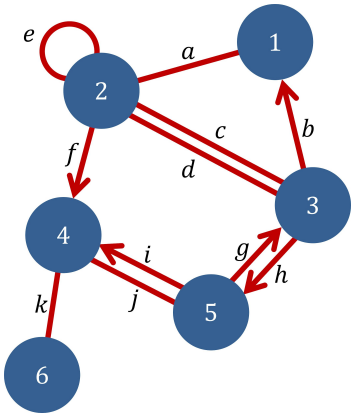
Graf Veri Modeli

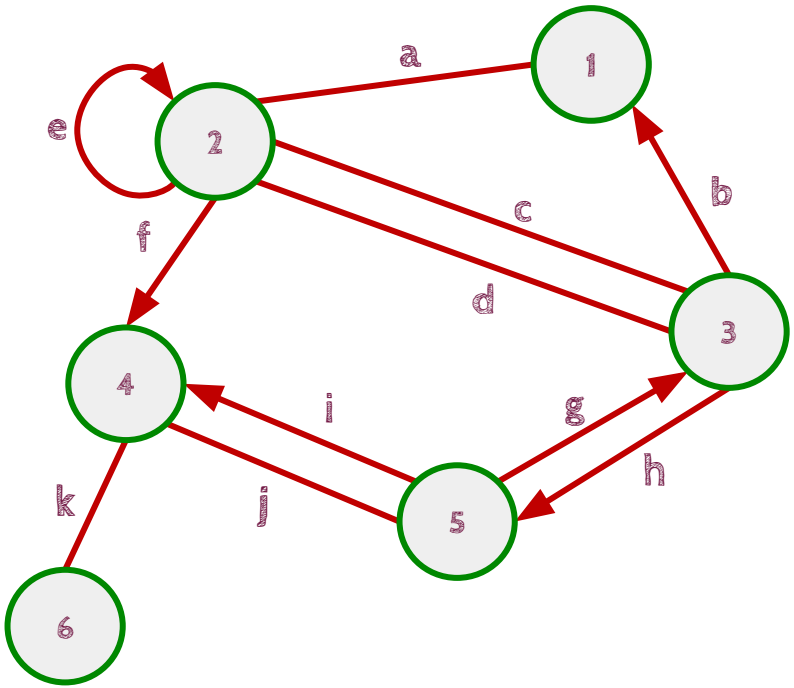


Suhap SAHIN
Onur GÖK

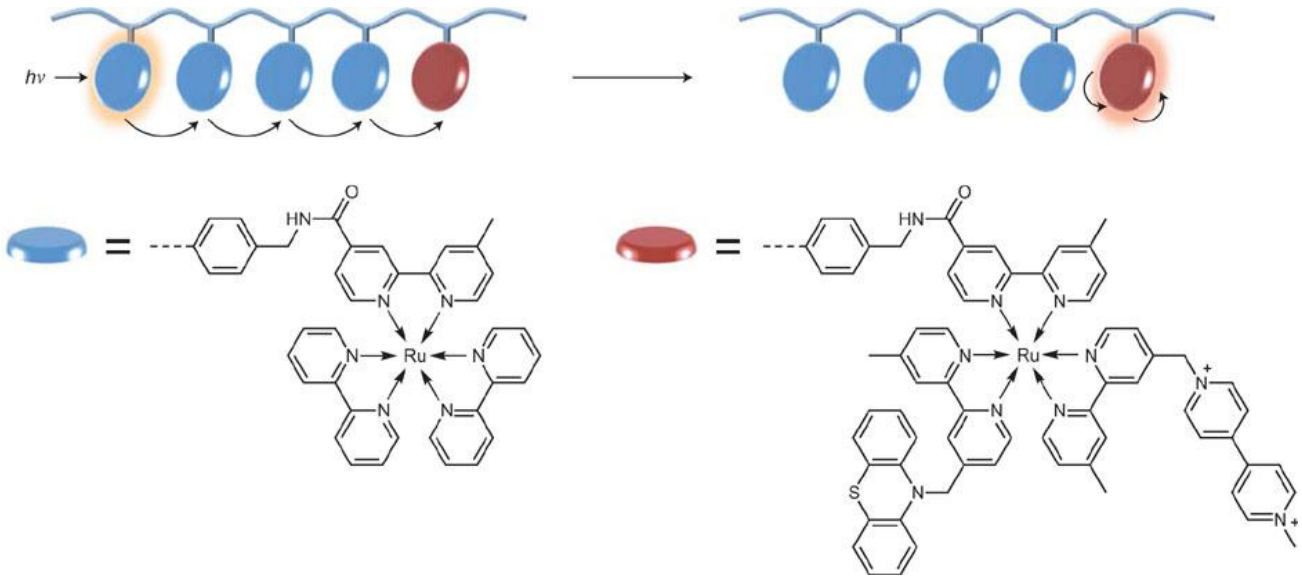
Graf Veri Modeli

1. Tanım ve Kullanım alanları
2. Grafların Bellekte tutulma sekilleri
3. Graf Renklendirme(Welch-powel alg.)
4. En kısa yol problemi
   - 4.1. Dijkstra E.K. Y. A.
   - 4.2. Bellman-Ford E. K. Y. A.
5. En kısa Yol Agacı
   - 5.1. Prim E. K. Y. A.A.
   - 5.2. Kruskal E. K.Y.A.A.

