13-AMALIY MASHG'ULOT. Graflarni analitik usulda berilishiga ko'ra chizish. Oddiy graf. Multigraf, psevdograf. Graf uchlarining darajalari va kirralari sonini topish. Graflar ustida amallar. Graflarning qo'shnilik va insidentlik matrisalari. Qo'shnilik va insidentlik matrisalariga kura grafni yasash

Reja:

1.Graflar nazariyasiga oid asosiy tushunchalar.
2.Mustaqil bajarish uchun masala va topshiriqlar
3.Graflar ustida amallar

1. Graflar nazariyasiga oid asosiy tushunchalar

Graflar nazariyasi fani – chiziqlar va nuqtalardan tuzilgan bazi bir geometrik konfiguratsiyalar to‘g‘risidagi masalalarni Echishda ishlatiladi. Bunday masalalarni yechishda, geometrik konfiguratsiyalarda nuqtalar bir –biri bilan to‘g‘ri chiziq yoki yoy bilan birlashtirilganmi, bularning uzunligi qancha kabi faktorlar e'tiborga olinmaydi. Eng muximi shundaki, har bir chiziq qandaydir berilgan ikkita nuqtani birlashtirayapti. Shunday qilib, grafning ta'rifini quyidagicha berishi mumkin.

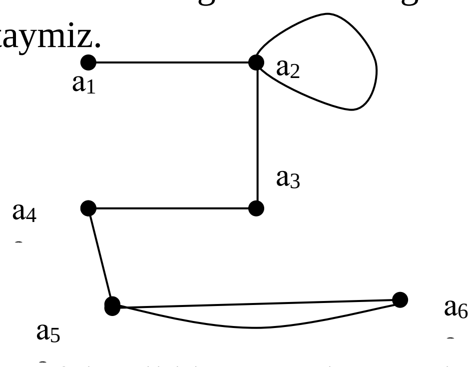
13.1-Ta'rif. To‘plam $V=\{a_1,a_2,\ldots,a_n\}$ va V to‘plamdan olingan juftliklar $E=\{(a_{i1}, a_{j1}),\ldots,(a_{ik}, a_{jk})\}$ naboriga Graf deyiladi.

V to‘plamdagi $a_1,\ldots,a_n$ lar qandaydir ob'ektlar bo‘lib G grafning uchlari deyiladi. E to‘plamdagi har bir $(a_{i1}, a_{j1}),\ldots,(a_{ik}, a_{jk})$ juftlik Grafning qirralari deyiladi.

Agar (a_i, a_j) qirra berilgan bo‘lsa, u holda a_i, va a_j uchlar birlashtirilgan deyiladi.

13.1-Misol. Agar $V=\{a_1, a_2, a_3, a_4, a_5, a_6, a_7,\}$va $E=\{(a_1,a_2)(a_2,a_2)(a_2,a_3)(a_3,a_4)(a_4,a_5)(a_5,a_6)(a_6,a_5)\}$ bo‘lsin, u holda V va E to‘plam G grafni hosil qiladi.

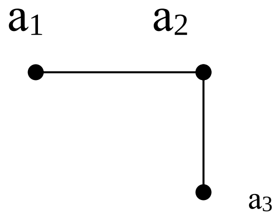
13.2-Ta'rif. Grafning uchlarini tugunlar, 2 ta uchini birlashtiruvchi chiziqni qirralar deb ataymiz.



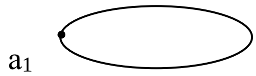
13.3-Ta'rif. Grafning ikkita tuguni umumiy qirra bilan o‘zaro bog‘langan bo'lsa, ular qo‘shni tugunlar deyiladi.

13.4-Ta'rif. Agar G ning 2 ta qirrasi umumiy tugunga ega bo‘lsa, ular qo‘shma qirralar deyiladi.

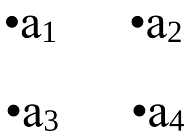
13.2-Misol. (a_1 a_2) qirra (a_2 a_3) qirraga qo‘shma, chunki a_2 umumiy tugunga ega.



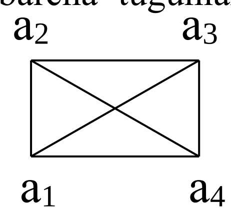
13.5-Ta’rif. Birorta tugunni o‘zini - o‘ziga bog‘laydigan qirraga sirtmoq deyiladi.



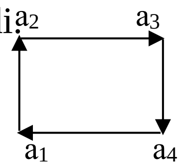
13.6-Ta’rif. Barcha tugunlari yolg‘iz tugundan iborat graf nol (bo‘sh) graf deyiladi.



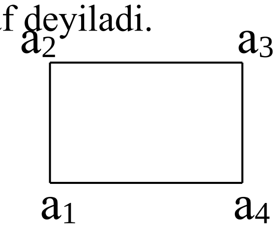
13.7-Ta’rif. Agar G grafning barcha tugunlari o‘zaro bog‘langan bo‘lsa, bunday graf to‘liq graf deyiladi.



