# DISKRET MATEMATIKA

Uslubiy ko'rsatma

Toshkent-2014

“O’zbekiston temir yo’llari” DATK
Toshkent temir yo’l muhandislari instituti

# DISKRET MATEMATIKA

«Diskret matematika» fanidan 5311300 – “Telekommunikatsiya” va 5111036 – “Kasb ta’limi (telekommunikatsiya)” ta’lim yo’nalishlari 2-bosqich bakalavriat talabalari uchun hisob-grafik ishlarini bajarishga doir uslubiy ko’rsatma

Toshkent 2014

УДК 519.854

Ushbu uslubiy ko’rsatma bakalavriatning “telekommunikatsiya” yo’nalishi talabalari uchun mo’ljallangan. Bu ko’rsatmada to’plamlar nazariyasi, kombinatorika, matematik mantiq, rele- kontakt sxemalari va graflar nazariyasi bo’yicha tipik masalalarga misollar va ularning yechimlari keltirilgan. Uslubiy ko’rsatma talabalar hisob- grafik ishi topshiriqlarini mustaqil bajarishlari uchun mo’ljallangan.

Ko’rsatma Institut Ilmiy uslubiy kengashi tomonidan nashrga tavsiya etilgan.

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## Kirish

Diskret matematika – zamonaviy matematikaning jo'shqin rivojlanayotgan bo'limlaridan biri bo'lib, avtomatik boshqaruv sistemalarini va telekommunikatsiya sistemalarini loyihalashtirishda keng qo'llaniladi.

"Diskret matematika" fani bakalavriatning "telekommunikatsiya" yo'nalishini o'quv rejasiga kiritilganidan so'ng, talabalar diskret matematikani o'zlashtirishlari va uning usullarini egallashlarida muhim ahamiyatga ega bo'lgan hisob grafik ishlarini bajarishlari uchun topshiriqlar to'plamini yaratishga zarurat tug'ildi.

Mazkur uslubiy ko'rsatma to'plamlar nazariyasi, kombinatorika, matematik mantiq, rele- kontakt sxemalari va graflar nazariyasiga oid tipik masalalardan tuzilgan. Ba'zi topshiriqlar [1], [2] dan olingan. Talabalar diskret matematikani boshqa usullari bilan tanishishni istasalar bu adabiyotlarga murojaat qilishlari mumkin

## 1. To'plamlar nazariyasi

**1- topshiriq.**

Agar $U = \{0,1,2,3,4,5,6,7,8,9\}$ universal to'plam bo'lib, X va Y quyidagi jadvalda variantlar bo'yicha berilgan bo'lsa $\overline{X \cup Y}$ , $\overline{Y}$, $X\Delta Y$, $X \cap \overline{Y}, X\backslash Y$ to'plamlarni toping.

| № | $X$ | $Y$ |
|---|---|---|
| 1 | {0,1,2,3,4} | {3,4,5,6,7} |
| 2 | {1,2,3,4,5} | {2,3,6,7,8} |
| 3 | {2,3,7,8,9} | {5,6,7,8,9} |
| 4 | {4,5,7,8,9} | {1,2,5,7.9} |
| 5 | {6,7,8,3,9} | (2,3,4,8,9) |
| 6 | {5,2,3,7,8} | {1,2,3,4,5} |
| 7 | {4,5,7,8,9} | {3,4,5,7,9} |
| 8 | {3,5,7,8,6} | {5,6,7,8,9} |
| 9 | {0,2,4,6,8} | {2,3,4,5,6} |
| 10 | {7,8,9,0,1} | {1,0,2,4,5} |
| 11 | {2,3,5,6,7} | {5,6.3,1,0} |
| 12 | {0,1,2,3,4} | {2,3,4,5,6} |
| 13 | {3,4,5,6,7} | {5,6,7,8,9} |
| 14 | {9,7,5,3,1} | {1,3,4,5,6} |
| 15 | {8,6,4,2,0} | {2,3,4,6,7} |
| 16 | {5,6,0,1,2} | {1,2,7,8,9} |

| | | |
|---|---|---|
| 17 | {4,5,3,2,0} | {0,1,2,7,8} |
| 18 | {1,4,7,8,9} | {0,2,5,8,9} |
| 19 | {2,3,5,6,7} | {3,5,7,1,0} |
| 20 | {0,3,6,5,4} | {0,1,2,3,4,5} |
| 21 | {5,6,7,8,9} | {2,3,4,5,6} |
| 22 | {3,5,8,7,0} | {1,0,3,5,4} |
| 23 | {3,2,0,6,7} | {5,6,7,8,9} |
| 24 | {0,1,5,6,7} | {3,4,5,8,7} |
| 25 | {5,2,3,7,8} | {0,4,5,7,8} |
| 26 | {2,3,7,8,9} | {4,5,6,8,9} |
| 27 | {4,2,5,8,9} | {1,2,3,4,5,6} |
| 28 | {0,2,6,8,9} | {2,4,6,7,3} |
| 29 | {3,5,7,8,6} | {0,1,2,3,4} |
| 30 | {1,2,3,4,5} | {0,1,2,3,7} |

**1 – Topshiriqni bajarishga misol**.

$X$={3,2,1,6,4}, $Y$={0,1,2,7,8} berilgan bo'lsa

а) $X \cup Y$={0,1,2,3,4,6,7,8}, $X \cap Y = \{1,2\}$, $\overline{Y} = \{3,4,5,6,9\}$