Tanım

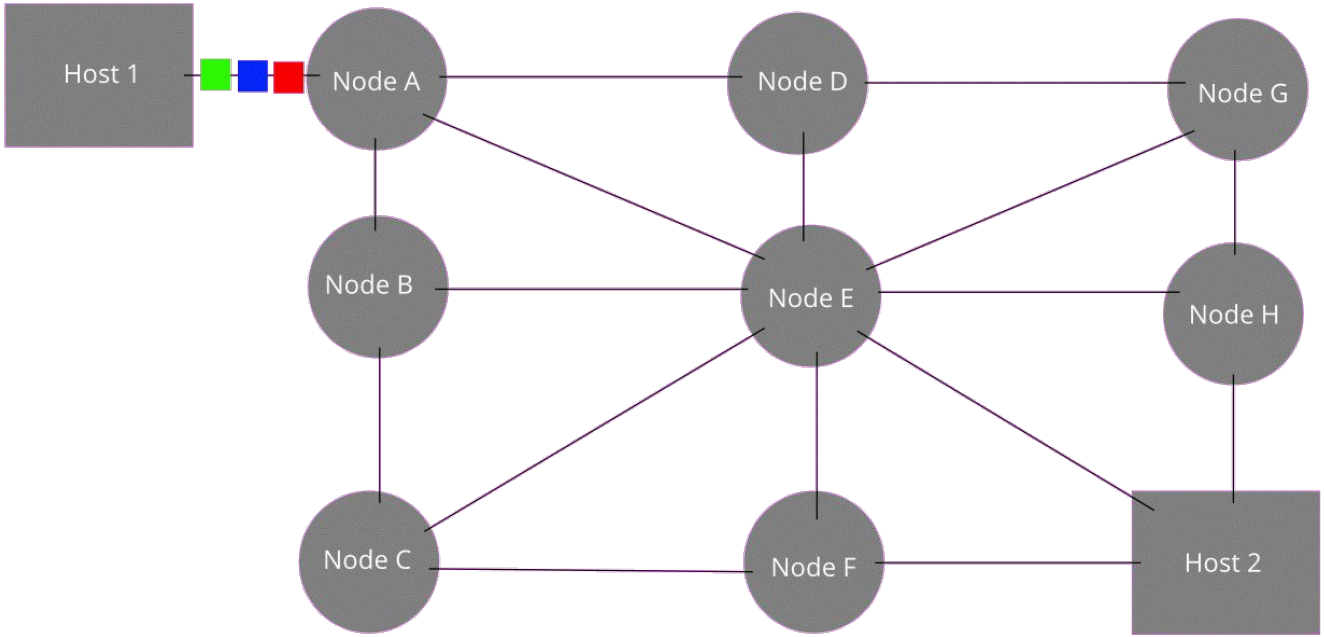


Kullanım Alanları



Kullanım Alanları

Kullanım Alanları

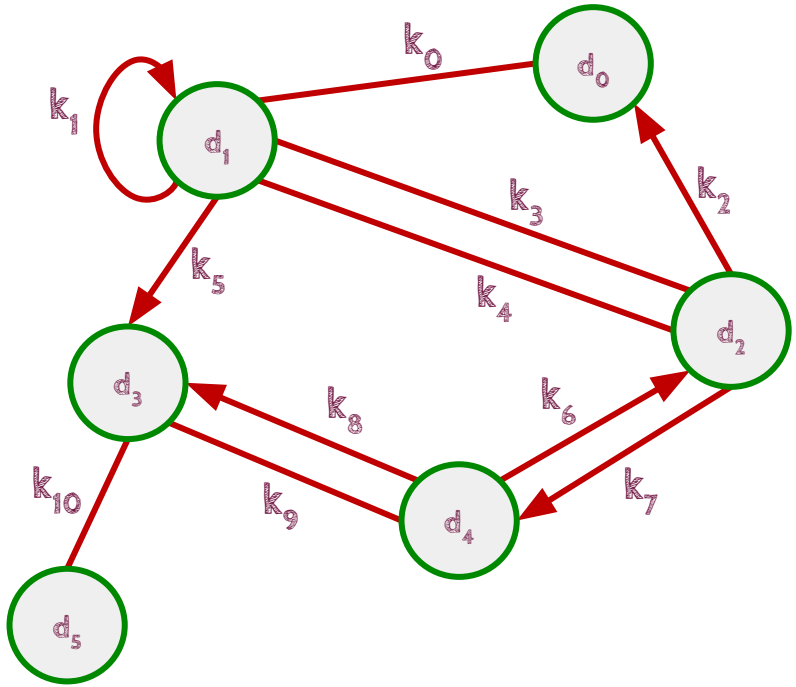


Graf

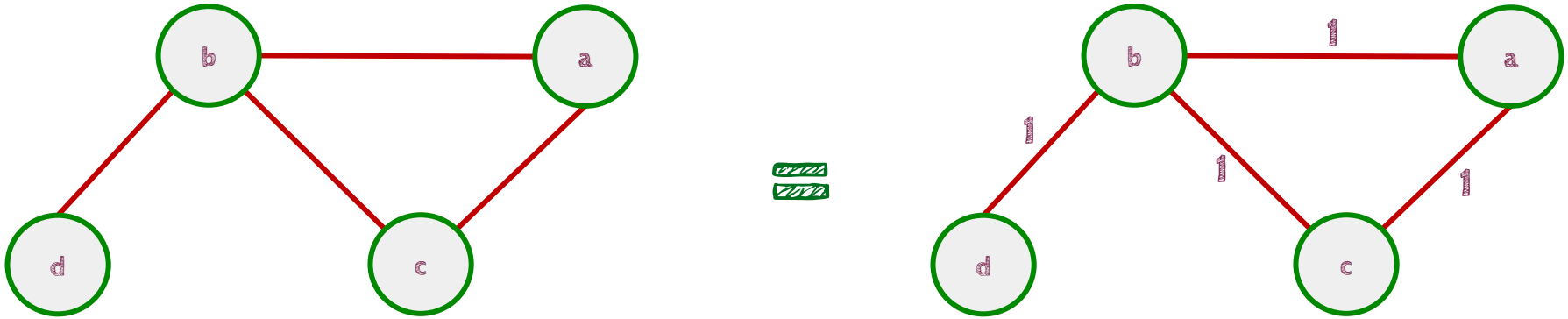
D={d0, d1, d2, d3, d4, d5}

K={ k0, k1, k2, k3, k4, k5, k6, k7, k8, k9, k10 }

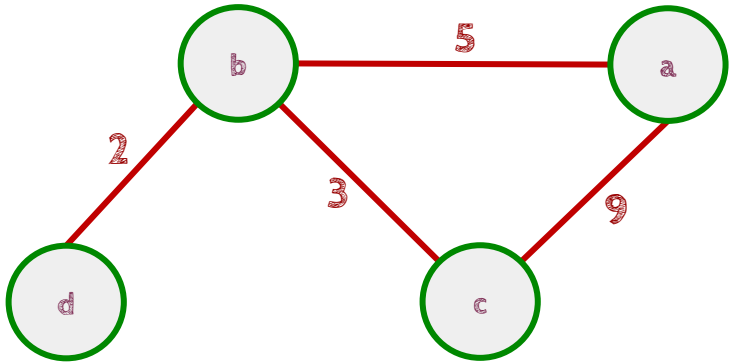
G={D,K}



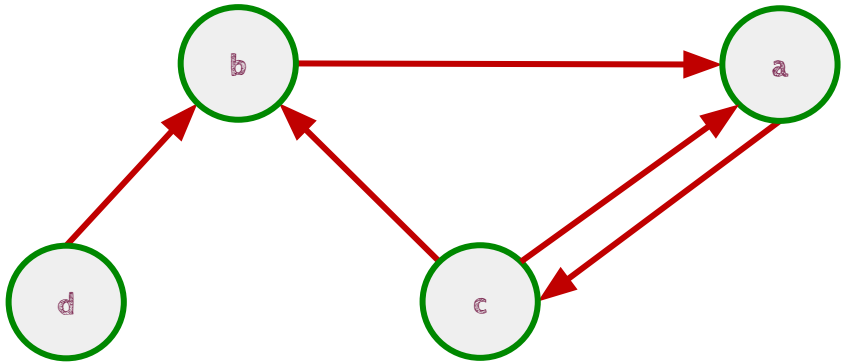
Basit Graf



Maliyetli Graf



Yönlendirilmis Graf

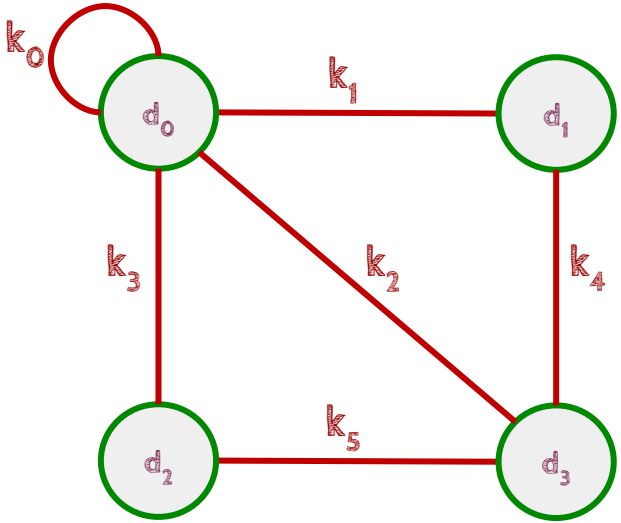


Komsuluk Bitisiklik

Komsuluk iliskisi $G_{dd}=\{(d_0,d_1)\}$

Bitisiklik iliskisi $G_{dk}=\{(d_0,k_0),(d_1,k_0)\}$

Komsuluk Bitisiklik



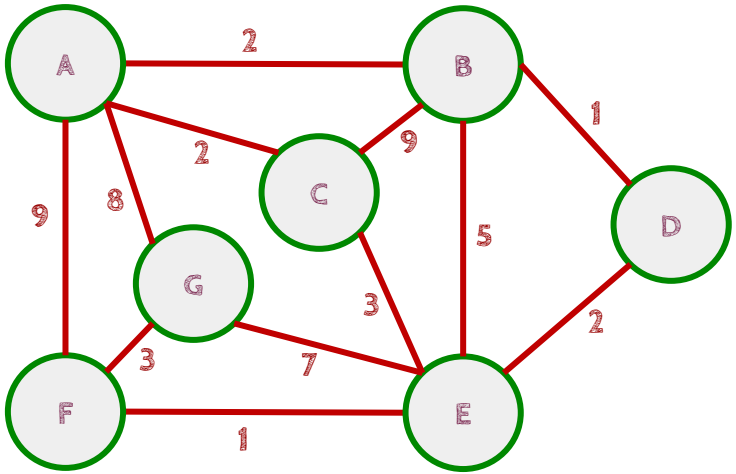
Komsuluk iliskisi

$Gdd=\{(d_0,d_0), (d_0,d_1), (d_0,d_2), (d_0,d_3), (d_1,d_0), (d_1,d_3), (d_2,d_0), (d_2,d_3), (d_3,d_0), (d_3,d_1), (d_3,d_2)\}$

Bitisiklik iliskisi

$Gdk=\{(d_0,k_0), (d_0,k_1), (d_0,k_2), (d_0,k_3), (d_1,k_1), (d_1,k_4), (d_2,k_3), (d_2,k_5), (d_3,k_2), (d_3,k_4), (d_3,k_5)\}$

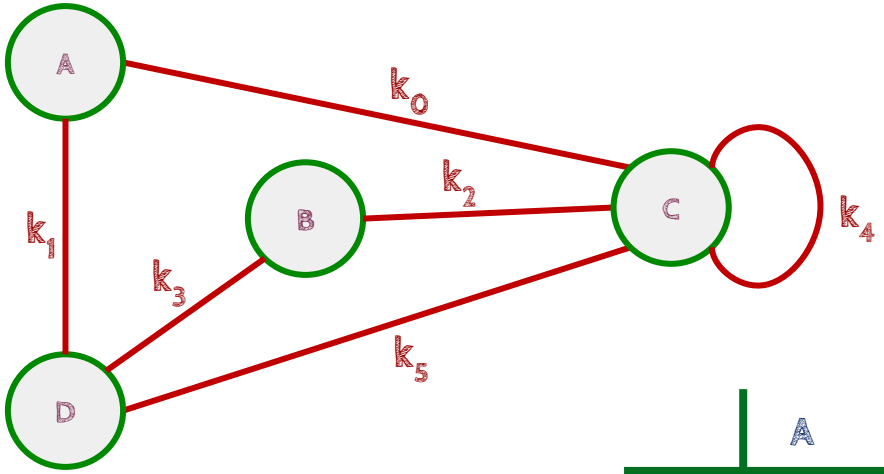
Komsuluk Bitisiklik



Komsuluk iliskisi

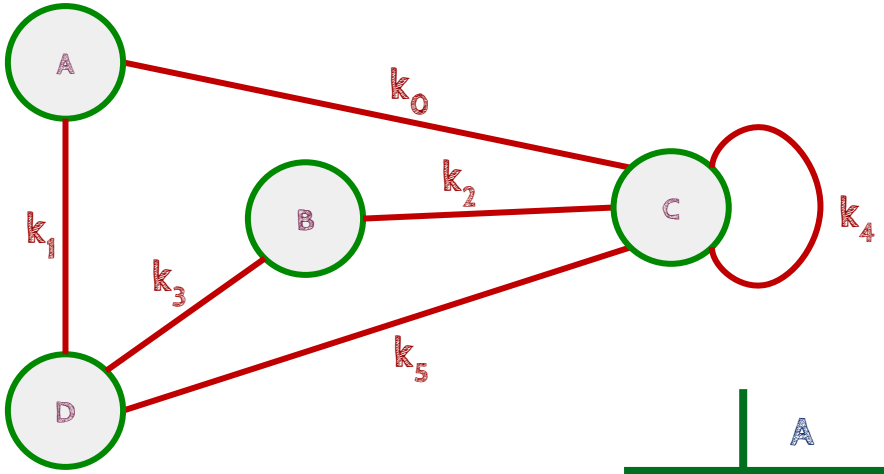
Gdd={(A,B:2), (A,C:2), (A,G:8), (A,F:9), (B,C:9), (B,D:1), (B,E:5), (C,E:3), (D,E:2), (E,G:7), (E,F:1),(F,G:3)}

Komsuluk Matrisi



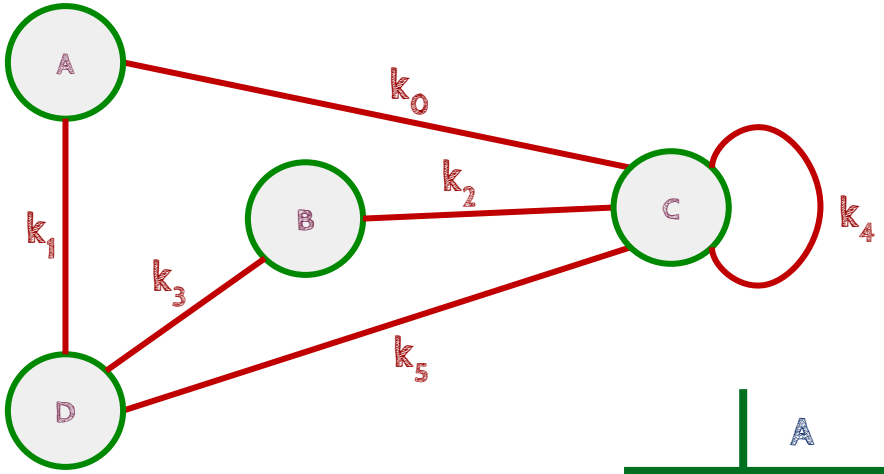
	A	B	C	D
A	0	0	1	1
B				
C				
D				

Komsuluk Matrisi



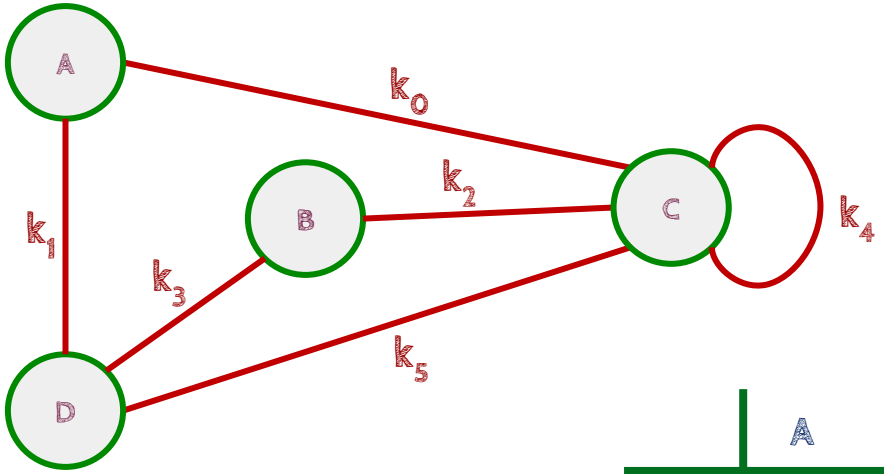
	A	B	C	D
A	0	0	1	1
B	0	0	1	1
C				
D				

Komsuluk Matrisi



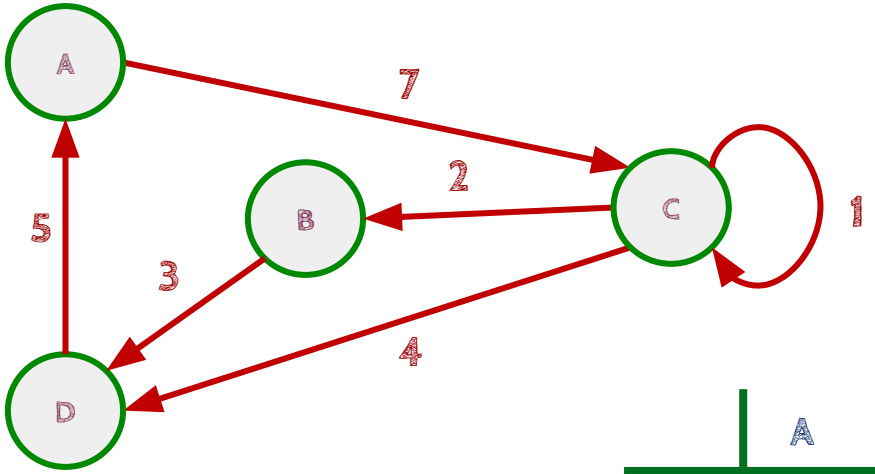
	A	B	C	D
A	0	0	1	1
B	0	0	1	1
C	1	1	1	1
D				

Komsuluk Matrisi



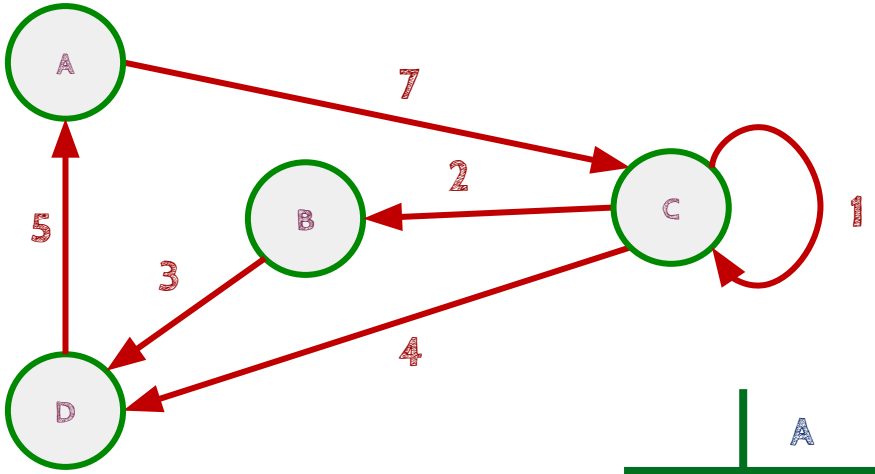
	A	B	C	D
A	0	0	1	1
B	0	0	1	1
C	1	1	1	1
D	1	1	1	0