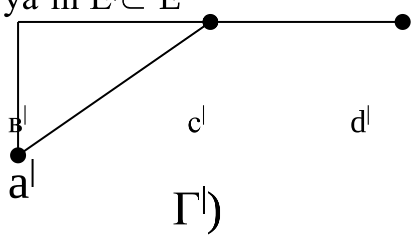
13.8-Ta’rif. Agar G grafning barcha qirralarida yo‘nalish ko‘rsatilgan bo‘lsa, bunday graf yo‘naltirilgan graf deyiladi.

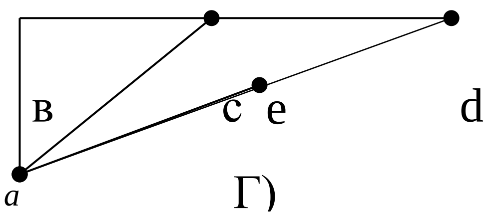


13.9-Ta’rif. Agar G grafning qirralarida yo‘naltirish ko‘rsatilmagan bo‘lsa, u holda graf yo‘naltirilmagan graf deyiladi.



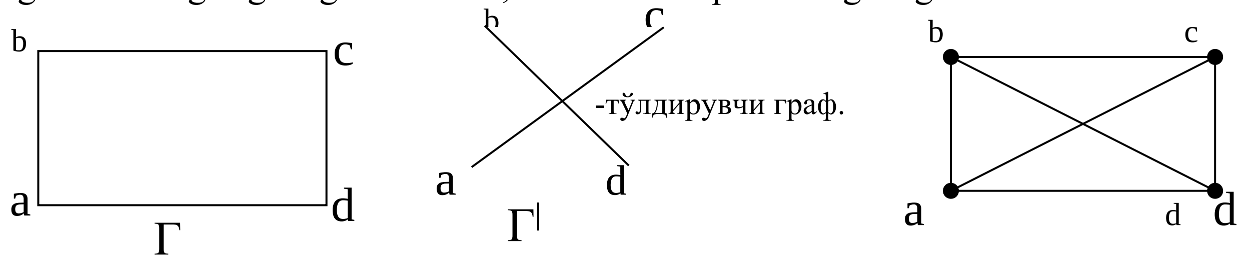
13.9-Ta’rif.$G^{|}$ graf G grafning qismi deyiladi, agar $G^{|}$ ning tugunlari to‘plami G ga tegishli bo‘lsa, ya’ni $V^{|}\subseteq V$ bo‘lsa, hamda $G^{|}$ ning barcha qirralari G ning ham qirralar bo‘lsa, ya’ni $E^{|}\subset E$





$$V=\{a, v, c, d\},\quad V^{|}=\{a^{|}, b^{|}, c^{|}, d^{|}\},\quad V^{|}\in V$$

13.10-Ta'rif. $G^{/}$ Graf G grafning to'ldiruvchisi diyiladi, agarda uning barcha tugunlari G grafga tegishli bo'lib, birorta ham qirrasi G ga tegishli bo'lmasa.



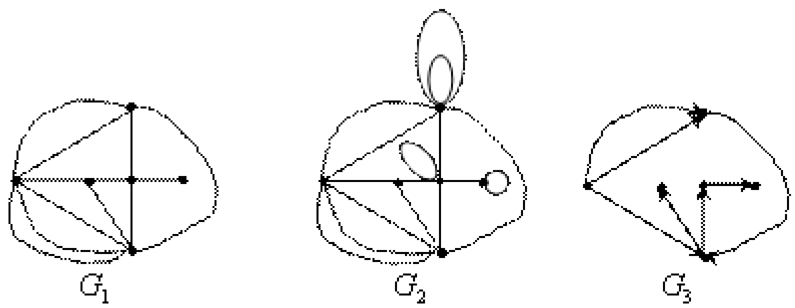
13.11-Ta'rif. a) Agar grafda takroriy (karrali) qirralar mavjud bo`lsa, bunday grafga **multigraf** deyiladi.

b) Agar grafda karrali qirralar bilan birga uchni o`z-o`zi bilan tutashtiruvchi ilmoqlar ham mavjud bo`lsa, bunday grafga **psevdograf** deyiladi.

c) Yo`nalishga ega bo`lgan qirralari mavjud graf **oriyentirlangan graf** (orgraf) deyiladi.

Orgrafning qirralari ularning yo`nalishini ko`rsatuvchi strelkalar bilan belgilanadi.

13.3-Misol:



G_1 – multigraf, G_2 – psevdograf, G_3 – oriyentirlangan multigraf.

13.12-Ta'rif. Agar *V* to`plamning quvvati *n* ga teng bo`lsa, *n* soni **grafning tartibi** deyiladi.

13.13-Ta'rif. Agar *V* to`plamning quvvati *n* ga teng bo`lsa, E to`plamning quvvati *m* ga teng bo`lsa, graf **(n, m) graf** deyiladi.

13.14- Ta'rif. Agar berilgan uch qirraning oxiri bo`lsa, qirra va uch **intsident** deyiladi.