б) $\overline{X \cup Y}$ ={5,9}

в) $\overline{Y} = \{3,4,5,6,9\}$

г) $X \Delta Y = (X \cup Y) \backslash (X \cap Y) = \{0,3,4,6,7,8\}$

д) $X \cap \overline{Y} = \{3,4,6\}$

е) $X \backslash Y = \{3,4,6\}$

**2- topshiriq.**

Tengliklarning to'g'riligini Eyler diagrammalari va algebraik usulda tekshiring.

| | | | |
|---|---|---|---|
| 1. | $\overline{(\overline{A} \backslash B)} \backslash A = A \cup B.$ | 2. | $\overline{A \backslash (B \cup A)} = U.$ |
| 3. | $(A \backslash B) \cap B = A.$ | 4. | $\overline{\overline{A} \cap (\overline{B} \backslash A)} = A \cup B.$ |
| 5. | $\overline{(\overline{A} \cap \overline{B})} \cup B = A \cap B.$ | 6. | $A \cap B \cup \overline{A \cup \overline{B}} = A.$ |
| 7. | $A \cup B \cap (A \cup C) A \cap C = A \cup B \cap C$ | 8. | $\overline{\overline{A} \cup \overline{B} \cup \overline{C}} = (A \cup B) \cap (A \cup C$ |
| 9. | $A \cap (B \backslash A) = A \cup B.$ | 10. | $\overline{\overline{A} \cap B} \cup B = A$ |
| 11. | $A \cap B \cup \overline{(\overline{A} \cup B)} = A$ | 12. | $A \cup B \cap (A \cup C) \cup A \cap C = A \cup B \cap C$ |

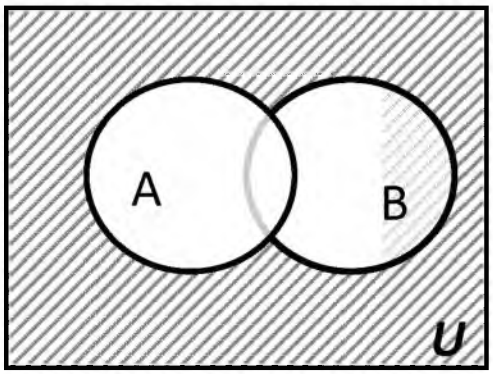
| | | | |
|---|---|---|---|
| 13. | $\overline{A} \cup \overline{B} \cup \overline{C} = \overline{(A \cup B) \cap (A \cup C)}$ | 14. | $\overline{A} \cap (\overline{B} \setminus A) = \overline{A \cup B}$ |
| 15. | $(\overline{A} \cap \overline{B}) \cup B = \overline{A \cap \overline{B}}$ | 16. | $(\overline{B} \setminus A) \setminus B = \overline{A \cup B}$ |
| 17. | $A \setminus \overline{(A \cup B)} = A$ | 18. | $\overline{A \setminus B} \cap B = \overline{A} \cap \overline{B}$ |
| 19. | $\overline{\overline{A}(\overline{B} \setminus A)} = A \cup B$ | 20 | $\overline{(\overline{A} \cap \overline{B}) \cup B} = A \cap B$ |
| 21. | $\overline{\overline{B} \cup \overline{(A \setminus B)}} = \emptyset$ | 22. | $\overline{A \cap \overline{B}} = A \cap B$ |
| 23. | $\left((A \setminus \overline{B}) \setminus \overline{A}\right) \setminus \overline{B} = A \cap B$ | 24. | $(A \cup B) \cup \overline{(\overline{A} \cup B)} = A$ |
| 25. | $A \cup B \cap (A \cup C) \cup A \cap C = A \cup B \cap C$ | 26. | $\overline{\overline{A} \cup \overline{B} \cup \overline{C}} = (A \cup B) \cap (A \cup C)$ |
| 27. | $\overline{A} \cap (\overline{B} \setminus A) = \overline{A \cup B}$ | 28. | $(A \cap \overline{B}) \cup B = \overline{A \cap \overline{B}}$ |
| 29. | $\left((A \setminus B) \cup \overline{A}\right) \cap B = \overline{A} \cap B$ | 30. | $\overline{(\overline{A} \setminus B) \setminus A} = A \cup B$ |

**2- topshiriqni bajarishga misol.**

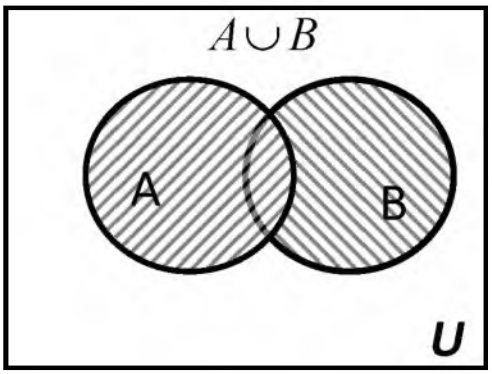
$\overline{(\overline{A} \setminus B) \setminus A} = A \cup B$ tenglikni tekshiring.

Yechish:

$\overline{(\overline{□} \setminus □) \setminus □} = \overline{(\overline{□} \cap \overline{□}) \cap \overline{□}} = \overline{\overline{□} \cap \overline{□}} = □ \cup □.$




$\overline{A} \setminus B$




$\overline{(\overline{A} \setminus B) \setminus A}$

**3- topshiriq.**

Agar $k, l, m, n$ variantlar bo'yicha quyidagi jadvalda berilgan bo'lsa, 1 dan 1000 gacha bo'lgan natural sonlardan nechtasi $k$ ga ham, $l$ ga ham, $m$ ga ham va $n$ ga ham bo'linmaydi?

