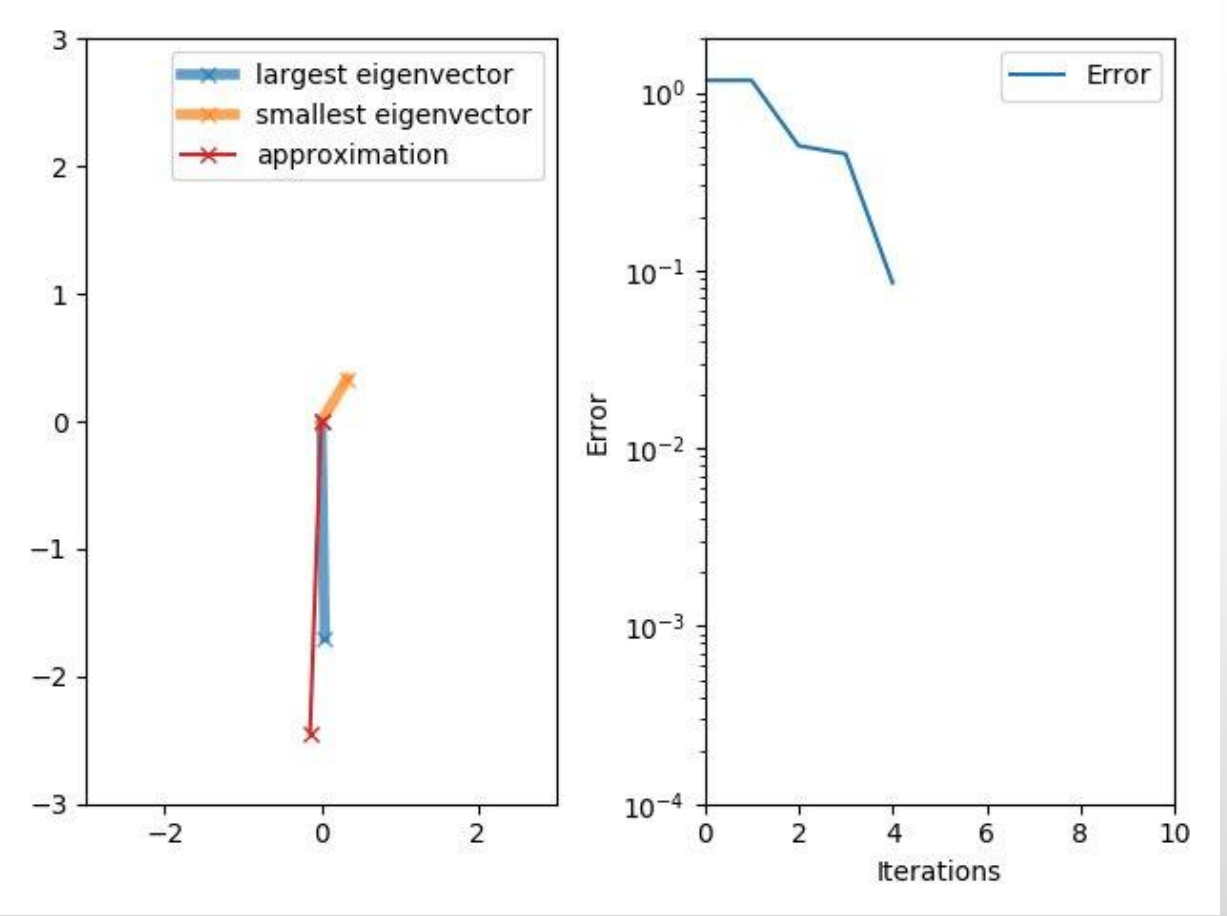

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