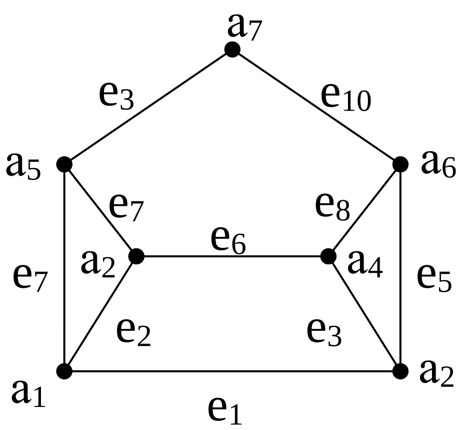
Qo'shmalik(insidentlik) matritsasi. Bizga G yo'naltirilmagan graf berilgan bo'lib, u chekli bo'lsin. Aytaylik $(a_1,\ldots,a_n)$, G grafning qirralari bo'lsin. U holda qo'shmalik matritsasi $\|A_{ij}\|$, i=1,m, j=1, n m ta qator va n ta ustundan iborat bo'ladi, A_{ij} matritsaning ustunlariga G ning tugunlari, qatorlariga G ning qirralarini mos qo'yamiz. U holda

$$A_{ij}=\begin{cases}1,\ agar\ e_i qirra\ a_j\ tugungaqo'shmabo'lsa.\\ 0,\ aksholda.\end{cases}$$

qoidadan foydadanib qo'shmalik matritsasini hosil qilamiz.

13.3-Misol.

	a_1	a_2	a_3	a_4	a_5	a_6	a_7
e_1	1	1	0	0	0	0	0
e_2	1	0	1	0	0	0	0
e_3	0	1	0	1	0	0	0
e_4	1	0	0	0	1	0	0
e_5	0	1	0	0	0	1	0
e_6	0	0	1	1	0	0	0
e_7	0	0	1	0	1	0	0
e_8	0	0	0	1	0	1	0
e_9	0	0	0	0	1	0	1
e_{10}	0	0	0	0	0	1	1



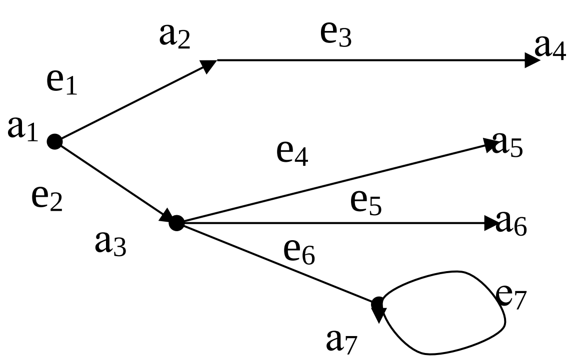
13.1-rasm

Agar G yo'naltirilgan graf bo'lsa, u holda

$$A_{ij}=\begin{cases}-1,\ agar\ a_j-tugun\ e_i-qirraning\ \ boshlanishi\ bo'lsa.\\ 1,agar\ a_j-tugun\quad e_i-qirraningoxiribo'lsa.\\ 0,agar\ a_j-tugun\ e_i-qirraga\ qo'shma\ bulmasa.\\ 2,agar\ a_j-tugun\ sirtmoq\ bo'lib\ e_i-qirraga\ qo'shma\ bo'lsa.\end{cases}$$

qoidadan foydadanib qo'shmalik matritsasini hosil qilamiz.

13.4-Misol.



13.2-расм

Qo‘shnilik matritsasi. Faraz qilaylik G graf yo‘naltirilmagan bo‘lsin. Grafning qo‘shnilik matritsasida A_{ij} ning ustunlariga ham qatorlariga ham grafning tugunlarini mos qo‘yamiz. U xolda

$$A_{ij}=\begin{cases} 1, \ agar \ \ a_i \ va \ a_j \ tugunlar \ qushni \ bo'lsa. \\ 0, aks \ holda. \end{cases}$$

qoidadan foydadanib qo’shnilik matritsasini hosil qilamiz.

13.5-Misol. 13.1-rasmda keltirilgan yo‘naltirilmagan graf uchun qo’shnilik matritsasi quyidagicha bo’ladi.

	a_2	a_3	a_4	a_5	a_6	a_7
	1	1	0	0	0	0
	0	0	0	0	0	0
	-1	0	1	0	0	0
	0	-1	0	1	0	0
	0	-1	0	0	1	0
	0	-1	1	0	0	1
	0	0	0	0	0	2

	a_2	a_3	a_4	a_5	a_6	a_7
	1	1	0	1	0	0
	0	0	1	0	1	0
	0	0	1	1	0	0
	1	1	0	0	1	0
	0	1	0	0	0	1
	1	0	1	0	0	1
	0	0	0	1	1	0

G yo‘naltirilgan graf bo‘lsin. U holda qo‘shnilik matritsasi A_{ij} ning ustunlariga ham satrlariga ham grafning tugunlarini mos qo‘yamiz. Uholda

$$\begin{cases} 1, \ agar \ a_i \ tugun \ \ a_j \ tugunning \ boshlanishi \ bo'lsa. \\ 0, \ \ agar \ \ a_i \ tugun \, a_j \ tugunga \ qo'shnibolmasa \ va \, a_i \ tugun \, a_j \ tugunning \ oxiri \ bo'lsa. \end{cases}$$

qoidadan foydadanib qo’shnilik matritsasini hosil qilamiz.