| № | $k$ | $l$ | $m$ | $n$ | № | $k$ | $l$ | $m$ | $n$ | № | $k$ | $l$ | $m$ | $n$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 5 | 6 | 7 | 11 | 7 | 9 | 5 | 3 | 21 | 2 | 5 | 4 | 13 |
| 2 | 2 | 3 | 4 | 5 | 12 | 8 | 5 | 2 | 9 | 22 | 2 | 8 | 5 | 13 |
| 3 | 3 | 4 | 5 | 8 | 13 | 3 | 8 | 16 | 7 | 23 | 11 | 7 | 9 | 3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 6 | 7 | 3 | 2 | 14 | 13 | 9 | 5 | 3 | 24 | 3 | 6 | 5 | 4 |
| 5 | 5 | 8 | 9 | 4 | 15 | 3 | 5 | 6 | 13 | 25 | 4 | 8 | 19 | 3 |
| 6 | 3 | 4 | 5 | 6 | 16 | 11 | 8 | 3 | 2 | 26 | 19 | 5 | 10 | 2 |
| 7 | 2 | 4 | 5 | 7 | 17 | 17 | 2 | 3 | 4 | 27 | 5 | 6 | 7 | 8 |
| 8 | 3 | 7 | 6 | 11 | 18 | 2 | 5 | 4 | 17 | 28 | 11 | 3 | 9 | 5 |
| 9 | 11 | 3 | 9 | 10 | 19 | 3 | 4 | 6 | 17 | 29 | 12 | 3 | 5 | 19 |
| 10 | 11 | 8 | 5 | 4 | 20 | 13 | 2 | 3 | 4 | 30 | 23 | 2 | 8 | 7 |

**3- topshiriqni bajarishga misol.**

Birdan minggacha natural sonlardan nechtasi 2ga ham, 7ga ham, 8 ga ham va 23 ga ham bo'linmaydi?

Yechish. Ikkiga bo'linmaydigan son 8 ga ham bo'linmaydi, shu sababli 8 ni sharndan chetlatishimiz mumkin. Aytish kerakki 2 ga har ikkinchi son bo'linadi,7 ga har yettinchi son bo'linadi, va hokazo.

Agar $[a]-a$ sonining butun qismi bo'lsa, kiritish va chetlatish formulasiga ko'ra izlanayotgan son:

$$M = 1000 - \left[\frac{1000}{2}\right] - \left[\frac{1000}{7}\right] - \left[\frac{1000}{23}\right] + \left[\frac{1000}{2\cdot 7}\right] + \left[\frac{1000}{2\cdot 23}\right] + \left[\frac{1000}{7\cdot 23}\right] - \left[\frac{1000}{2\cdot 7\cdot 23}\right] = 1000 - 500 - 142 - 43 + 71 + 21 + 6 - 3 = 410.$$

## 2. Kombinatorika

**4- topshiriq.**

Agar $a, b, n$ variantlar bo'yicha quyidagi jadvalda berilgan bo'lsa, $(a+b)^n$ binom yoyilmasida eng katta hadni toping.

| № | $a$ | $b$ | $n$ | № | $a$ | $b$ | $n$ | № | $a$ | $b$ | $n$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $\sqrt{5}$ | 3 | 20 | 11 | $\sqrt{13}$ | 3 | 26 | 21 | $\sqrt{3}$ | 1,9 | 10 |
| 2 | 10 | $\sqrt{3}$ | 17 | 12 | 4 | $\sqrt{13}$ | 10 | 22 | 2,8 | $\sqrt{6}$ | 17 |
| 3 | $\sqrt{5}$ | 2 | 18 | 13 | $\sqrt{7}$ | 2,5 | 8 | 23 | $\sqrt{7}$ | 2,5 | 16 |
| 4 | 3 | $\sqrt{6}$ | 14 | 14 | 3 | $\sqrt{3}$ | 80 | 24 | 2,3 | $\sqrt{8}$ | 20 |
| 5 | $\sqrt{7}$ | 3 | 15 | 15 | $\sqrt{5}$ | 3 | 10 | 25 | $\sqrt{13}$ | 2,7 | 14 |
| 6 | 3 | $\sqrt{10}$ | 19 | 16 | 13 | $\sqrt{6}$ | 9 | 26 | 3,3 | $\sqrt{7}$ | 16 |
| 7 | $\sqrt{11}$ | 4 | 30 | 17 | $\sqrt{13}$ | 4 | 11 | 27 | $\sqrt{11}$ | 5 | 22 |
| 8 | 3 | $\sqrt{12}$ | 60 | 18 | 8 | $\sqrt{8}$ | 60 | 28 | 3 | $\sqrt{10}$ | 30 |
| 9 | $\sqrt{8}$ | 5 | 16 | 19 | $\sqrt{10}$ | 3,3 | 10 | 29 | $\sqrt{5}$ | 4,3 | 26 |
| 10 | 4 | $\sqrt{13}$ | 14 | 20 | 3,2 | $\sqrt{5}$ | 15 | 30 | 6 | $\sqrt{15}$ | 40 |

**4- topshiriqni bajarishga misol.**

Agar $a=1, b=\sqrt{3}, n=100$ berilgan bo'lsa, $(a+b)^n$binom yoyilmasida eng katta hadni toping.