Yönlü Komsuluk Matrisi



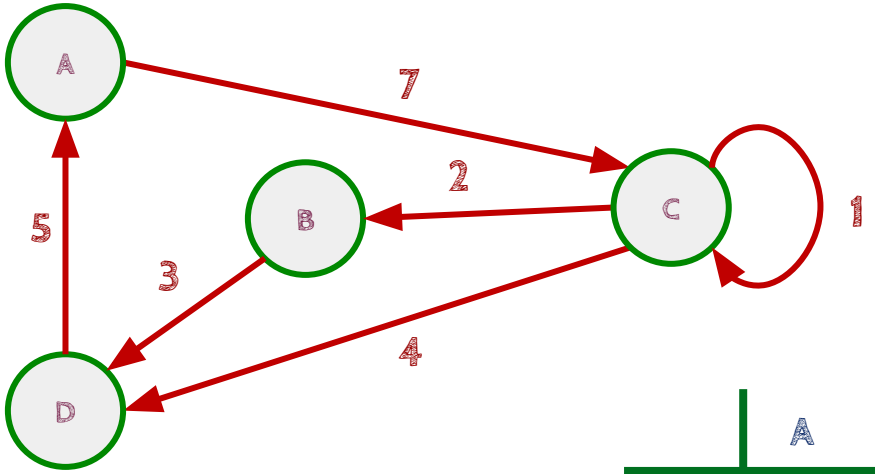
	A	B	C	D
A	-	-	7	-
B				
C				
D				

Yönlü Komsuluk Matrisi



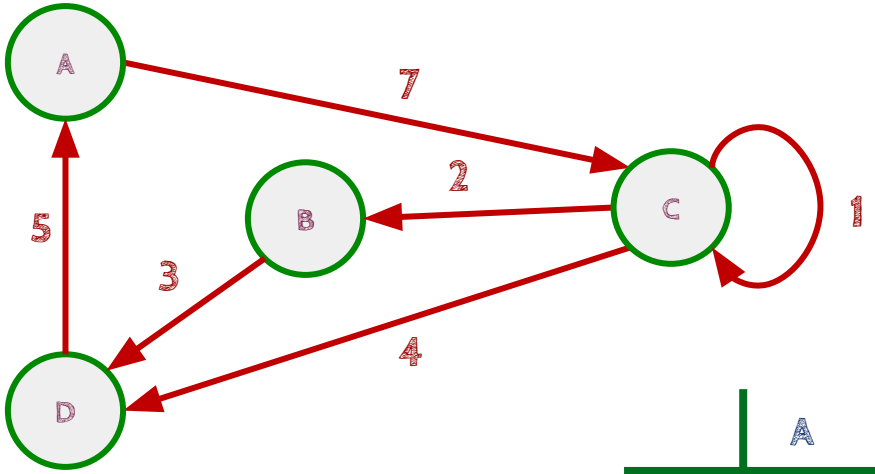
	A	B	C	D
A	-	-	7	-
B	-	-	-	3
C				
D				

Yönlü Komsuluk Matrisi



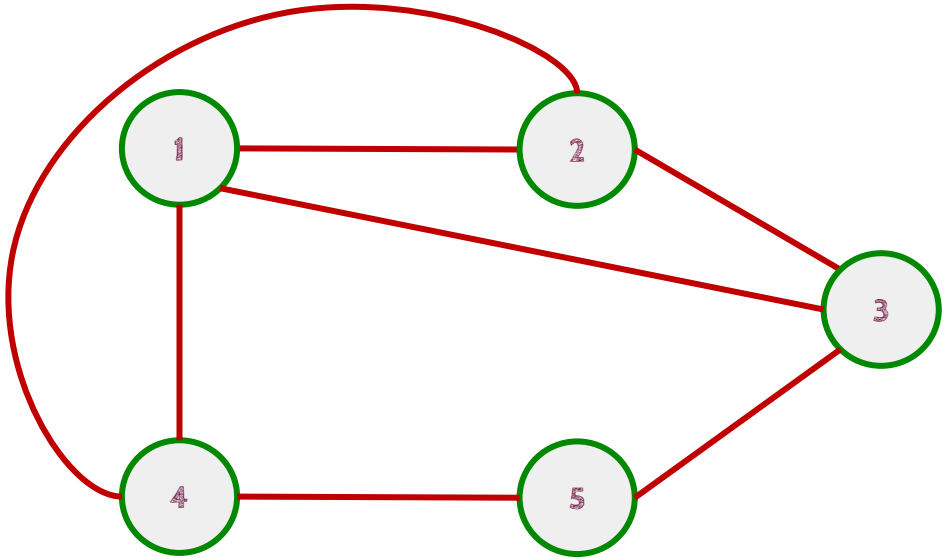
	A	B	C	D
A	-	-	7	-
B	-	-	-	3
C	-	2	1	4
D				

Yönlü Komsuluk Matrisi



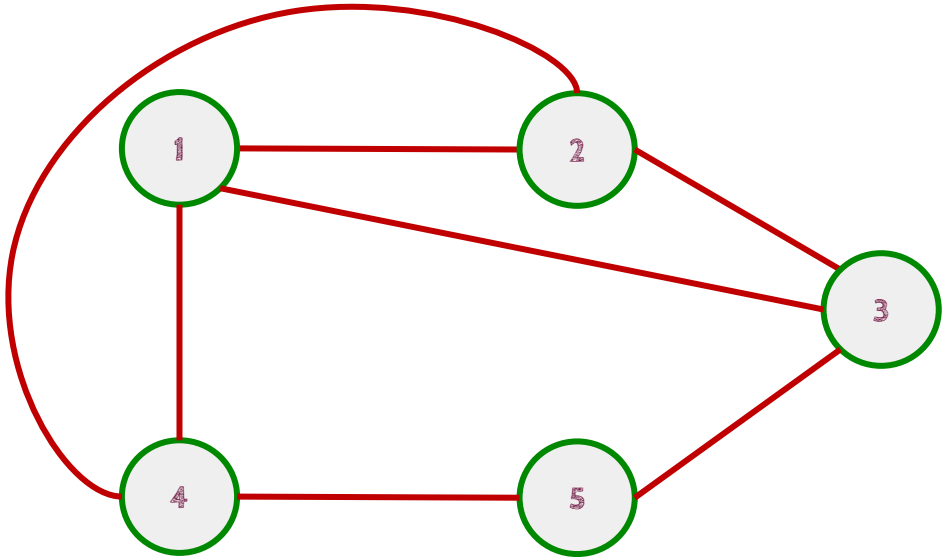
	A	B	C	D
A	-	-	7	-
B	-	-	-	3
C	-	2	1	4
D	5	-	-	-

Komsuluk Matrisi



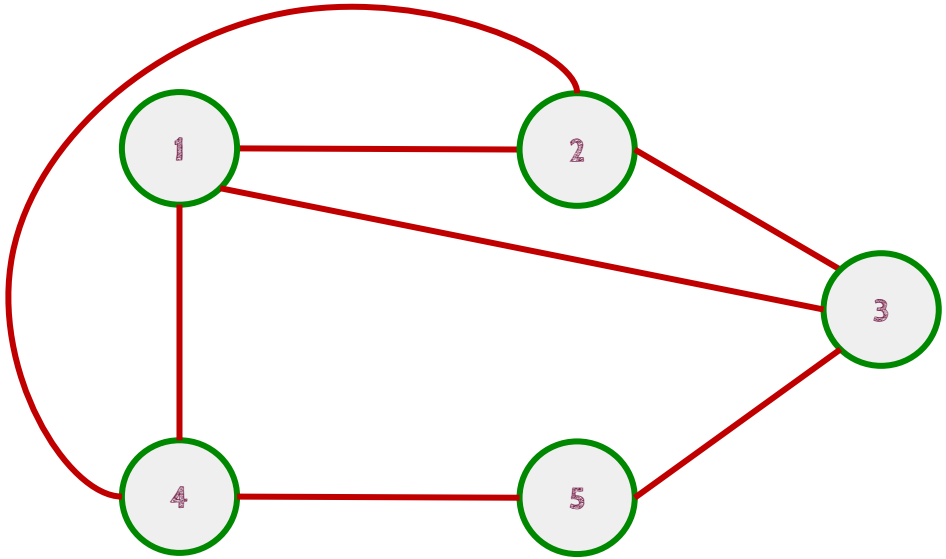
	1	2	3	4	5
1	0	1	1	0	0
2					
3					
4					
5					

Komsuluk Matrisi



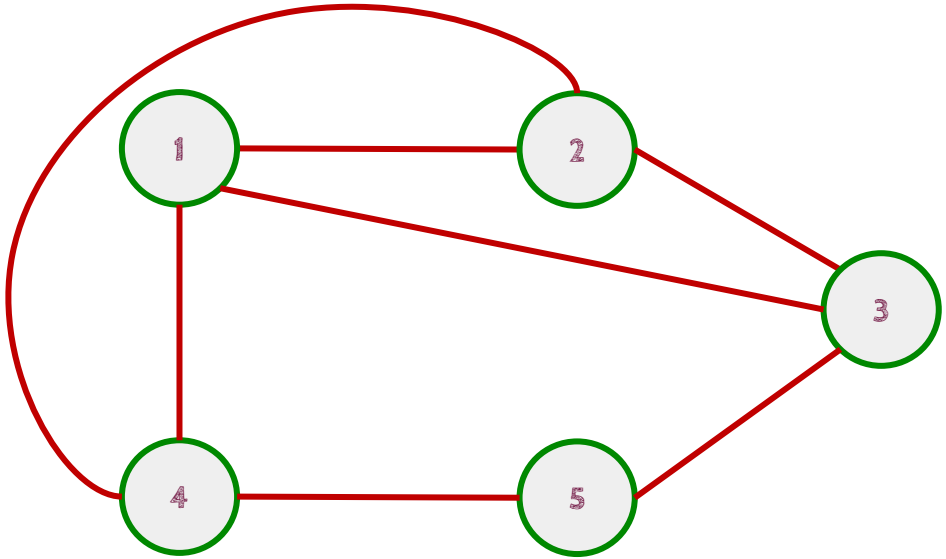
	1	2	3	4	5
1	0	1	1	0	0
2	1	0	1	1	0
3					
4					
5					

Komsuluk Matrisi



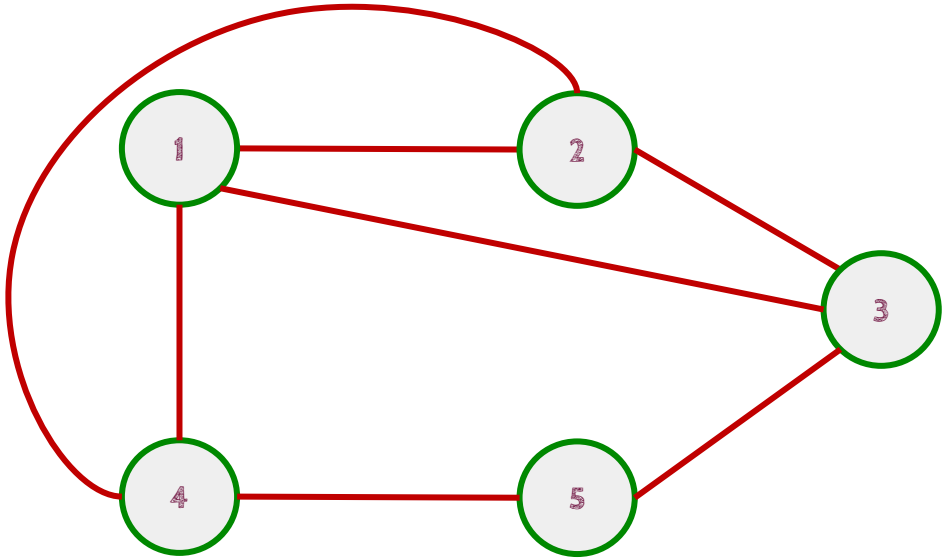
	1	2	3	4	5
1	0	1	1	0	0
2	1	0	1	1	0
3	1	1	0	0	1
4					
5					

Komsuluk Matrisi



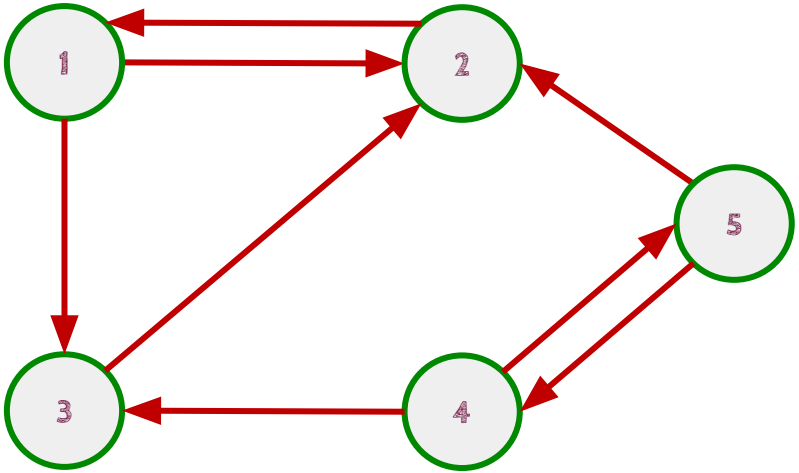
	1	2	3	4	5
1	0	1	1	0	0
2	1	0	1	1	0
3	1	1	0	0	1
4	0	1	0	0	1
5					

Komsuluk Matrisi



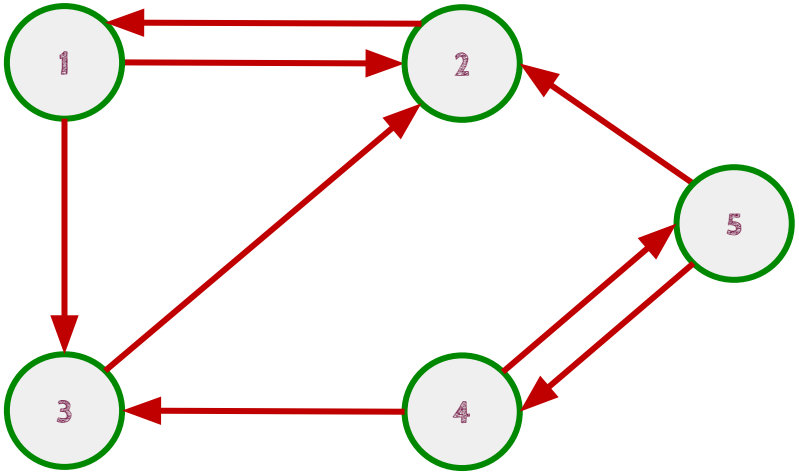
	1	2	3	4	5
1	0	1	1	0	0
2	1	0	1	1	0
3	1	1	0	0	1
4	0	1	0	0	1
5	0	0	1	1	0

Yönlü Komsuluk Matrisi



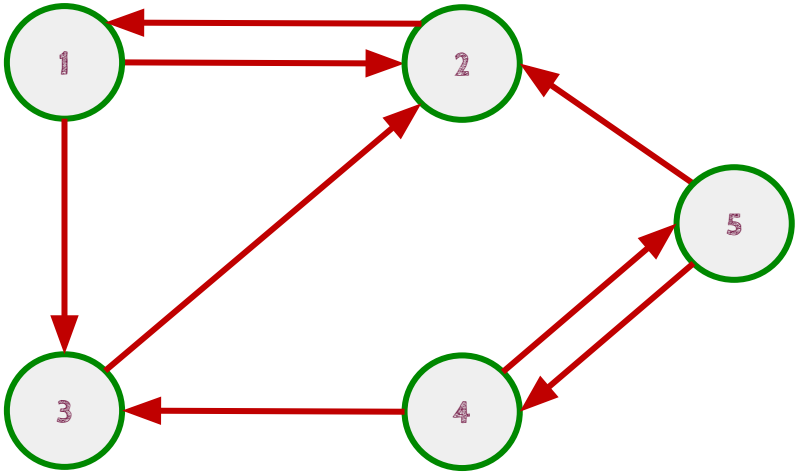
	1	2	3	4	5
1	0	1	1	0	0
2					
3					
4					
5					