13.6-Misol. 13.2-rasmda keltirilgan yo‘naltirilgan graf uchun qo’shnilik matritsasi quyidagicha bo’ladi.

	a_2 a_3 a_4 a_5 a_6 a_7
	1 1 0 0 0 0
	0 0 1 0 0 0
	0 0 0 1 1 1
	0 0 0 0 0 0
	0 0 0 0 0 0
	0 0 0 0 0 0
	0 0 0 0 0 1

2. Mustaqil bajarish uchun masala va topshiriqlar

2.1. Graflar ustida amallar

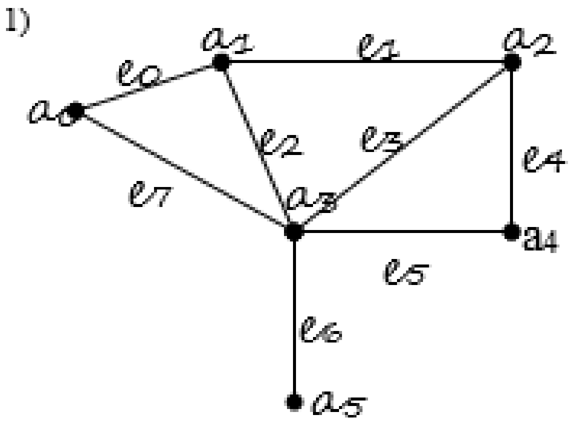
Quyidagi keltirilgan yunaltirilgan va yunaltirilmagan graflar uchun:

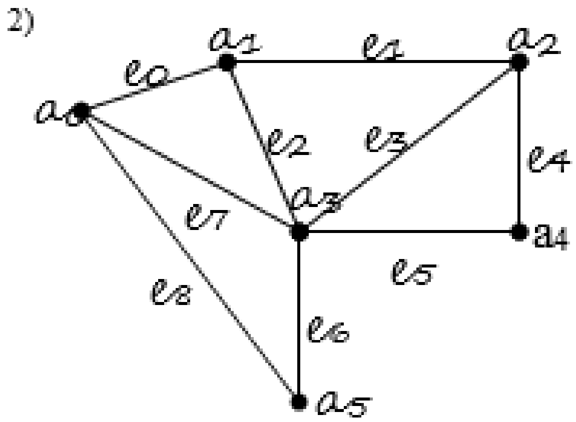
1) Grafni tuldiruvchisini toping.

2) Grafni kism grafini toping.

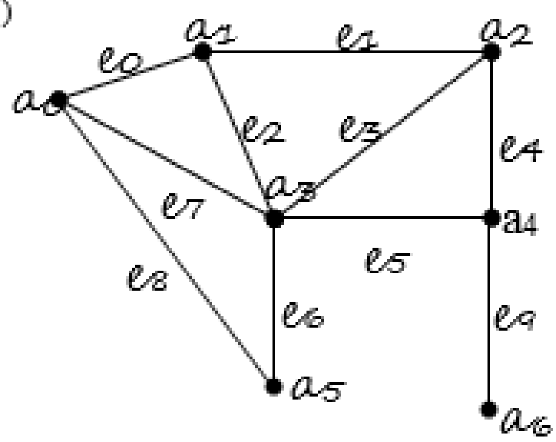
3) Ko’shmalik matritsani tuzing.

4) Ko’shnilik matritsani tuzing.

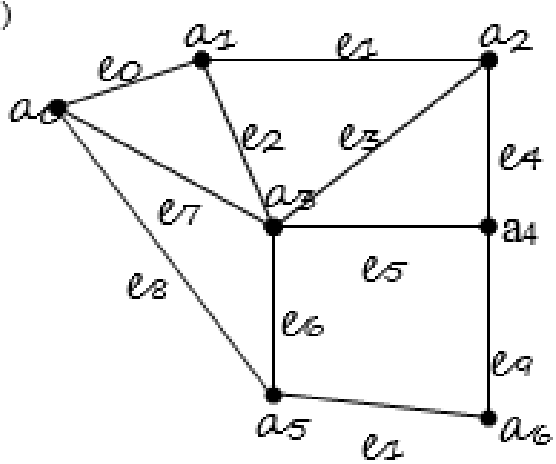




3)


a0
a1
a2
a3
a4
a5
a6
e0
e1
e2
e3
e4
e5
e6
e7
e8
e9

4)