Yechish. Aytaylik $T_k$ –$\left(1+\sqrt{3}\right)^{100}$ binom yoyilmasida eng katta hadi bo'lsin, $T_k = C_{100}^k\left(\sqrt{3}\right)^k$. U holda $T_k > T_{k-1}$ va $T_k > T_{k+1}$. Demak, ushbu tengsizliklar sistemasi o'rinli $\begin{cases} C_{100}^k\left(\sqrt{3}\right)^k > C_{100}^{k-1}\left(\sqrt{3}\right)^{k-1} \\ C_{100}^k\left(\sqrt{3}\right)^k > C_{100}^{k+1}\left(\sqrt{3}\right)^{k+1} \end{cases}$ yoki

$\begin{cases} \frac{100!}{k!(100-k)!}\left(\sqrt{3}\right)^k > \frac{100!}{(k-1)!(101-k)!}\left(\sqrt{3}\right)^{k-1} \\ \frac{100!}{k!(100-k)!}\left(\sqrt{3}\right)^k > \frac{100!}{(k+1)!(99-k)!}\left(\sqrt{3}\right)^{k+1}. \end{cases}$

Qisqartishlardan so'ng $\begin{cases} (101-k)\sqrt{3} > k \\ k+1 > (100-k) \end{cases}$, sistemadan $k$ uchun $\frac{100\sqrt{3}-1}{1+\sqrt{3}} < k < \frac{101\sqrt{3}}{1+\sqrt{3}}$ o'rinli ekani kelib chiqadi. $\sqrt{3}$=1,732 taqribiy qiymatni o'rniga qo'ysak , natijada 63,135<$k$<64,64.

Bu oraliqda $k$ ning yagona butun qiymati $k$=64. Demak, $T_{64} = C_{100}^{64}\left(\sqrt{3}\right)^{64} = \frac{100!}{64!36!}3^{32}$, $(1+\sqrt{3})^{100}$ binom yoyilmasida eng katta had.

**5- topshiriq.**

Quyidagi proporsiyalardan $x$ va $y$ topilsin.

| | | | |
|---|---|---|---|
| 1. | $C_x^{y+1}:C_x^y:C_x^{y-1} = 5:4:2$ | 16. | $C_x^{y+1}:C_x^y:C_x^{y-1} = 21:14:6$ |
| 2. | $C_x^{y+1}:C_x^y:C_x^{y-1} = 3:3:2$ | 17. | $C_x^{y+2}:C_x^{y+1}:C_x^y = 3:5:5$ |
| 3. | $C_x^{y+2}:C_x^{y+1}:C_x^y = 42:35:20$ | 18. | $C_{x+1}^{y+2}:C_{x+1}^{y+1}:C_{x+1}^y = 2:4:5$ |
| 4. | $C_{x+1}^{y+2}:C_{x+1}^{y+1}:C_{x+1}^y = 3:4:3$ | 19. | $C_{x+1}^{y+1}:C_{x+1}^y:C_{x+1}^{y-1} = 2:3:3$ |
| 5. | $C_{x+1}^{y+1}:C_{x+1}^y:C_{x+1}^{y-1} = 4:5:4$ | 20. | $C_x^{y+1}:C_x^y:C_x^{y-1} = 14:8:3$ |
| 6. | $C_{x+1}^{y+2}:C_{x+1}^{y+1}:C_{x+1}^y = 5:6:5$ | 21. | $C_{x+1}^{y+1}:C_{x+1}^y:C_{x+1}^{y-1} = 15:5:1$ |
| 7. | $C_{x+1}^{y+1}:C_{x+1}^y:C_{x+1}^{y-1} = 14:7:2$ | 22. | $C_x^{y+1}:C_x^y:C_x^{y-1} = 15:24:28$ |
| 8. | $C_x^{y+2}:C_x^{y+1}:C_x^y = 5:3:1$ | 23. | $C_x^{y+1}:C_x^y:C_x^{y-1} = 3:4:3$ |
| 9. | $C_x^{y+1}:C_x^y:C_x^{y-1} = 6:14:21$ | 24. | $C_{x+1}^{y+2}:C_{x+1}^{y+1}:C_{x+1}^y = 6:7:6$ |

| | | | |
|---|---|---|---|
| 10. | $C_x^{y+2}: C_x^{y+1}: C_x^y = 24:9:2$ | 25. | $C_{x+1}^{y+1}: C_{x+1}^y: C_{x+1}^{y-1} = 5:5:3$ |
| 11. | $C_{x+1}^{y+2}: C_{x+1}^{y+1}: C_{x+1}^y = 28:12:3$ | 26. | $C_x^{y+1}: C_x^y: C_x^{y-1} = 1:7:21$ |
| 12. | $C_{x+1}^{y+1}: C_{x+1}^y: C_{x+1}^{y-1} = 6:3:1$ | 27. | $C_x^{y+2}: C_x^{y+1}: C_x^y = 7:7:5$ |
| 13. | $C_x^{y+1}: C_x^y: C_x^{y-1} = 72:45:20$ | 28. | $C_{x+1}^{y+2}: C_{x+1}^{y+1}: C_{x+1}^y = 45:20:6$ |
| 14. | $C_x^{y+2}: C_x^{y+1}: C_x^y = 14:10:5$ | 29. | $C_{x+1}^{y+1}: C_{x+1}^y: C_{x+1}^{y-1} = 55:22:6$ |
| 15. | $C_{x+1}^{y+2}: C_{x+1}^{y+1}: C_{x+1}^y = 28:24:15$ | 30. | $C_x^{y+2}: C_x^{y+1}: C_x^y = 45:35:20$ |

**5- topshiriqni bajarishga misol.**

$C_x^{y+1}: C_x^y: C_x^{y-1} = 2:2:1$ proporsiyadan $x$ va $y$ topilsin.

Yechish. Birinchi hadni ikkinchiga nisbatini va ikkinchi hadni uchinchiga nisbatini alohida yozib, qisqartishlardan song $\begin{cases} \frac{x-y}{y+1} = 1 \\ \frac{x-y+1}{y} = 2 \end{cases}$ sistema o'rinli ekani ma'lum bo'ladi . Uni yechsak $x = 5, y = 2$.