Yönlü Komsuluk Matrisi



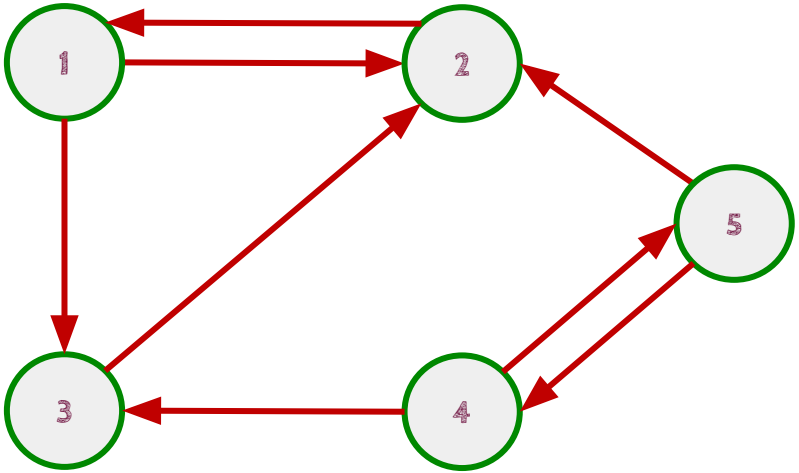
	1	2	3	4	5
1	0	1	1	0	0
2	1	0	0	0	0
3					
4					
5					

Yönlü Komsuluk Matrisi



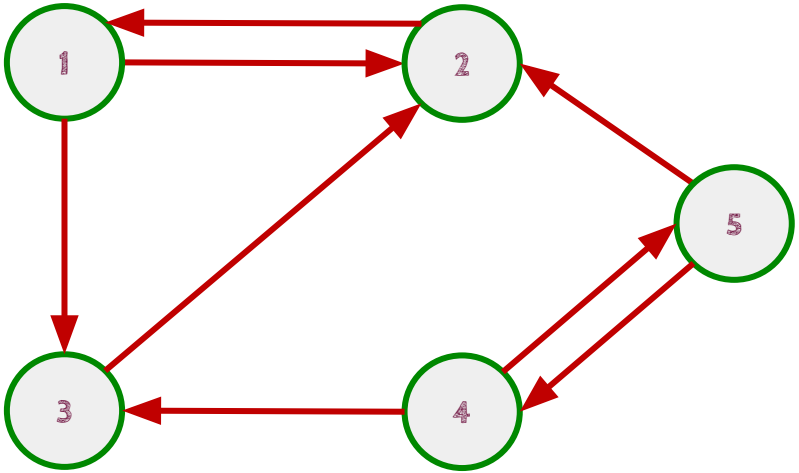
	1	2	3	4	5
1	0	1	1	0	0
2	1	0	0	0	0
3	0	1	0	0	0
4					
5					

Yönlü Komsuluk Matrisi



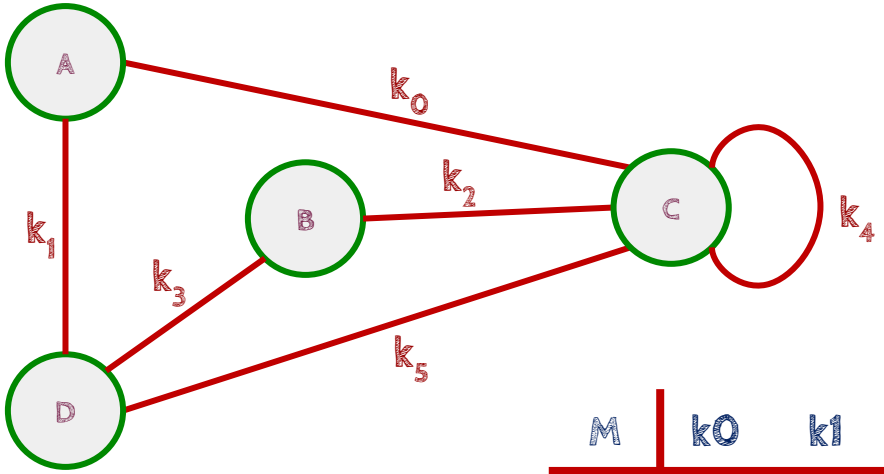
	1	2	3	4	5
1	0	1	1	0	0
2	1	0	0	0	0
3	0	1	0	0	0
4	0	0	1	0	1
5					

Yönlü Komsuluk Matrisi



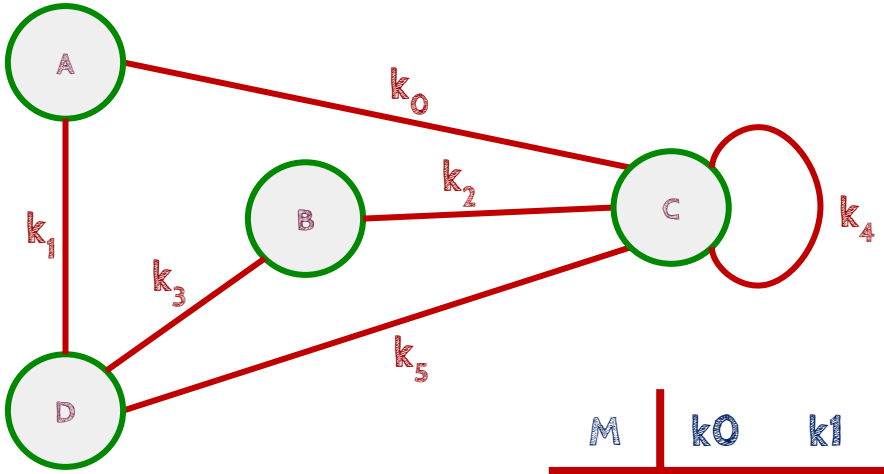
	1	2	3	4	5
1	0	1	1	0	0
2	1	0	0	0	0
3	0	1	0	0	0
4	0	0	1	0	1
5	0	1	0	1	0

Bitisiklik Matrisi



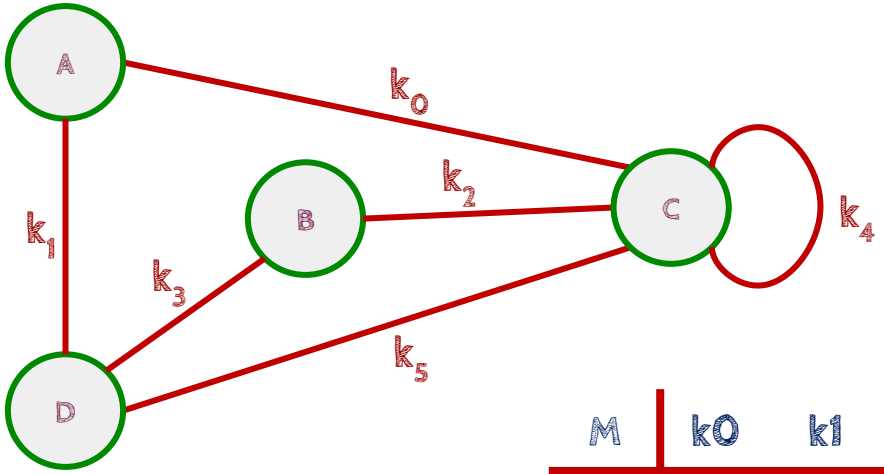
M	k0	k1	k2	k3	k4	k5
A	1	1	0	0	0	0
B						
C						
D						

Bitisiklik Matrisi



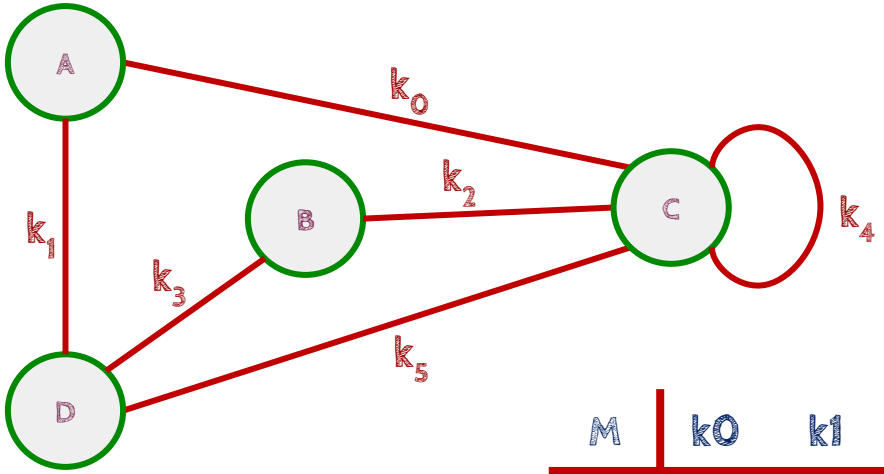
M	k0	k1	k2	k3	k4	k5
A	1	1	0	0	0	0
B	0	0	1	1	0	0
C						
D						

Bitisiklik Matrisi



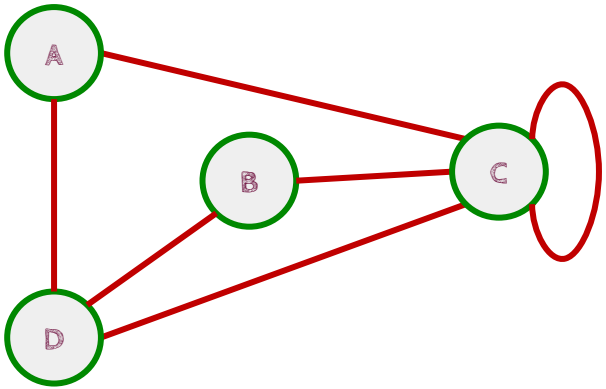
M	k0	k1	k2	k3	k4	k5
A	1	1	0	0	0	0
B	0	0	1	1	0	0
C	1	0	1	0	1	1
D						

Bitisiklik Matrisi



M	k0	k1	k2	k3	k4	k5
A	1	1	0	0	0	0
B	0	0	1	1	0	0
C	1	0	1	0	1	1
D	0	1	0	1	0	1

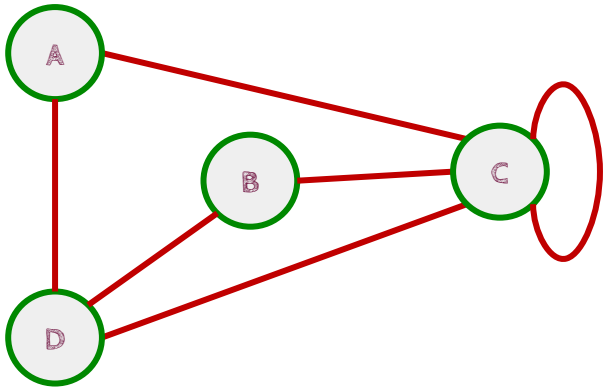
Bellekte Tutulması



Matris

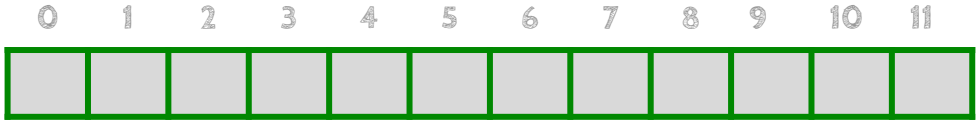
	A	B	C	D
A	0	0	1	1
B	0	0	1	1
C	1	1	1	1
D	1	1	1	0