a0
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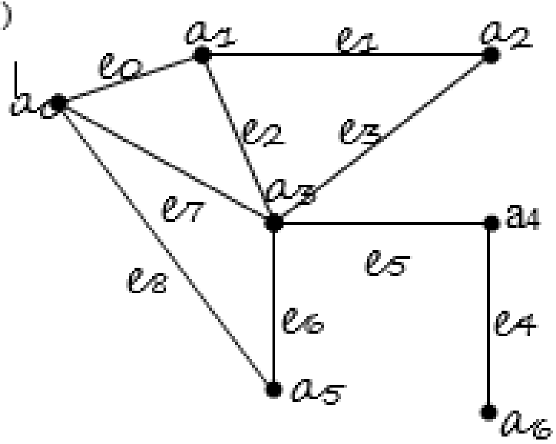
5)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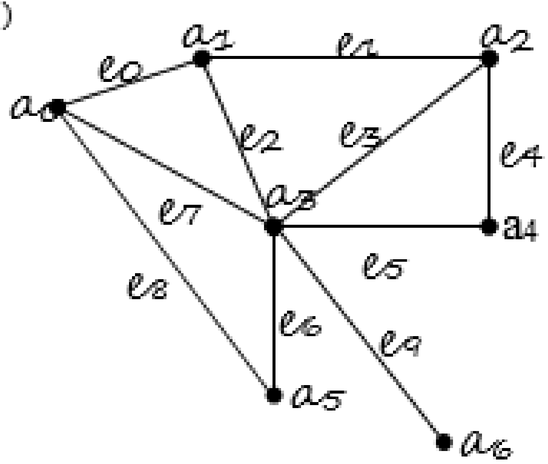
6)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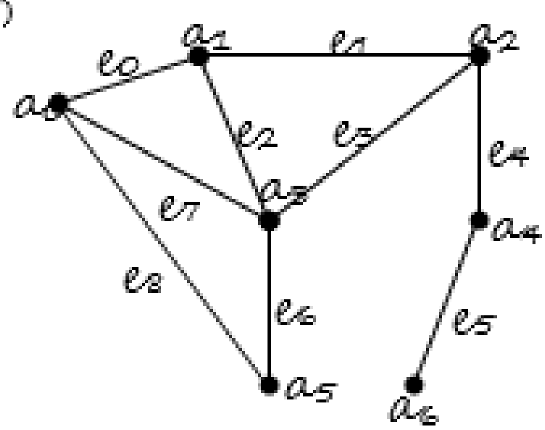
7)



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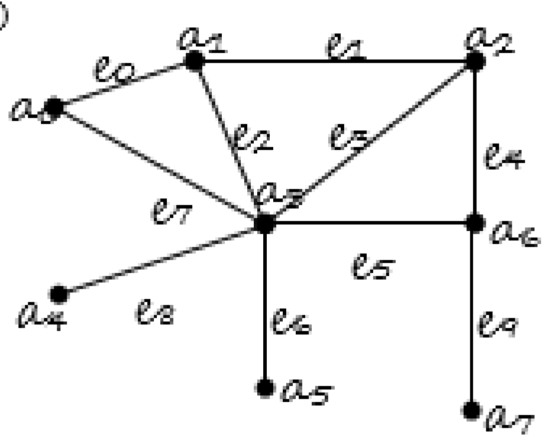

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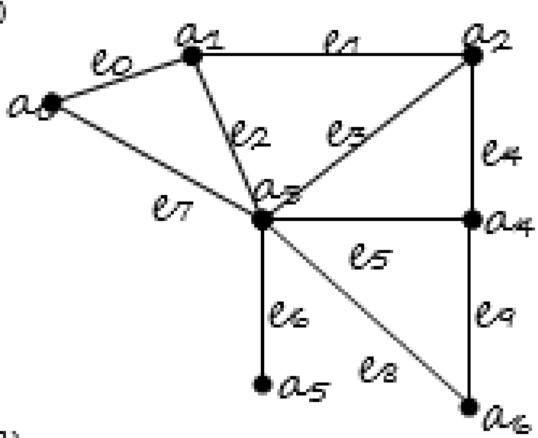

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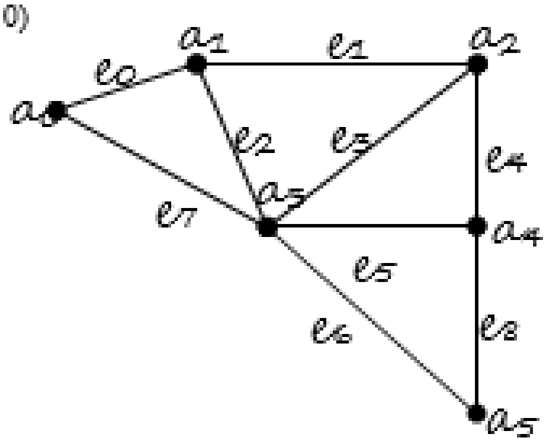

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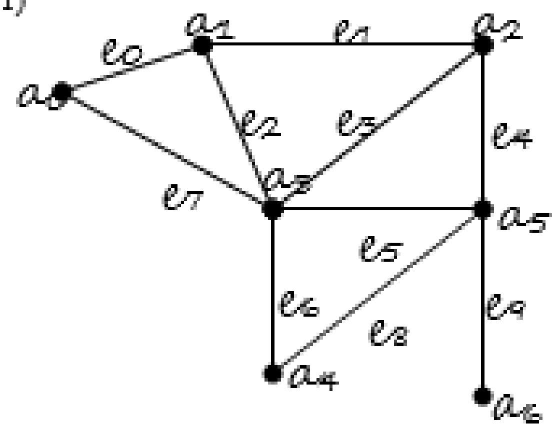