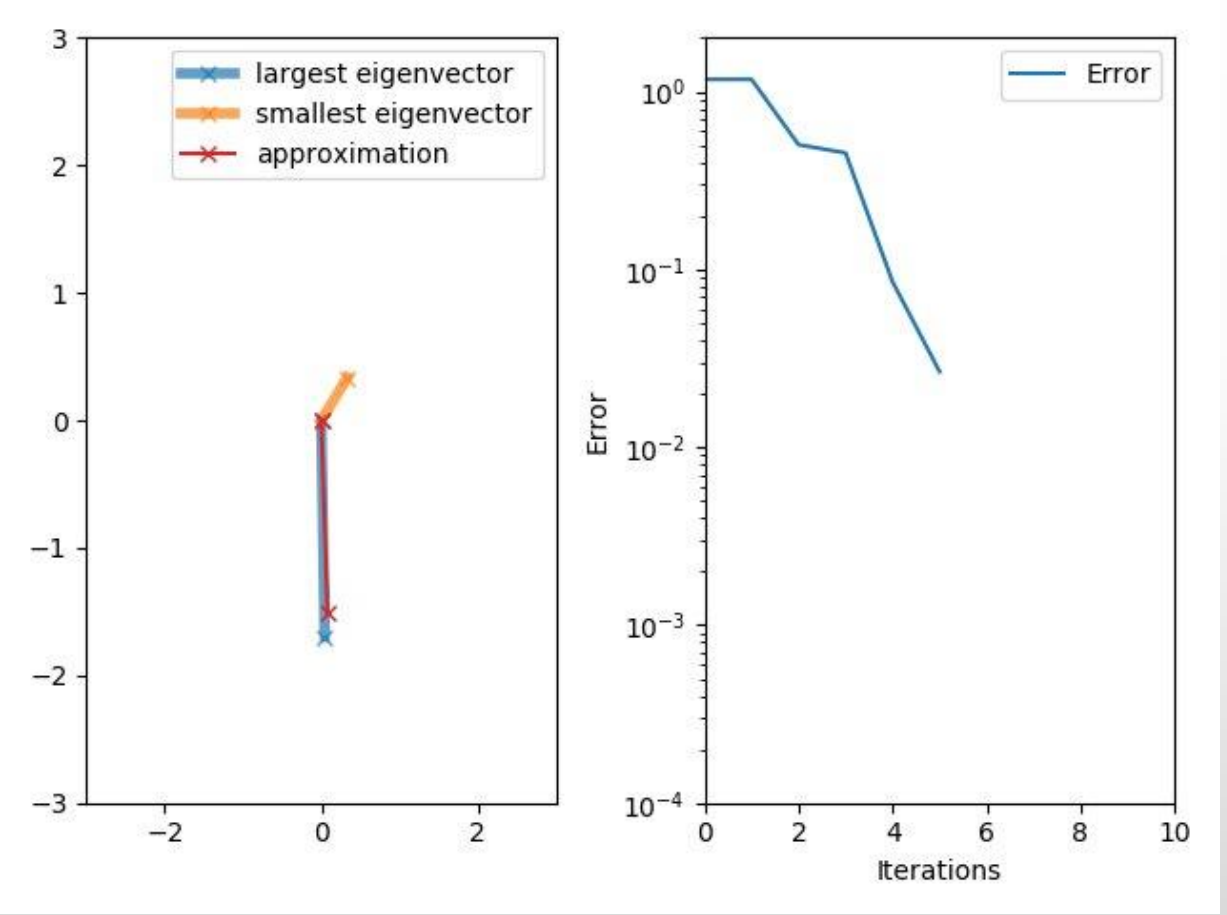

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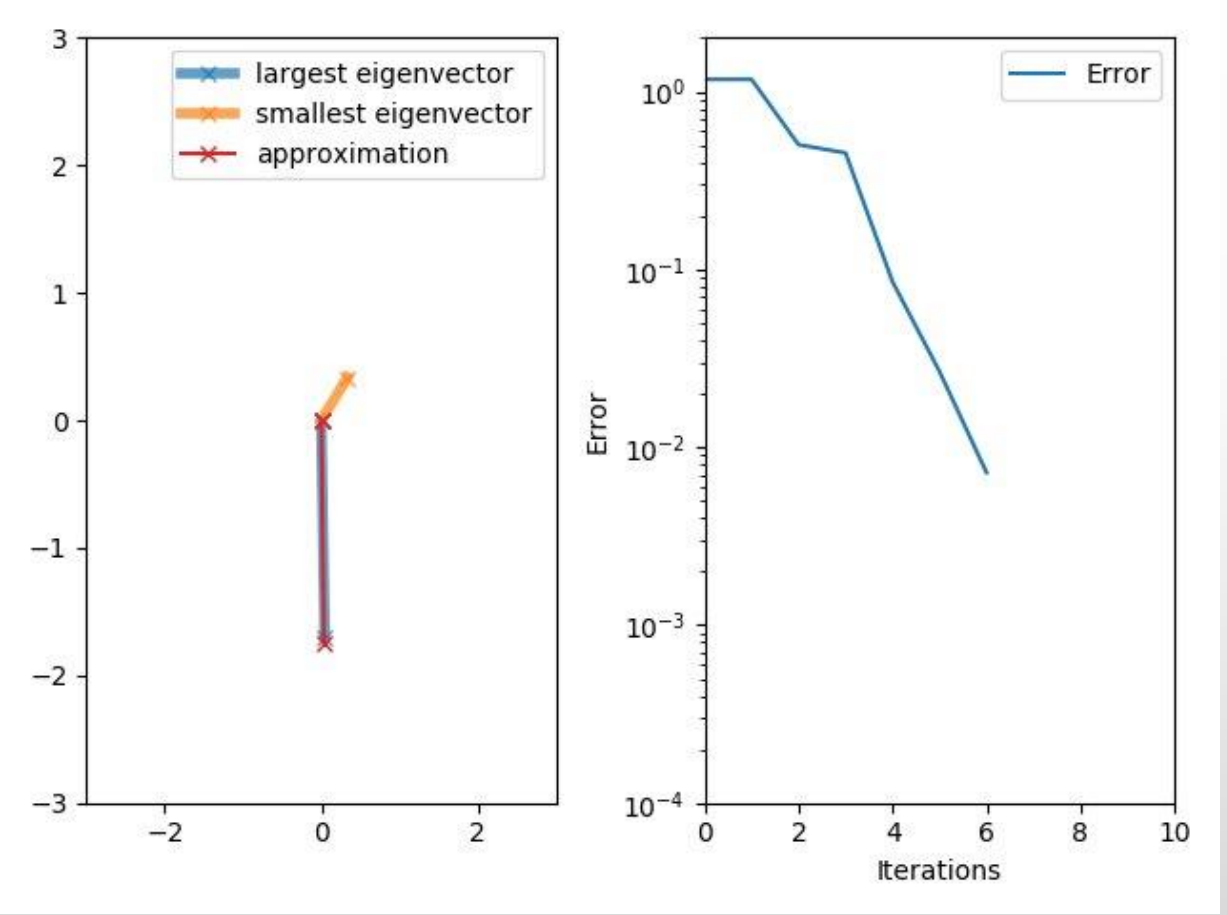