Bellekte Tutulması



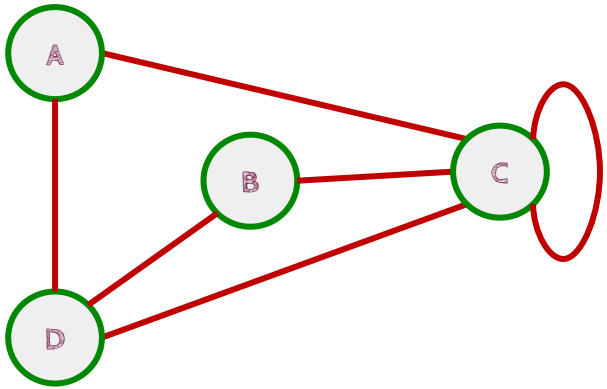
Matris

	A	B	C	D
A	0	0	1	1
B	0	0	1	1
C	1	1	1	1
D	1	1	1	0



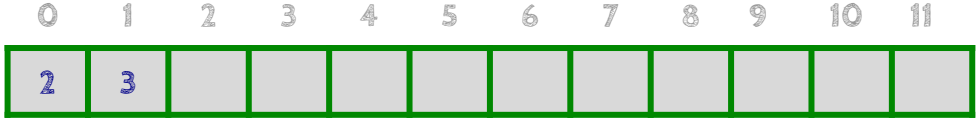
Dizi

Bellekte Tutulması



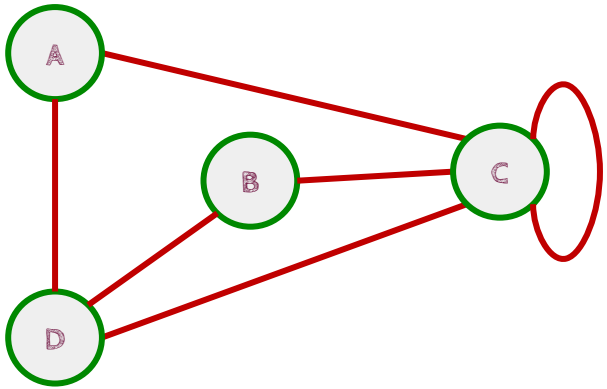
Matris

	A	B	C	D
A	0	0	1	1
B	0	0	1	1
C	1	1	1	1
D	1	1	1	0



Dizi

Bellekte Tutulması



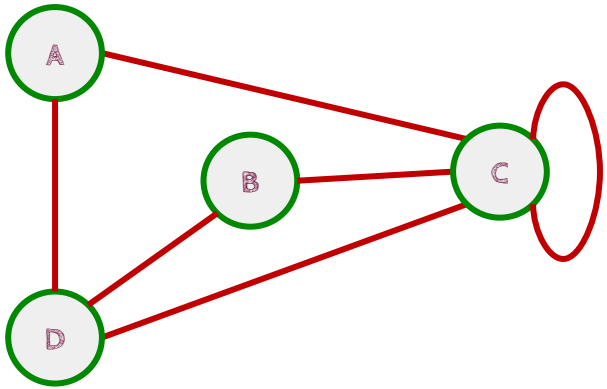
Matris

	A	B	C	D
A	0	0	1	1
B	0	0	1	1
C	1	1	1	1
D	1	1	1	0

0	1	2	3	4	5	6	7	8	9	10	11
2	3	2	3	0	1	2	3	0	1	2	-

Dizi

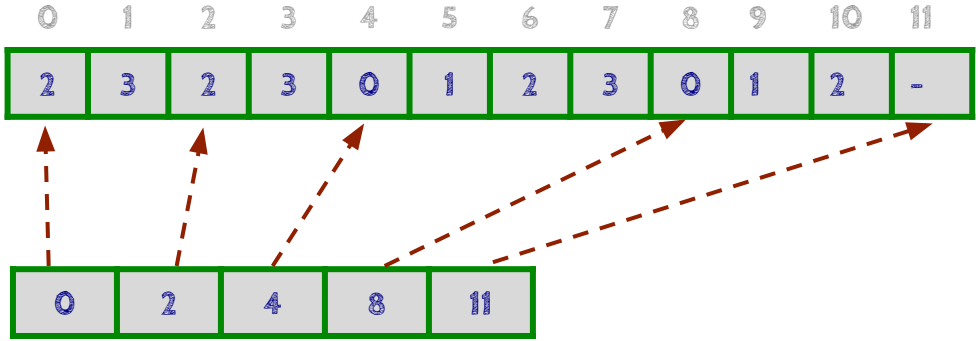
Bellekte Tutulması



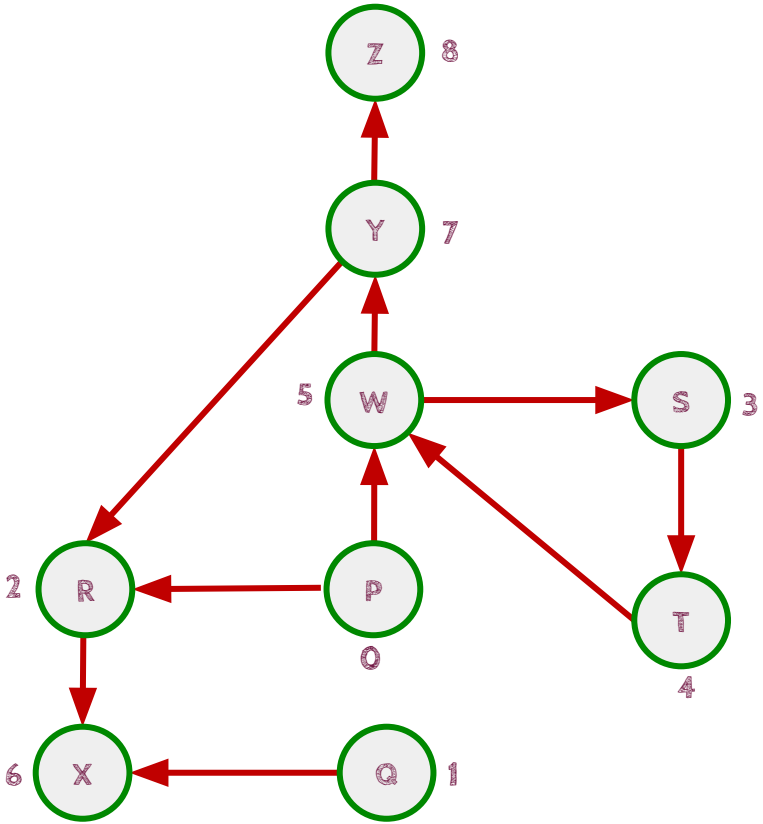
Matris

	A	B	C	D
A	0	0	1	1
B	0	0	1	1
C	1	1	1	1
D	1	1	1	0

Dizi

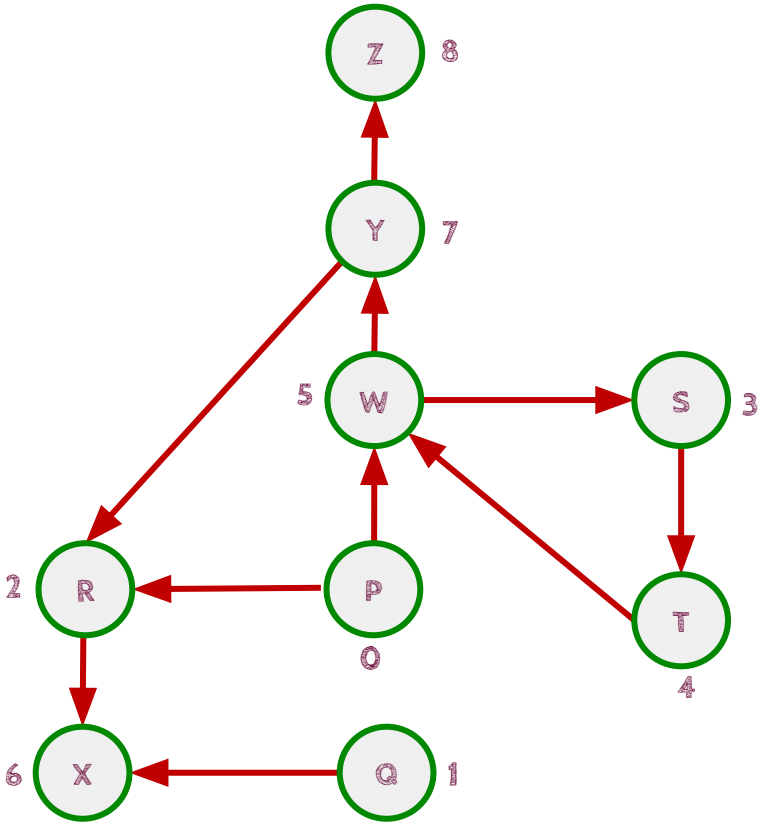


Bellekte Tutulması



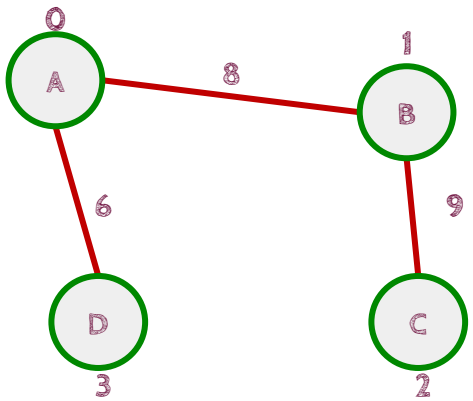
		0	1	2	3	4	5	6	7	8
		P	Q	R	S	T	W	X	Y	Z
0	P	0	0	1	0	0	1	0	0	0
1	Q									
2	R									
3	S									
4	T									
5	W									
6	X									
7	Y									
8	Z									

Bellekte Tutulması



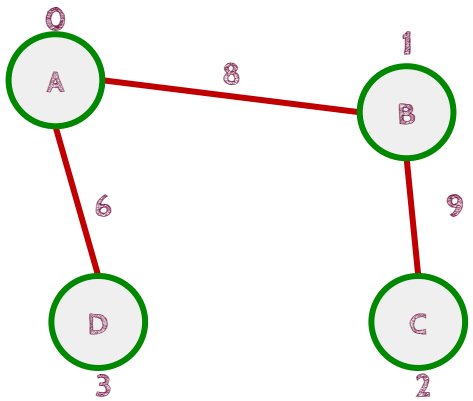
		0	1	2	3	4	5	6	7	8
		P	Q	R	S	T	W	X	Y	Z
0	P	0	0	1	0	0	1	0	0	0
1	Q	0	0	0	0	0	0	1	0	0
2	R	0	0	0	0	0	0	1	0	0
3	S	0	0	0	0	1	0	0	0	0
4	T	0	0	0	0	0	1	0	0	0
5	W	0	0	0	1	0	0	0	1	0
6	X	0	0	0	0	0	0	0	0	0
7	Y	0	0	1	0	0	0	0	0	1
8	Z	0	0	0	0	0	0	0	0	0

Bellekte Tutulması



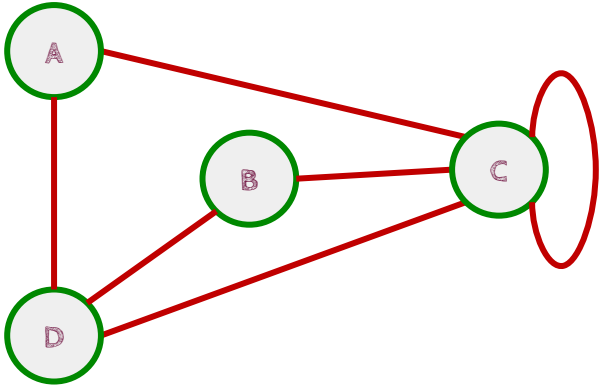
		0	1	2	3
		A	B	C	D
0	A	∞	8	∞	6
1	B				
2	C				
3	D				

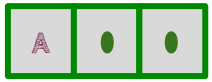
Bellekte Tutulması

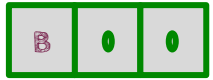


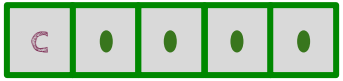
		0	1	2	3
		A	B	C	D
0	A	∞	8	∞	6
1	B	8	∞	9	∞
2	C	∞	9	∞	∞
3	D	6	∞	∞	∞

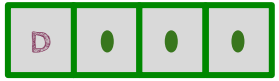
Bellekte Tutulması











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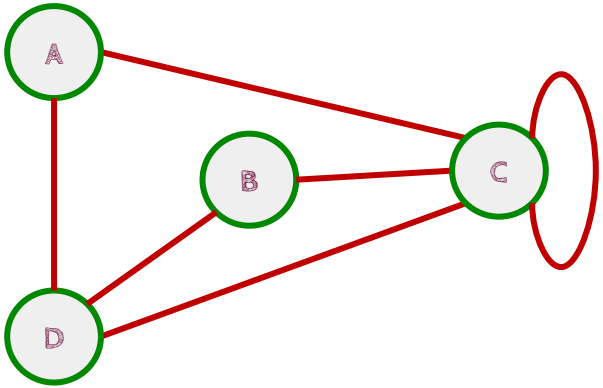

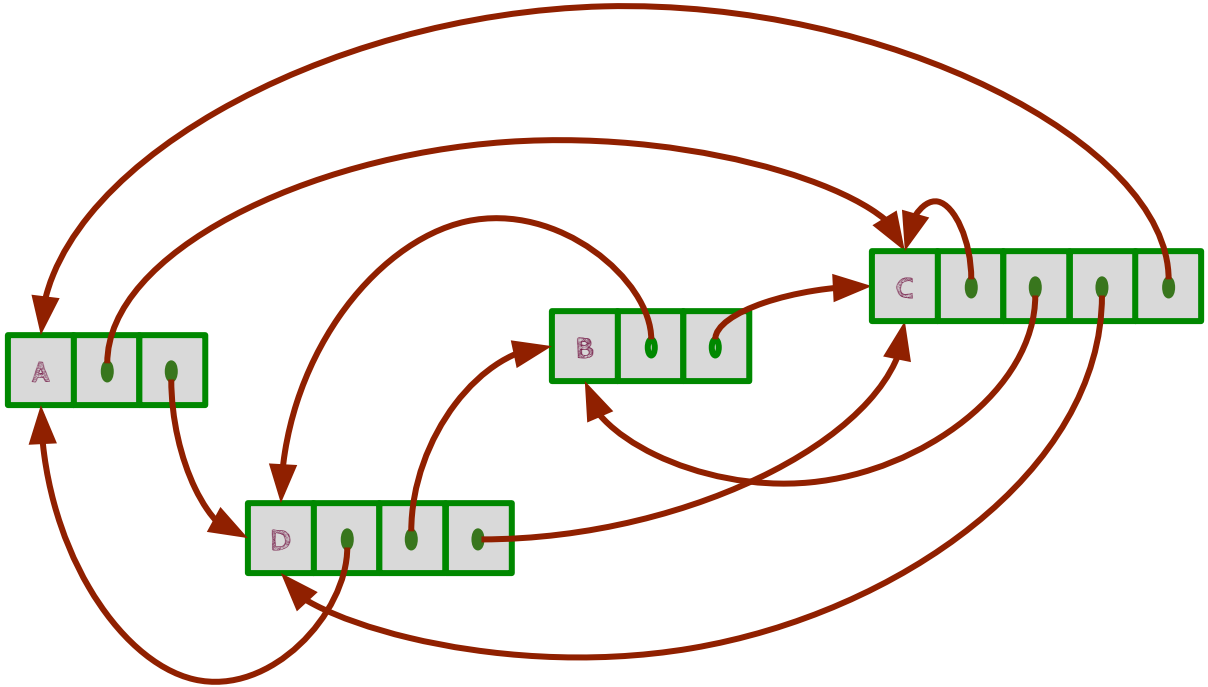

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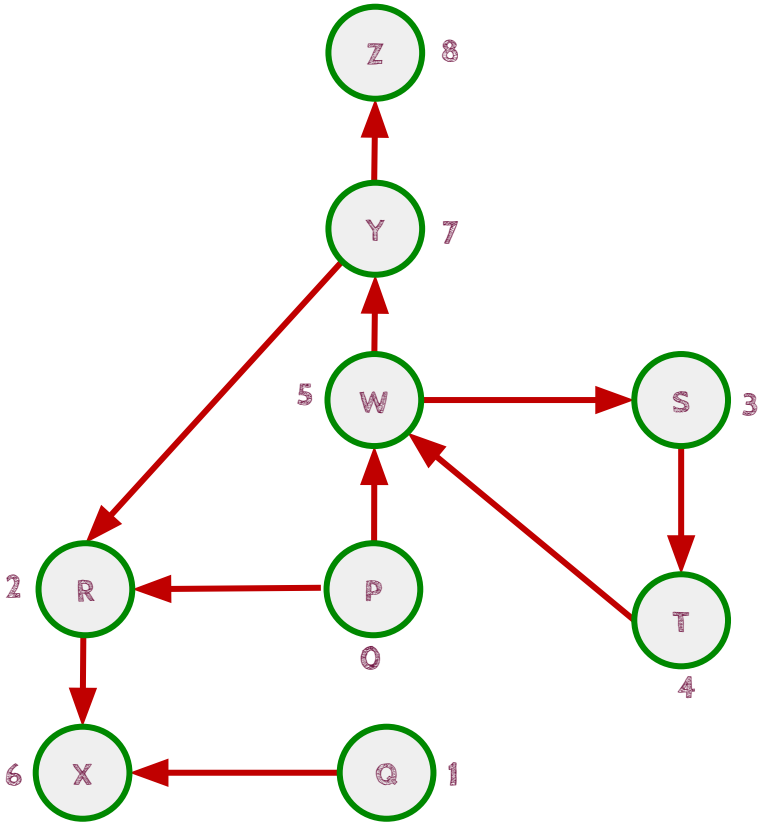