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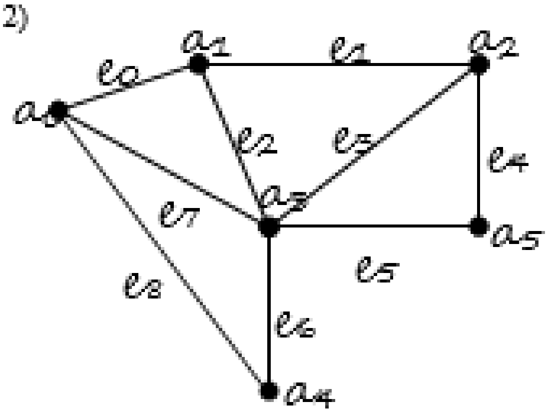

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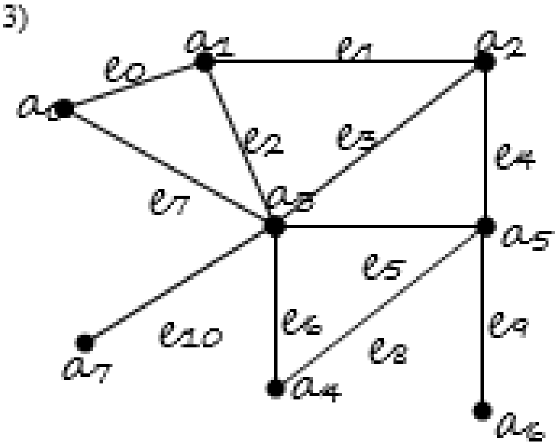

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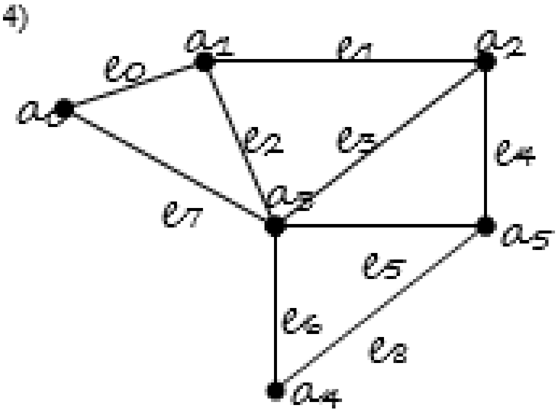

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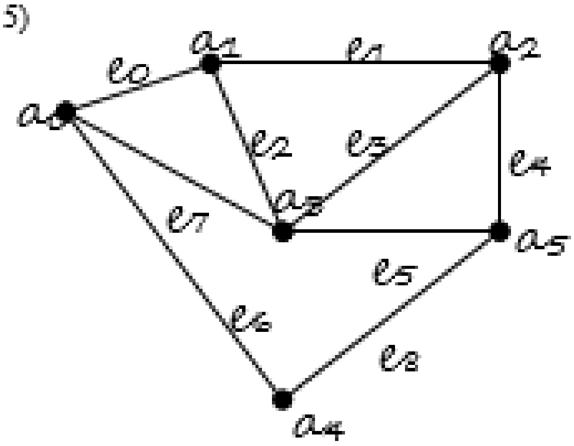

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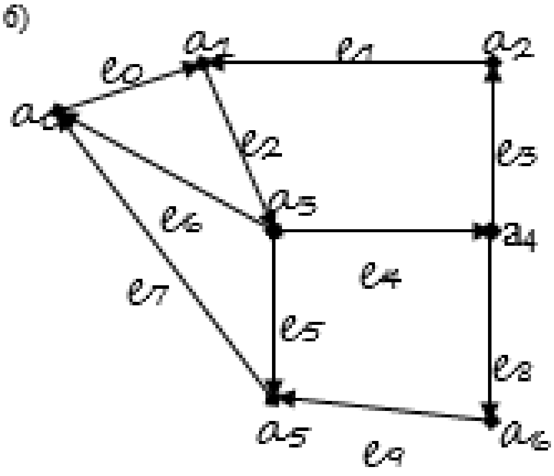

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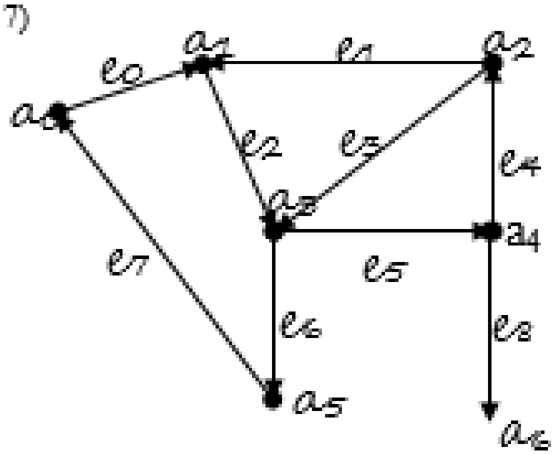