## 3. Matematik mantiq

**6-topshiriq.**

1. DNSH dagi $f_1, f_2, f_3$ formulalarni MDNSH ga keltirib ularni teng kuchliligini tekshiring.

2. $f_2$ formulani KNSH ga keltiring va hosil bo'lgan ifodani soddalashtiring.

| № | $f_1$ | $f_2$ | $f_3$ |
|---|---|---|---|
| 1 | $\overline{x} \cdot \overline{y} \vee x\overline{y} \vee yz$ | $x\overline{y} \vee xz$ | $\overline{y} \vee z$ |
| 2 | $\overline{y}\,\overline{z} \vee xz \vee \overline{x}y\overline{z} \vee \overline{y}\,z$ | $\overline{y}\,\overline{x} \vee x\overline{y} \vee yz$ | $\overline{z}\,\overline{x} \vee \overline{y} \vee xz$ |
| 3 | $\overline{y}\,\overline{z} \vee xz \vee \overline{x}\,\overline{y}$ | $y\overline{z} \vee \overline{x}y \vee y\overline{x} \vee \overline{y}z$ | $x\overline{y}z \vee xy\overline{z} \vee \overline{x}$ |
| 4 | $x\overline{y}\,\overline{z} \vee xz \vee \overline{x}yz$ | $x\overline{y}\,\overline{z} \vee z \vee \overline{x}y$ | $x\overline{y} \vee yz$ |
| 5 | $\overline{y}z \vee xy \vee y\overline{z} \vee \overline{z}\,\overline{x}$ | $\overline{y}\,\overline{x} \vee yz \vee xz$ | $\overline{y}\,\overline{x} \vee y\overline{z} \vee xz$ |
| 6 | $\overline{y}\,\overline{z} \vee xy\overline{z} \vee \overline{x}\,\overline{y}z$ | $x\overline{z} \vee \overline{x}\,\overline{y}$ | $x \vee \overline{x}yz$ |
| 7 | $x\overline{y}\,\overline{z} \vee xz \vee yz \vee \overline{x}y\overline{z}$ | $y\overline{x} \vee \overline{y}x \vee xz$ | $z\overline{x} \vee \overline{y}x \vee x\overline{z}$ |
| 8 | $\overline{x}\,\overline{y}z \vee x\overline{y} \vee yz \vee x\overline{z} \vee \overline{x}y\overline{z}$ | $yx \vee \overline{y}x \vee z$ | $\overline{y}z \vee y\overline{z} \vee xz$ |
| 9 | $\overline{y}z \vee \overline{x}\,\overline{y} \vee y\overline{z} \vee x\overline{y}\,\overline{z}$ | $y\overline{x} \vee \overline{y}x \vee x\overline{z}$ | $\overline{y} \vee \overline{z}$ |
| 10 | $x\overline{y}z \vee x\overline{z} \vee y\overline{z} \vee \overline{x}yz$ | $y\overline{x} \vee \overline{y}x \vee x\overline{z}$ | $\overline{x} \vee y\overline{z}$ |

| | | | |
|---|---|---|---|
| 11 | $\bar{x}y\bar{z} \vee \bar{y}z \vee xy \vee x\bar{y}\,\bar{z}$ | $y\bar{x} \vee yx \vee x$ | $\bar{y}z \vee y\bar{z} \vee x$ |
| 12 | $\bar{x}yz \vee \bar{y}\,\bar{x} \vee xy\bar{z} \vee \bar{y}\,\bar{z}$ | $y\bar{x} \vee \bar{y}\,\bar{z} \vee z$ | $\bar{y}\,\bar{x} \vee z\bar{x} \vee \bar{z}x$ |
| 13 | $\bar{y}\,\bar{z} \vee zx \vee \bar{z}y$ | $yx \vee \bar{y}z$ | $x \vee z$ |
| 14 | $\bar{z}\,\bar{y} \vee z\bar{y}\,\bar{x} \vee xy \vee \bar{x}\,\bar{z}$ | $\bar{z}\,\bar{y} \vee y\bar{z} \vee xz$ | $\bar{y}\,\bar{x} \vee xy \vee \bar{z}$ |
| 15 | $\bar{z}y \vee \bar{y}\,\bar{z} \vee \bar{x}z \vee \bar{x}\,\bar{z}$ | $\bar{z}\,\bar{y} \vee \bar{y}z \vee \bar{x}z \vee \bar{z}x$ | $\bar{x}yz \vee \bar{y} \vee xy\bar{z}$ |
| 16 | $\bar{x}y\bar{z} \vee xy \vee x\bar{y}z$ | $yz \vee x \vee \bar{x}y\bar{z}$ | $xz \vee y\bar{z}$ |
| 17 | $x\bar{z}\vee\bar{x}\,\bar{y} \vee \bar{x}z \vee yz$ | $xy \vee xz \vee \bar{y}\,\bar{z}$ | $\bar{x}z \vee xy \vee \bar{y}\,\bar{z}$ |
| 18 | $\bar{x}\,\bar{z} \vee x\bar{y}\,\bar{z} \vee \bar{x}yz$ | $y\bar{x} \vee \bar{y}z$ | $y \vee x\bar{y}z$ |
| 19 | $xy \vee \bar{x}yz \vee xz \vee \bar{x}\,\bar{y}z$ | $xy \vee \bar{y}z \vee y\bar{z}$ | $\bar{x} \vee x\bar{y} \vee y\bar{z}$ |
| 20 | $x\bar{y}\,\bar{z} \vee y\bar{z} \vee \bar{x}y \vee \bar{x}\,\bar{y}z$ | $xy \vee \bar{y}z \vee y\bar{z}$ | $\bar{x}z \vee \bar{x}y \vee x\bar{z}$ |
| 21 | $xz \vee \bar{x}z \vee \bar{x}y\bar{z} \vee \bar{y}\,\bar{z}$ | $\bar{x}y \vee \bar{y}z \vee y\bar{z}$ | $\bar{x} \vee \bar{z}$ |
| 22 | $xy\bar{z} \vee \bar{x}z \vee \bar{x}y \vee x\bar{y}z$ | $\bar{x}y \vee \bar{y}z \vee y\bar{z}$ | $\bar{y} \vee \bar{x}z$ |
| 23 | $\bar{x}\,\bar{y}z \vee x\bar{z} \vee xy \vee \bar{x}y\bar{z}$ | $y \vee yz \vee \bar{y}\,\bar{z}$ | $x\bar{z} \vee y \vee \bar{x}z$ |
| 24 | $x\bar{y}z \vee \bar{x}\,\bar{z} \vee \bar{x}yz \vee \bar{y}\,\bar{z}$ | $\bar{y}z \vee x \vee \bar{x}\,\bar{z}$ | $\bar{x}y \vee x\bar{y} \vee \bar{y}\,\bar{z}$ |
| 25 | $xy \vee \bar{x}\,\bar{z}$ | $\bar{x}y \vee x\bar{y}\,\bar{z}$ | $y\bar{z} \vee \bar{x}\,\bar{y}\,\bar{z} \vee xyz$ |
| 26 | $xz \vee y \vee \bar{x}\,\bar{y}z$ | $xy \vee \bar{x}z$ | $xy\bar{z} \vee \bar{x}\,\bar{y}\,z \vee yz$ |
| 27 | $x\bar{y} \vee \bar{x}\,\bar{z} \vee yz$ | $x\bar{y} \vee \bar{y}\,\bar{z} \vee \bar{x}y \vee xz$ | $yz \vee xy \vee \bar{x}\,\bar{z}$ |
| 28 | $\bar{x}y\bar{z} \vee \bar{x}\,\bar{y}z \vee \bar{x}\,\bar{y}$ | $\bar{y}z \vee \bar{x}\,\bar{z}$ | $xy\bar{z} \vee z$ |
| 29 | $yz \vee x\bar{y}z \vee xy \vee\vee x\bar{y}\,\bar{z}$ | $yz \vee x\bar{z} \vee \bar{x}z$ | $y\bar{z} \vee \bar{y} \vee \bar{x}z$ |
| 30 | $\bar{x}z \vee y \vee xz$ | $\bar{x}y\bar{z} \vee \bar{x}z \vee x\bar{y}\,\bar{z} \vee \bar{y}z$ | $x\bar{y} \vee \bar{x}y \vee \bar{y}\,\bar{z}$ |