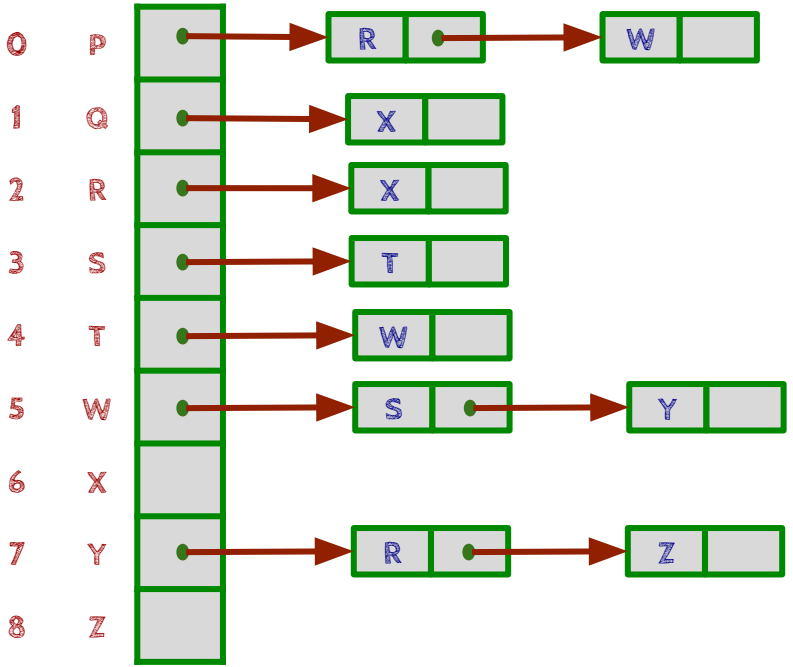

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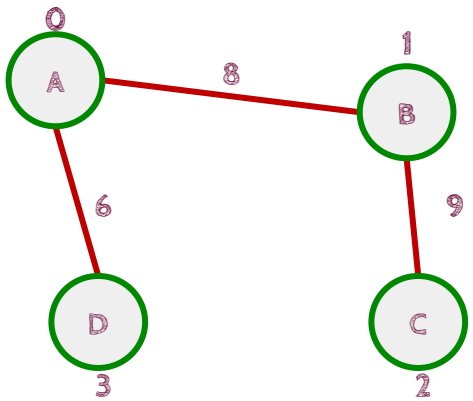
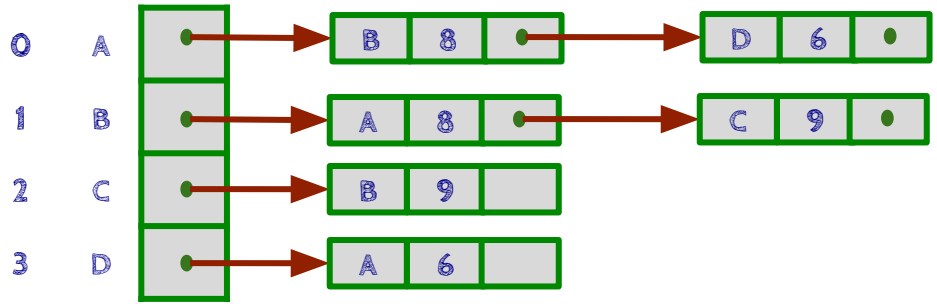
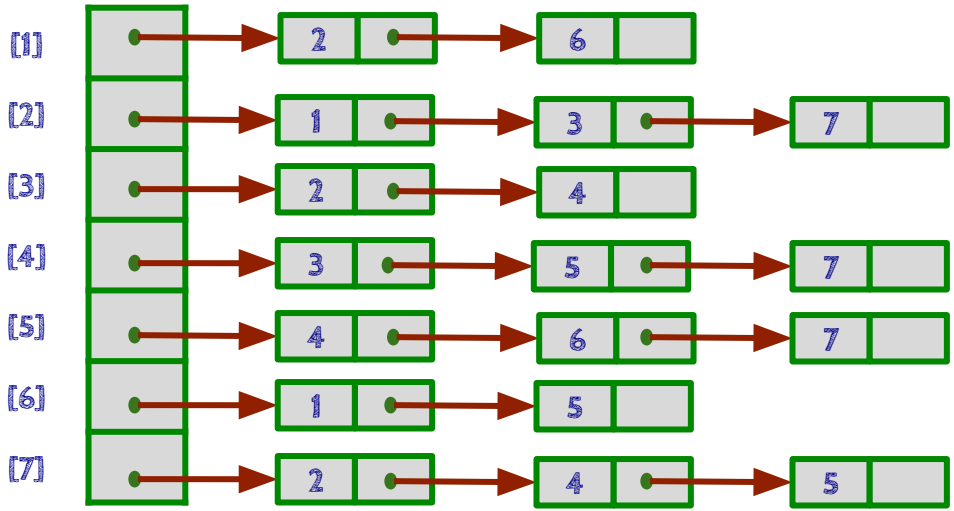




Komsuluk Matrisi

	1	2	3	4	5	6	7
1	0	1	0	0	0	1	0
2	1	0	1	0	0	0	1
3	0	1	0	1	0	0	0
4	0	0	1	0	1	0	1
5	0	0	0	1	0	1	1
6	1	0	0	0	1	0	0
7	0	1	0	1	1	0	0

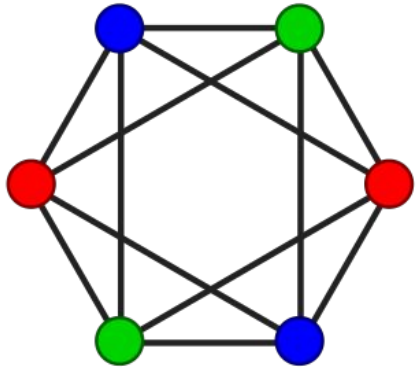


Graf Renklendirme

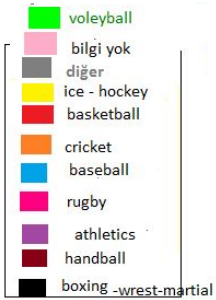
Graf üzerinde birbirine komsu olan dügümlere farklı renk atama

En az sayıda renk kullanılarak tüm dügümlere komsularından farklı renk verme

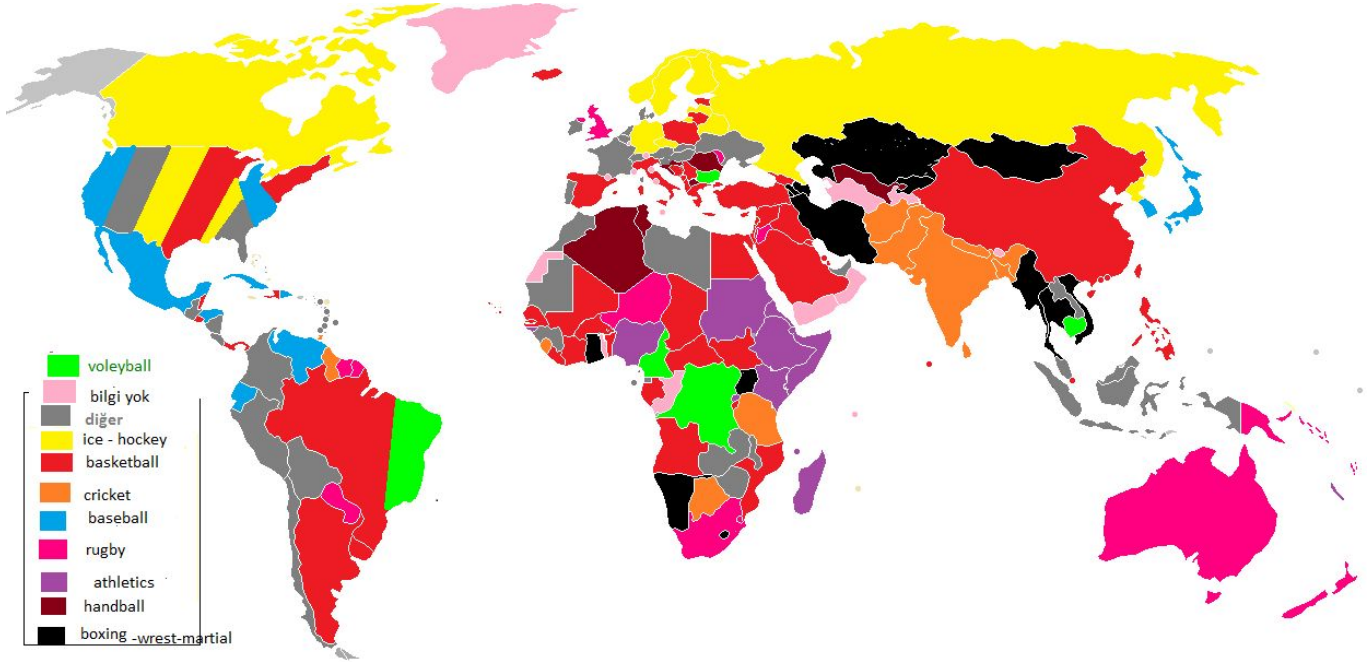
Kullanılan toplam renk sayısı kromatik (chromatik) sayı olarak adlandırılır.



Graf Renklendirme

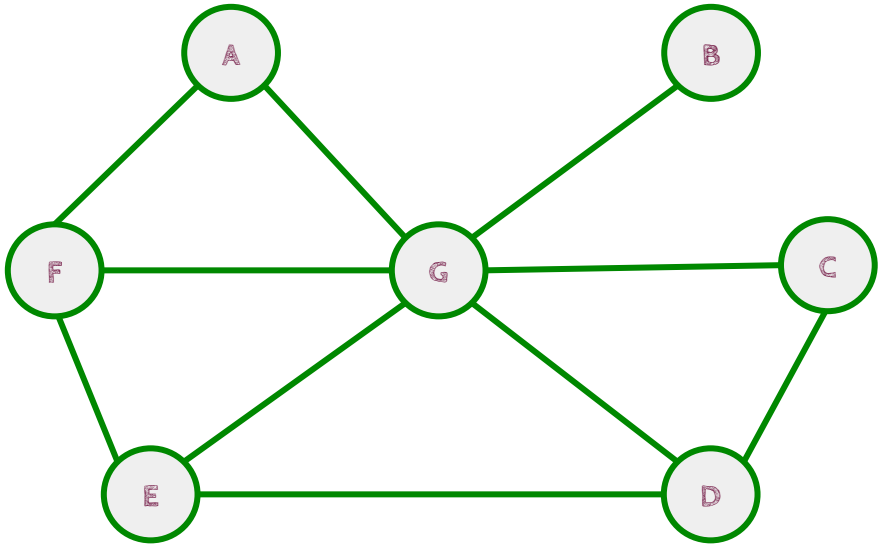


Graf Renklendirme



Welch-Powel Algoritması

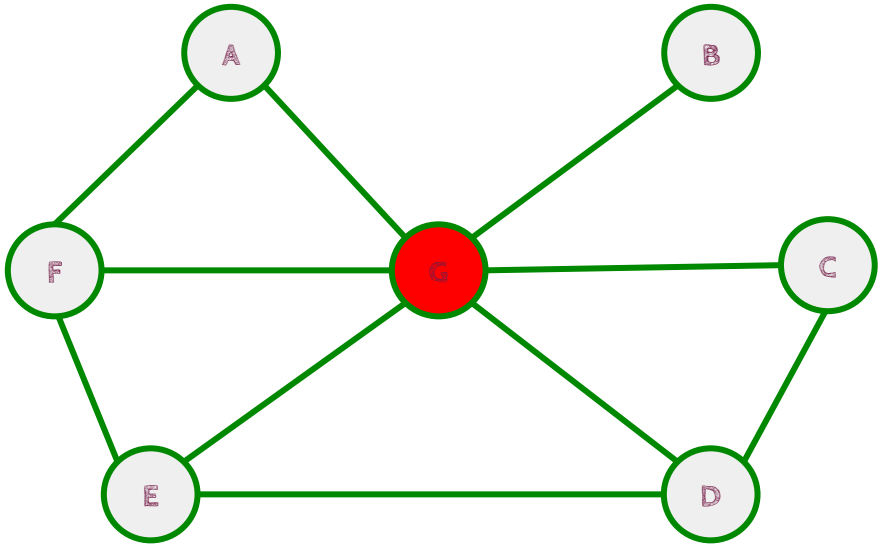
Adım 1: Dügümler derecelerine göre büyükten küçüge dogru sıralanır.