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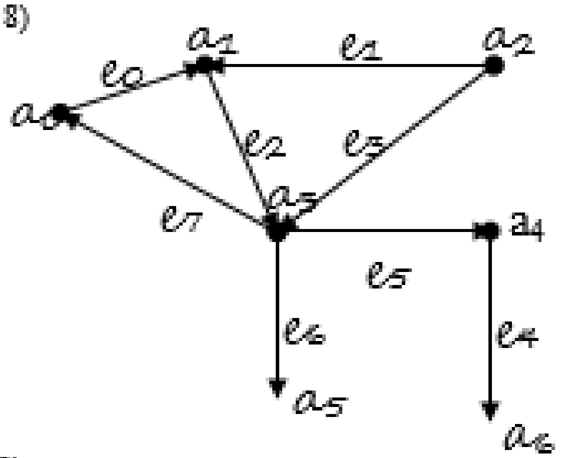

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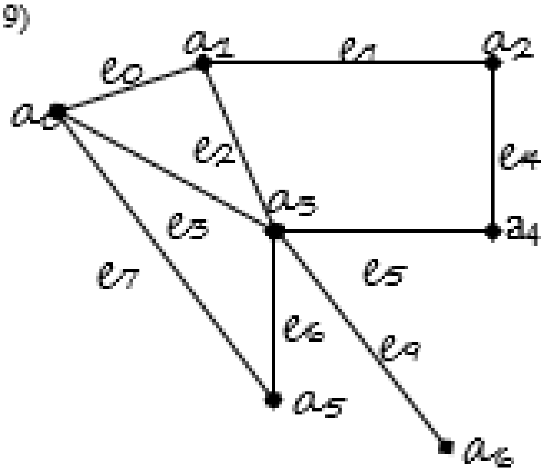

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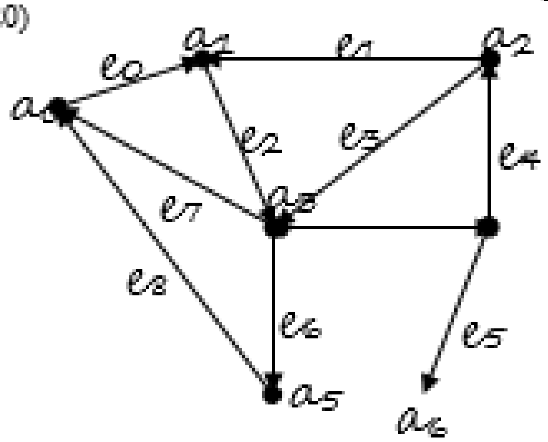

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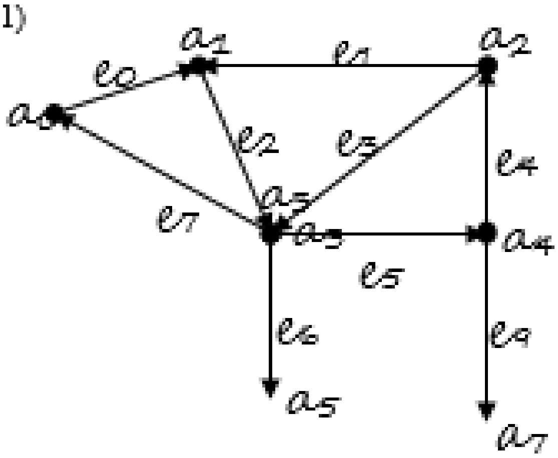

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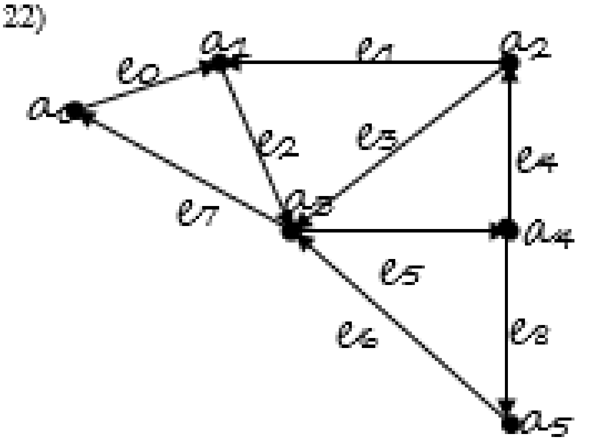

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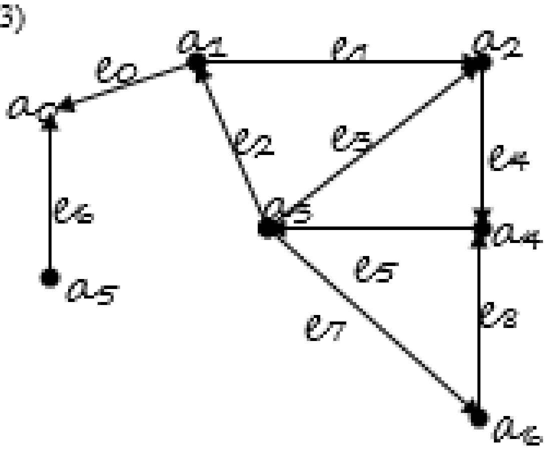