**6- topshiriqni bajarishga misol.** 6- topshiriqni $f_1(x,y,z) = \bar{x}\,\bar{y} \vee y\bar{z} \vee xz, f_2(x,y,z) = \bar{x} \vee xy\bar{z} \vee \bar{y}z,\ \ f_3(x,y,z) = xy \vee \bar{x}\,\bar{z} \vee z\bar{y}$ uchun bajaring.

Berilgan formulalarni MDNSH ga keltiramiz

$f_1(x,y,z) = \bar{x}\,\bar{y} \vee y\bar{z} \vee xz = \bar{x}\,\bar{y} \cdot 1 \vee 1 \cdot y\bar{z} \vee x \cdot 1 \cdot z = \bar{x}\,\bar{y}(z\vee\bar{z}) \vee (x\vee\bar{x})y\bar{z} \vee x(y\vee\bar{y})z = \bar{x}\,\bar{y}z \vee \bar{x}\,\bar{y}\bar{z} \vee xy\bar{z} \vee \bar{x}y\bar{z} \vee xyz \vee x\bar{y}z$

$f_2(x,y,z) = \bar{x} \vee xy\bar{z} \vee \bar{y}z = f_2(x,y,z) = \bar{x}(y\vee\bar{y})(z\vee\bar{z}) \vee xy\bar{z} \vee (x\vee\bar{x})\bar{y}z = \ \bar{x}yz \vee \bar{x}y\bar{z} \vee \bar{x}\,\bar{y}z \vee \bar{x}\,\bar{y}\,\bar{z} \vee xy\bar{z} \vee x\bar{y}z \vee \bar{x}\,\bar{y}z = \bar{x}yz \vee \bar{x}y\bar{z} \vee \bar{x}\,\bar{y}z \vee \bar{x}\,\bar{y}\,\bar{z} \vee xy\bar{z} \vee x\bar{y}z, f_3(x,y,z) = xy(z\vee\bar{z}) \vee \bar{x}(y\vee\bar{y})\,\bar{z} \vee (x\vee\bar{x})z\bar{y} = \bar{x}\,\bar{y}z \vee \bar{x}\,\bar{y}\bar{z} \vee xy\bar{z} \vee \bar{x}y\bar{z} \vee xyz \vee x\bar{y}z$ .