Dügüm	Derece
G	6
D	3
E	3
F	3
C	2
A	2
B	1

Welch-Powel Algoritması

Adım 2: ilk renk numarası birinci sıradaki dügüme atanır, daha sonra aynı renk numarası komsuluk matrisinde komsu olmayan diger dügüme verilir.

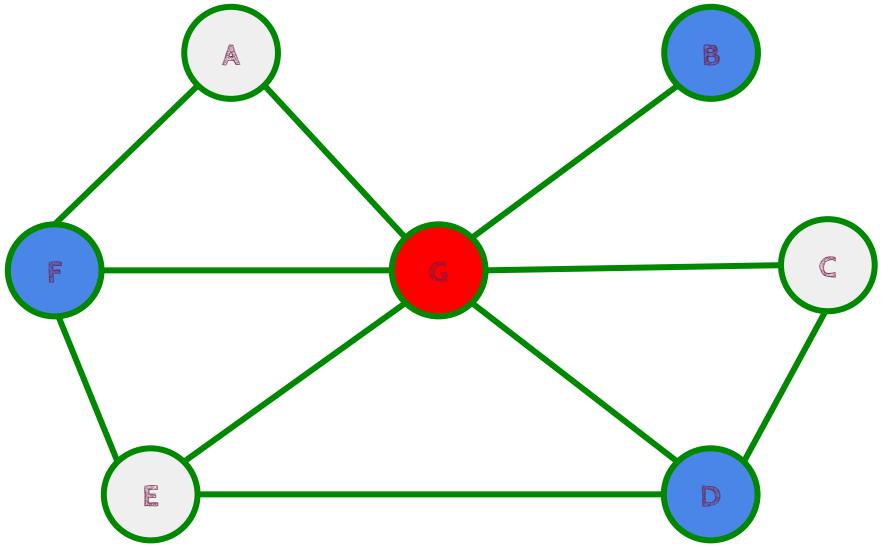


Dügüm	Derece
G	6
D	3
E	3
F	3
C	2
A	2
B	1

Kırmızı: G

Welch-Powel Algoritması

Adım 3: Renk numarası bir artırılır, bu numara daha önce atama yapılmamış dügümlerden derecesi en büyük olana verilir ve adım 2 diger dügümler için tekrarlanır.



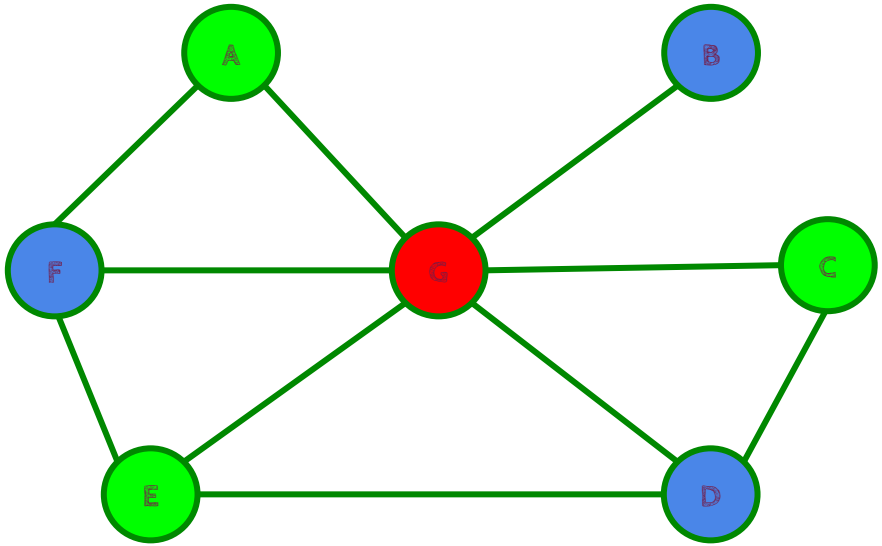
Dügüm	Derece
G	6
D	3
E	3
F	3
C	2
A	2
B	1

Kırmızı: G

Mavi: D,F,B

Welch-Powel Algoritması

Adım 3: Renk numarası bir artırılır, bu numara daha önce atama yapılmamış dügümlerden derecesi en büyük olana verilir ve adım 2 diger dügümler için tekrarlanır.



Dügüm	Derece
G	6
D	3
E	3
F	3
C	2
A	2
B	1

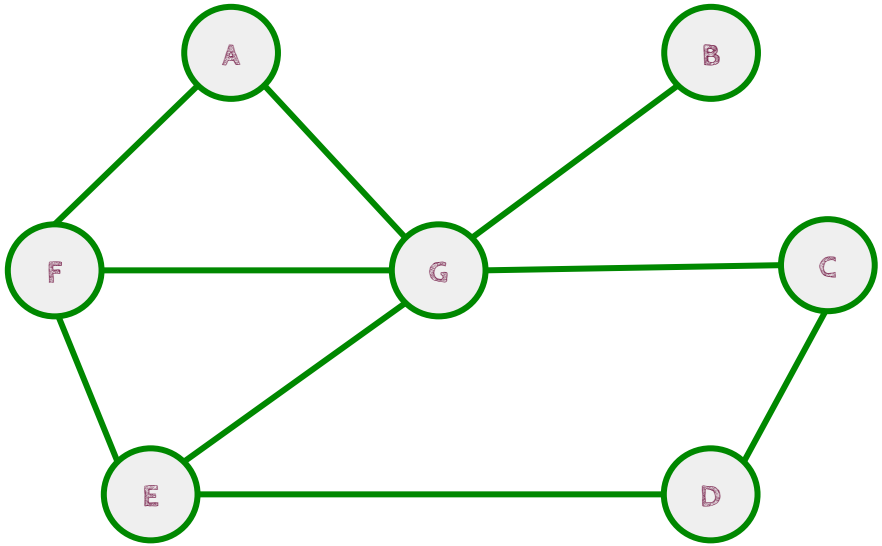
Kırmızı: G

Mavi: D,F,B

Yesil: A,E,C

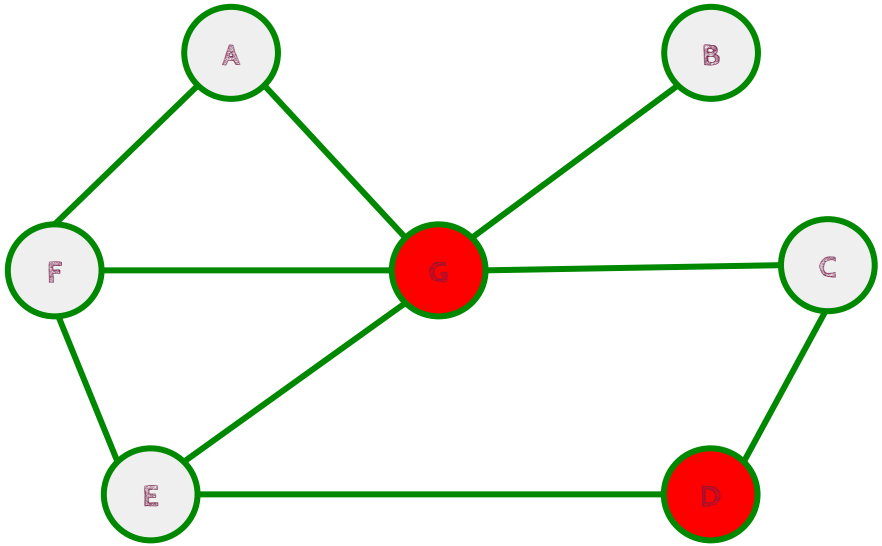
Kromatik sayı: 3

Welch-Powel Algoritması



Dügüm	Derece
G	5
E	3
F	3
D	2
C	2
A	2
B	1

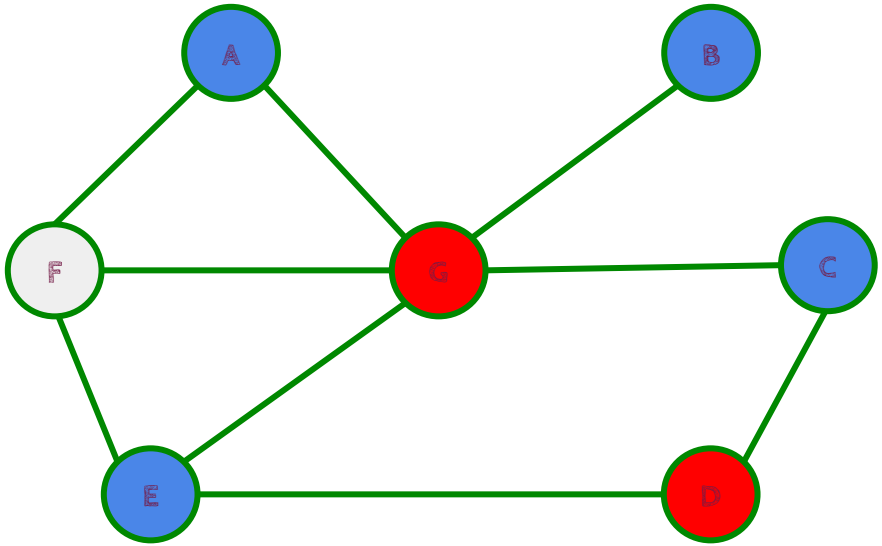
Welch-Powel Algoritması



Dügüm	Derece
G	5
E	3
F	3
D	2
C	2
A	2
B	1

Kırmızı: G,D

Welch-Powel Algoritması

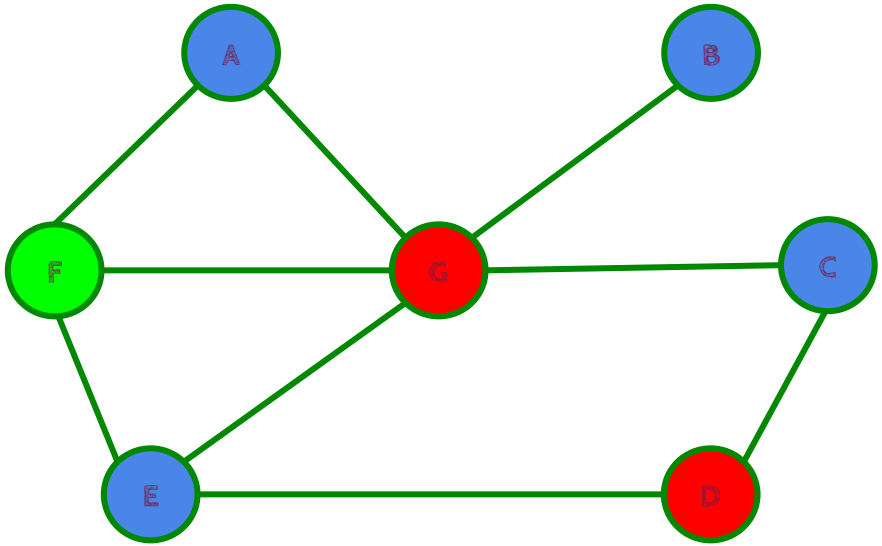


Dügüm	Derece
G	5
E	3
F	3
D	2
C	2
A	2
B	1

Kırmızı: G,D

Mavi: A,B,C,E

Welch-Powel Algoritması



Dügüm	Derece
G	5
E	3
F	3
D	2
C	2
A	2
B	1

Kırmızı: G,D

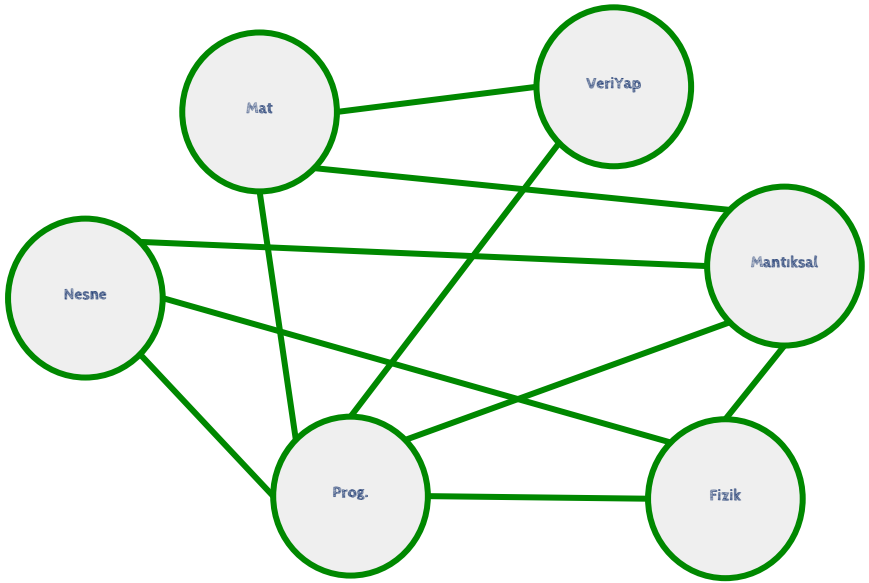
Mavi: A,B,C,E

Yesil: F

Kromatik sayı: 3

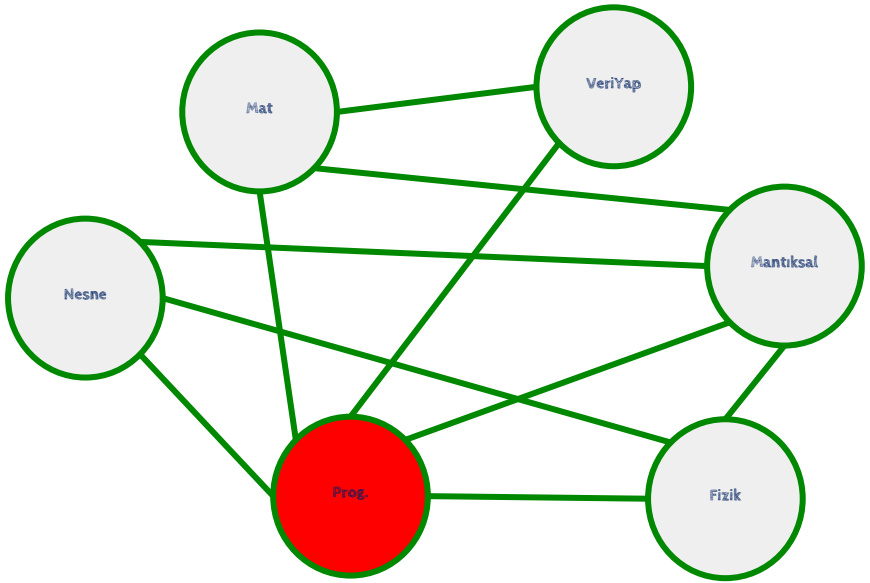
Sınav Çakışması

Ögr1: Mat, VeriYap, Prog.
Ögr2: Mat, Mantıksal, Prog.
Ögr3: Mantıksal, Fizik, Nesne
Ögr4: Fizik,Prog., Nesne