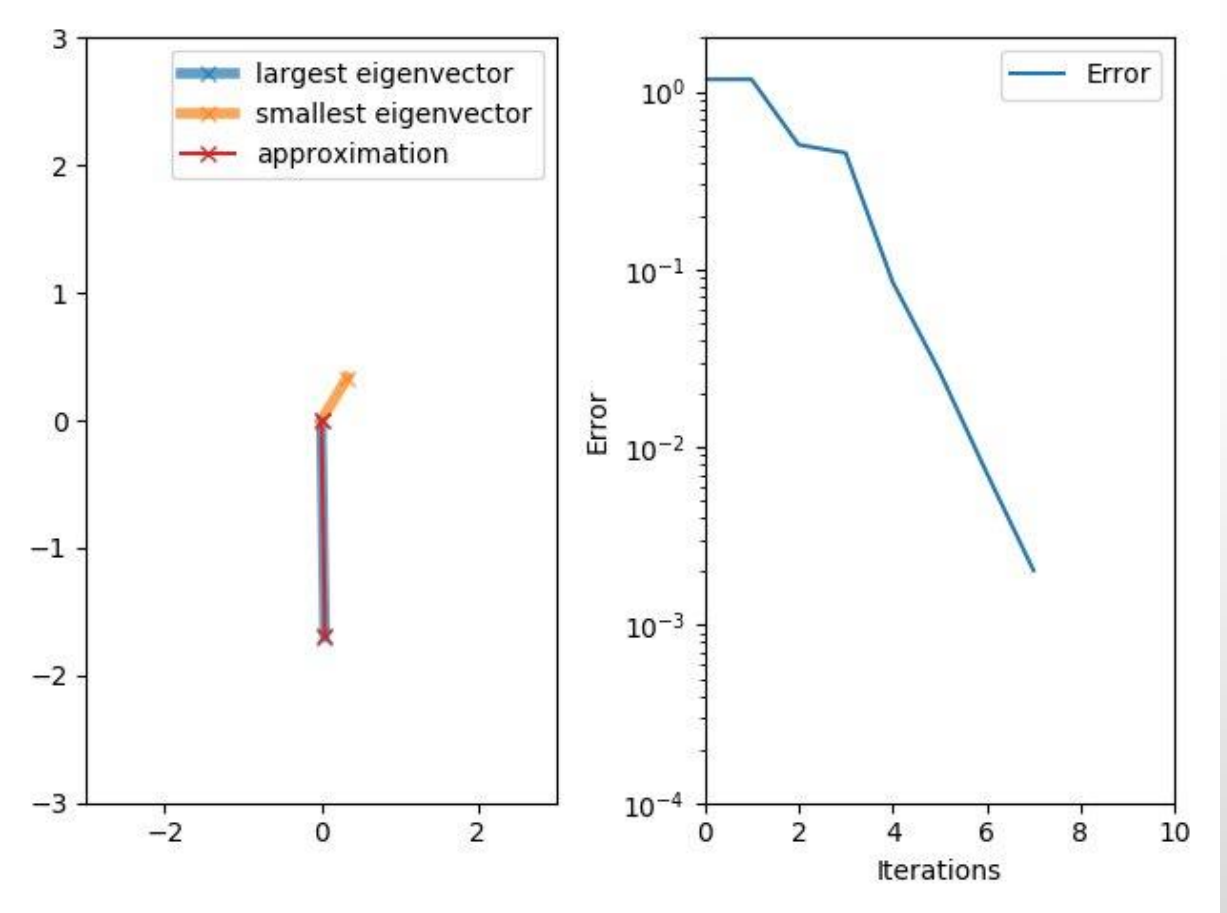


Power Iteration Algoritması