Demak , $f_1 \equiv f_3 \not\equiv f_2$. $f_2$ formulani KNSHga keltiramiz:

$$f_2(x,y,z) = \bar{x} \vee xy\bar{z} \vee \bar{y}z = (x\vee\bar{x}) \vee (\bar{x} \vee y\bar{z}) \vee \bar{y}z$$
$$= (\bar{x} \vee y) \vee (\bar{x} \vee \bar{z}) \vee \bar{y}z = (\bar{x} \vee y \vee z)(\bar{x} \vee \bar{y} \vee \bar{z})$$

**7-topshiriq.** Formulaning Bu qiymatlari bo'yicha uning MDNSH, MKNSHni yozing va rele-kontakt sxemasini chizing.

| № | $f$ | № | $f$ | № | $f$ |
|---|---|---|---|---|---|
| 1 | 1001 0111 | 11 | 0011 1000 | 21 | 0111 1001 |
| 2 | 0110 1011 | 12 | 0001 0110 | 22 | 0100 1010 |
| 3 | 1110 0110 | 13 | 1101 1010 | 23 | 0011 1000 |
| 4 | 0111 1001 | 14 | 0101 1100 | 24 | 1000 0111 |
| 5 | 1100 0111 | 15 | 1110 1101 | 25 | 0110 0011 |
| 6 | 1001 0100 | 16 | 0010 1101 | 26 | 0111 1010 |
| 7 | 1011 0101 | 17 | 1010 1101 | 27 | 1101 0111 |
| 8 | 1000 0110 | 18 | 0010 0110 | 28 | 0011 1110 |
| 9 | 1010 0110 | 19 | 1010 0111 | 29 | 1101 1000 |
| 10 | 0101 1000 | 20 | 0101 1001 | 30 | 0110 0101 |

**7- topshiriqni bajarishga misol.**

Berilgan $f(x,y,z) = (0001\ 0101)$ formula uchun 7- topshiriqni bajaring.

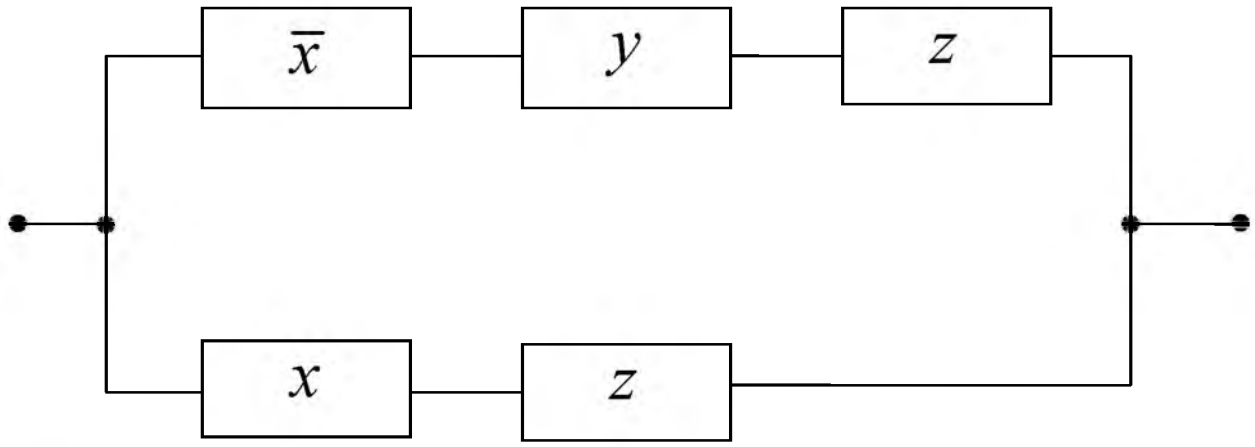
Yechish. Berilgan formulaning rostlik jadvalini tuzamiz

| $x$ | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|
| $y$ | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| $z$ | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| $f$ | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 |

Jadvalga ko'ra MDNH:

$f = \bar{x}yz \vee x\bar{y}z \vee xyz = \bar{x}yz \vee xz(\bar{y} \vee y) = \bar{x}yz \vee xz$

Rele –kontakt sxemasini chizamiz:




Jadvalga ko'ra MKNH::

$f = (x \vee y \vee z) \cdot (x \vee y \vee \bar{z}) \cdot (x \vee \bar{y} \vee z) \cdot (\bar{x} \vee y \vee z) \cdot (\bar{x} \vee \bar{y} \vee z).$

## 4. Graflar nazariyasi

**8-topshiriq.**

Berilgan qo'shnilik matritsasi bo'yicha orgraf chizing. Undan strelkalarni yo'qotish bilan graf hosil qiling. Hosil bo'lgan graf uchun qo'shnilik va insindentlik matritsalarini yozing.

1. $\begin{pmatrix}01200\\00011\\10000\\00101\\01010\end{pmatrix}$ 2. $\begin{pmatrix}00011\\10010\\20000\\10100\\00100\end{pmatrix}$ 3. $\begin{pmatrix}00012\\00100\\10001\\10100\\00010\end{pmatrix}$ 4. $\begin{pmatrix}01010\\10110\\01000\\10000\\01010\end{pmatrix}$

5. $\begin{pmatrix}00210\\11000\\10100\\20100\\00010\end{pmatrix}$ 6. $\begin{pmatrix}10010\\10101\\2000\\00110\\01010\end{pmatrix}$ 7. $\begin{pmatrix}10100\\20001\\01000\\10100\\10002\end{pmatrix}$ 8. $\begin{pmatrix}00002\\00001\\00010\\11101\\11000\end{pmatrix}$

9. $\begin{pmatrix}10111\\01120\\10000\\00111\\10000\end{pmatrix}$ 10. $\begin{pmatrix}11010\\01201\\10001\\10101\\01010\end{pmatrix}$ 11. $\begin{pmatrix}01001\\10011\\20110\\01100\\00010\end{pmatrix}$ 12. $\begin{pmatrix}21000\\10110\\01101\\10111\\01000\end{pmatrix}$

13. $\begin{pmatrix}01101\\00011\\10111\\01121\\00110\end{pmatrix}$ 14. $\begin{pmatrix}10201\\10000\\01010\\11101\\01011\end{pmatrix}$ 15. $\begin{pmatrix}00001\\10020\\00001\\10001\\10011\end{pmatrix}$ 16. $\begin{pmatrix}00001\\00001\\12000\\11110\\10000\end{pmatrix}$