Sınav Çakışması

Ögr1: Mat, VeriYap, Prog.
Ögr2: Mat, Mantıksal, Prog.
Ögr3: Mantıksal, Fizik, Nesne
Ögr4: Fizik,Prog., Nesne

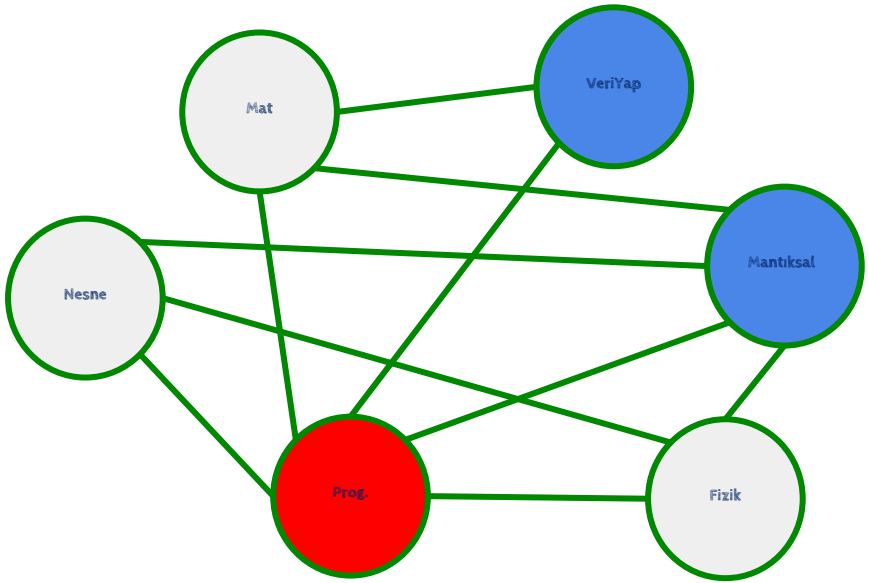


Düğüm	Derece
Prog.	5
Mantıksal	4
Mat	3
Fizik	3
Nesne	2
VeriYap	2

Kırmızı: Prog.

Sınav Çakışması

Ögr1: Mat, VeriYap, Prog.
Ögr2: Mat, Mantıksal, Prog.
Ögr3: Mantıksal, Fizik, Nesne
Ögr4: Fizik,Prog., Nesne

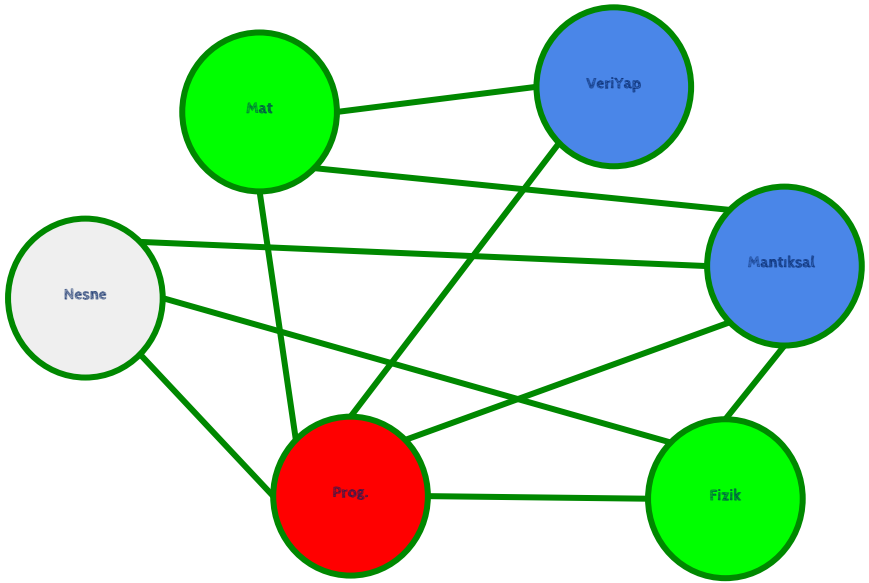


Düğüm	Derece
Prog.	5
Mantıksal	4
Mat	3
Fizik	3
Nesne	2
VeriYap	2

Kırmızı: Prog.
Mavi: VeriYap, Mantıksal

Sınav Çakışması

Ögr1: Mat, VeriYap, Prog.
Ögr2: Mat, Mantıksal, Prog.
Ögr3: Mantıksal, Fizik, Nesne
Ögr4: Fizik,Prog., Nesne

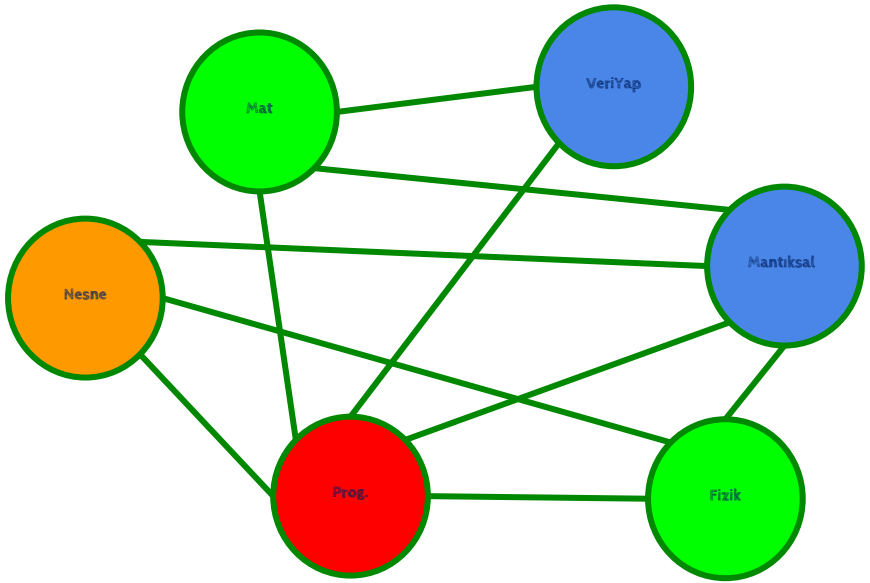


Dügüm	Derece
Prog.	5
Mantıksal	4
Mat	3
Fizik	3
Nesne	2
VeriYap	2

Kırmızı: Prog.
Mavi: VeriYap, Mantıksal
Yesil: Mat, Fizik

Sınav Çakışması

Ögr1: Mat, VeriYap, Prog.
Ögr2: Mat, Mantıksal, Prog.
Ögr3: Mantıksal, Fizik, Nesne
Ögr4: Fizik,Prog., Nesne



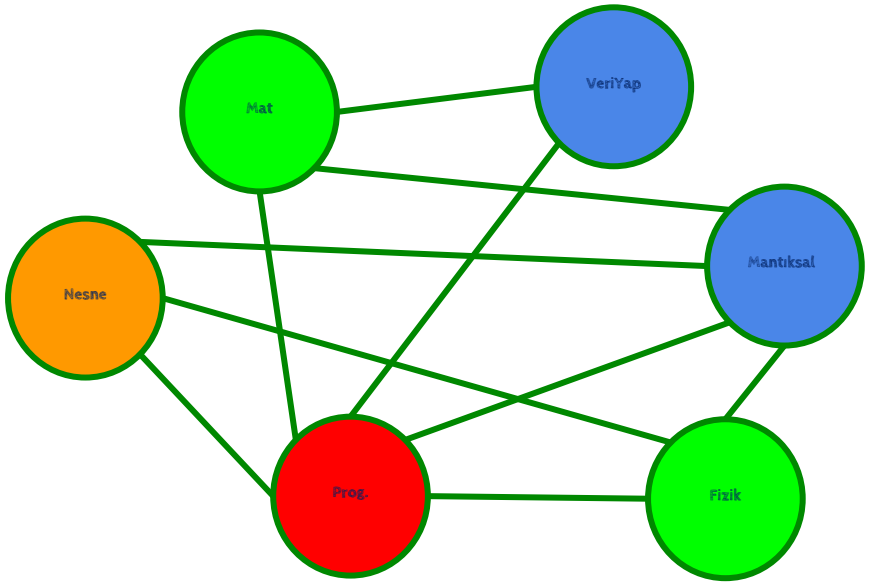
Düğüm	Derece
Prog.	5
Mantıksal	4
Mat	3
Fizik	3
Nesne	2
VeriYap	2

Kırmızı: Prog.
Mavi: VeriYap, Mantıksal
Yesil: Mat, Fizik
Turuncu: Nesne

Kromatik sayı: 4

Sınav Çakışması

Ögr1: Mat, VeriYap, Prog.
Ögr2: Mat, Mantıksal, Prog.
Ögr3: Mantıksal, Fizik, Nesne
Ögr4: Fizik,Prog., Nesne



Düğüm	Derece
Prog.	5
Mantıksal	4
Mat	3
Fizik	3
Nesne	2
VeriYap	2

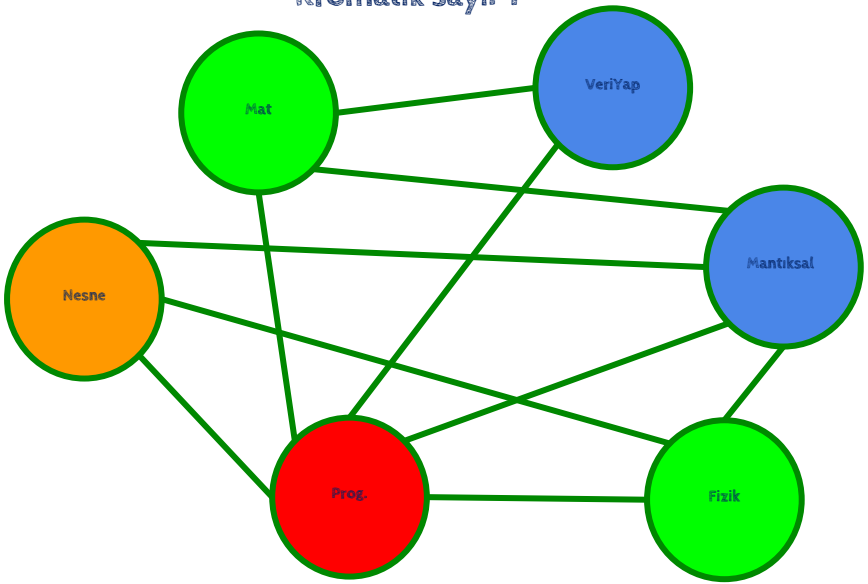
Saat 10:00: Prog.
Saat 12:00: VeriYap, Mantıksal
Saat 14:00: Mat, Fizik
Saat 16:00: Nesne

Welch-Powel Algoritması

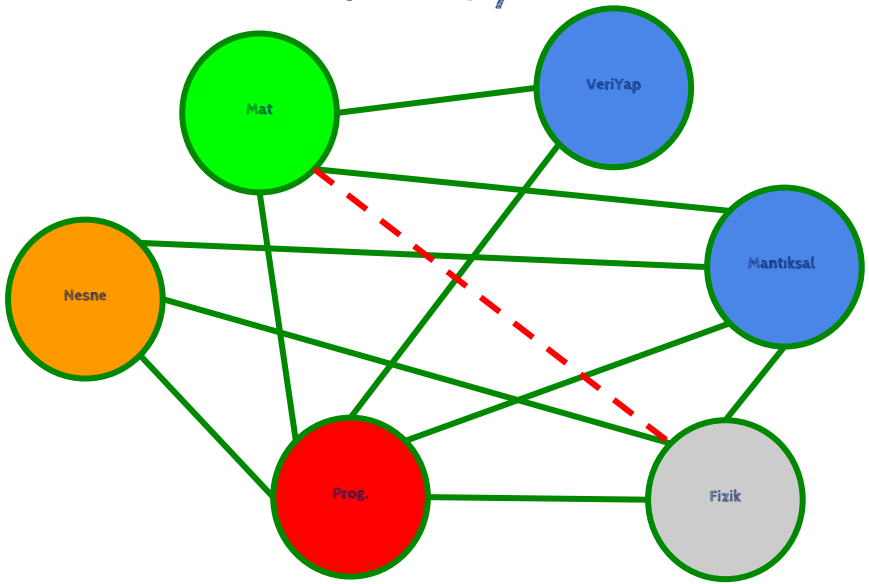
4 < Kromatik Sayı ise Graf 3 boyutludur.

Kromatik sayı <= 4 ise Graf 2 boyutludur (Düzlemseldir).

Kromatik sayı: 4



Kromatik sayı: 5



Sorular