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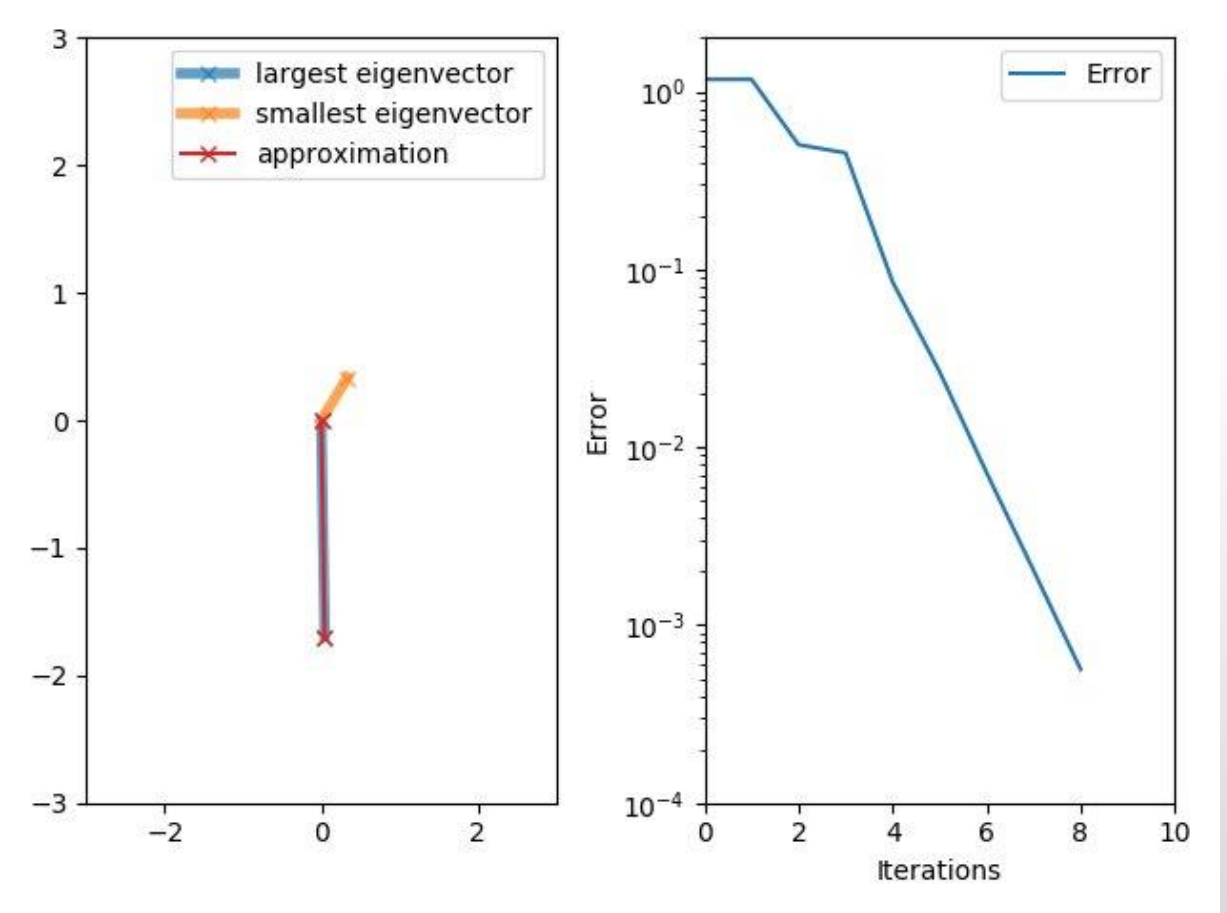

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