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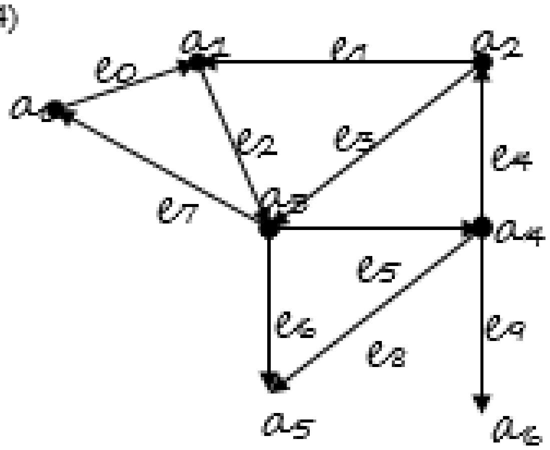

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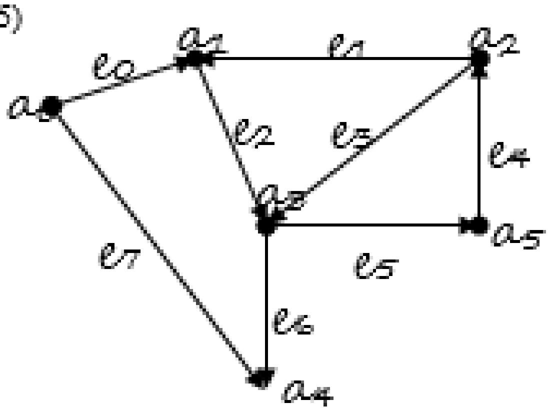

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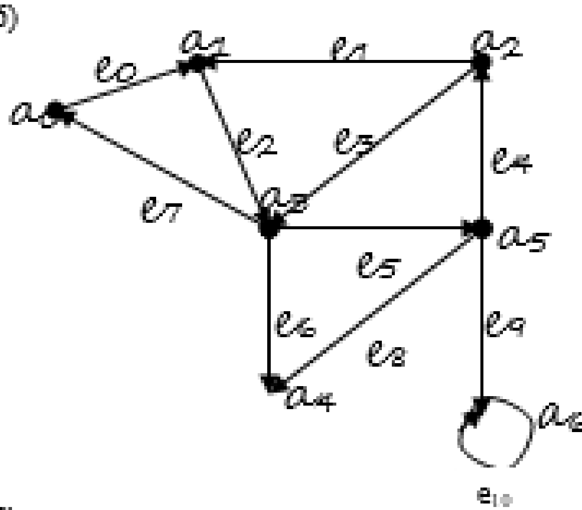

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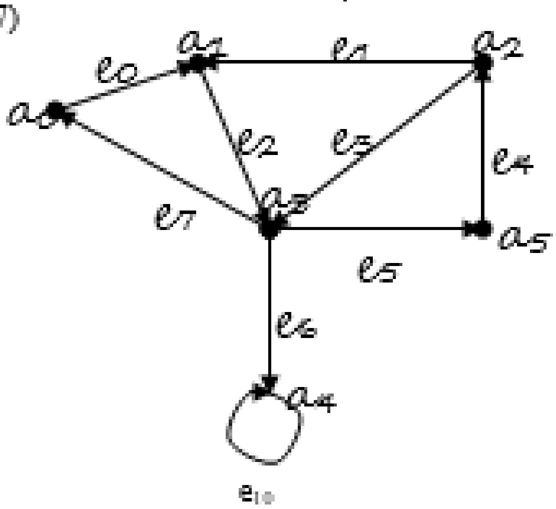

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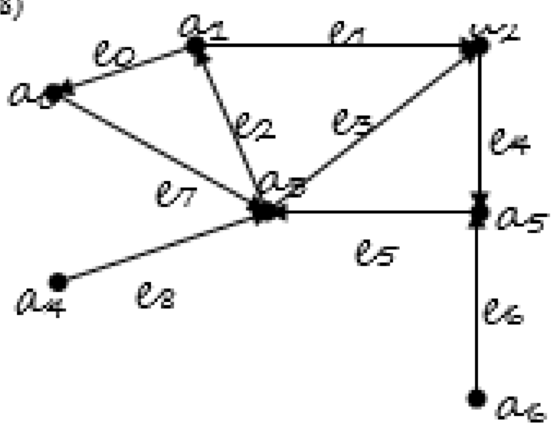
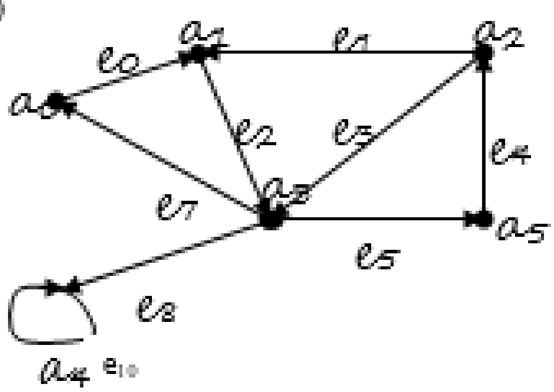


29)



30)