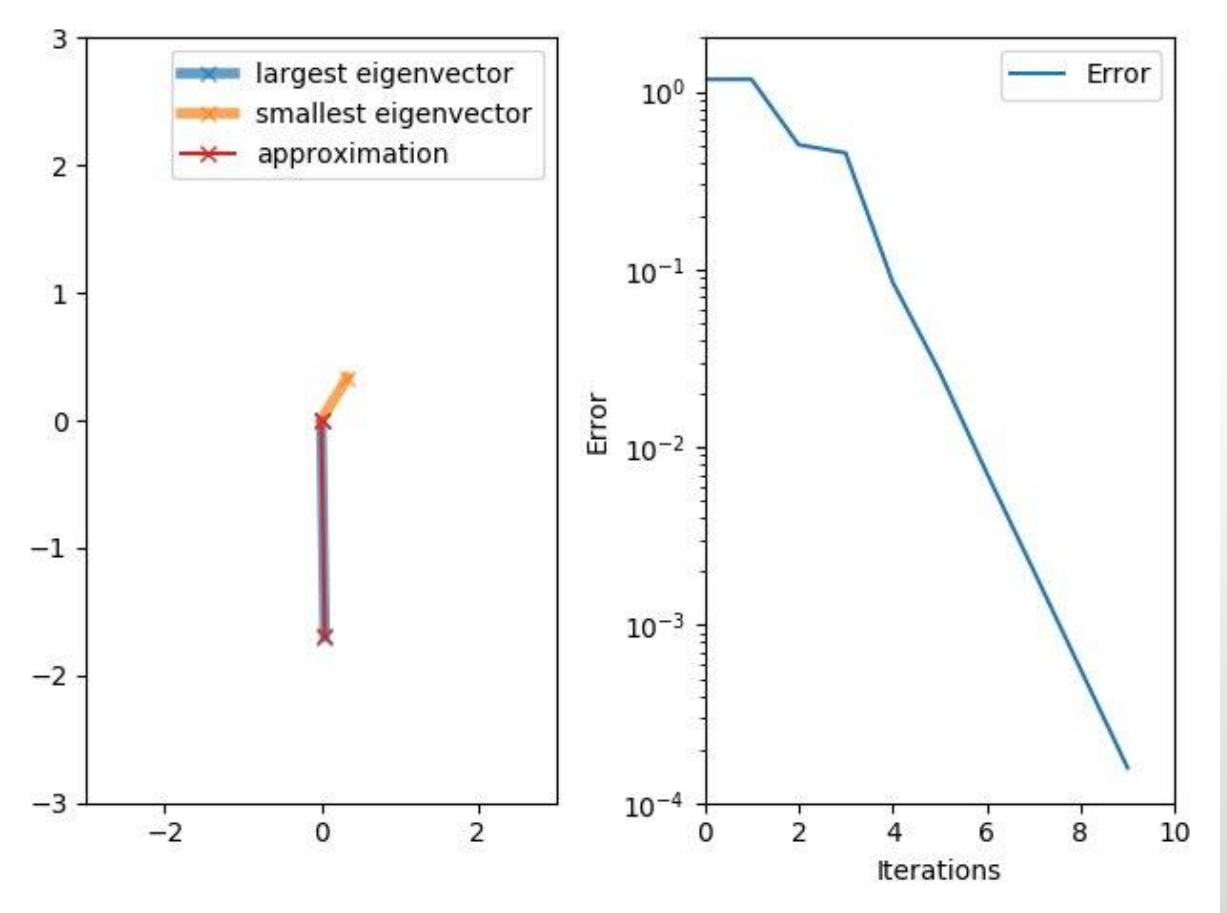

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