17. $\begin{pmatrix}00001\\10011\\10000\\00101\\01020\end{pmatrix}$ 18. $\begin{pmatrix}01110\\20001\\00001\\10001\\02010\end{pmatrix}$ 19. $\begin{pmatrix}00102\\10001\\01003\\00001\\01010\end{pmatrix}$ 20. $\begin{pmatrix}01100\\00020\\00011\\10100\\00010\end{pmatrix}$

21. $\begin{pmatrix}00200\\10100\\10111\\00001\\10010\end{pmatrix}$ 22. $\begin{pmatrix}11210\\00001\\10000\\00100\\00010\end{pmatrix}$ 23. $\begin{pmatrix}10100\\11101\\01001\\10000\\21000\end{pmatrix}$ 24. $\begin{pmatrix}10111\\20100\\10010\\01001\\01111\end{pmatrix}$

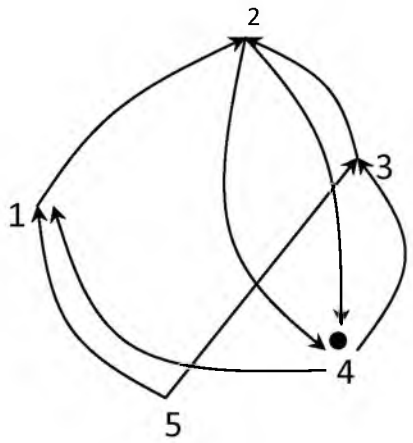
25. $\begin{pmatrix}01210\\11011\\00100\\11101\\00010\end{pmatrix}$ 26. $\begin{pmatrix}11200\\11011\\00110\\10101\\11010\end{pmatrix}$ 27. $\begin{pmatrix}00100\\01010\\11011\\01110\\00100\end{pmatrix}$ 28. $\begin{pmatrix}11001\\10001\\10001\\20011\\11011\end{pmatrix}$

29. $\begin{pmatrix}10101\\01011\\10001\\11002\\10000\end{pmatrix}$ 30. $\begin{pmatrix}00010\\10001\\00001\\10000\\01010\end{pmatrix}$

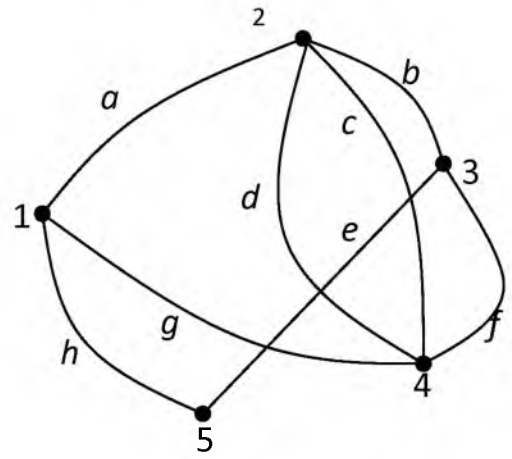
**8 - topshiriqni bajarishga misol.**
Quyidagi matritsa berilgan deylik

$$\begin{pmatrix}0&1&0&0&0\\1&0&0&2&0\\0&1&0&0&0\\1&0&1&0&0\\1&0&1&0&0\end{pmatrix}$$

Yechish. Berilgan matritsa bo'yicha orgraf tuzamiz:




U holda strelkalari chetlashtirilgan graf quyidagicha bo'ladi:




Uning qo’shnilik matritsasi:

$$A(\Gamma)=\begin{pmatrix} 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

Insindentlik matritsasi esa quyidagicha:

$$B(\Gamma)=\begin{pmatrix} a & b & c & d & e & f & g & h \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

**9-topshiriq**.

Berilgan grafni chizing va uning uchun marshrut,zanjir,oddiy siklni yozing. Grafni orgrafga almashtirib uning uchun ham yo’l,oddiy yo’l, kontur, oddiy kontur yozing. Bu graflarning siklomatik sonini toping.

1. G = (V,E) =(V={ 1,2,3,4,5,6},
E={(1,2),(1,3),(1,5),(1,6),(2,3),(2,4),2,6),(3,4),(3,5),
(4,5),(4,6),(5,6)}).
2. G=(V,E) =(V={1,2,3,4,5,6,7},
E={(1,4),(1,5),(1,6),(1,7),(2,4),(2,7),(3,4),(3,5),(3,6),(3,7),(4,7)}).

3. G = (V,E) =(V={ 1,2,3,4,5,6,7,8},
E={(1,6),(1,8),(2,6),(2,7),(3,4),(3,5),(3,6),(33,8),(4,5),(4,6),(4,8),(7,8)}).

4. G = (V,E) =(V={ 1,2,3,4,5,6},
E={(1,2),(1,3),(1,4),(1,6),(2,3),(3,4),(3,6),(4,5),(4,6),(5,6)}).

5. G = (V,E) =(V={ 1,2,3,4,5,6},
E={(1,2),(1,3),(1,5),(1,6),(2,4),(3,4),(3,5),(3,6),(4,5),(4,6),(5,6)}).

6. G = (V,E) =(V={ 1,2,3,4,5,6,7,8},
E={(1,2),(1,4),(1,5),(1,6),(2,3),(2,4),(2,8),(3,8),(5,6),(6,7),(6,8),(7,8)}).

7. G = (V,E) =(V={ 1,2,3,4,5,6,7,8,9},
E={(1,8),(1,9),(2,5),(2,9),(3,5),(3,6),(3,7),(3,9),(4,5),(4,9),
(5,6),(7,9),(8,9)}).

8. G = (V,E) =(V={ 1,2,3,4,5,6},
E={(1,4),(1,5),(1,6),(1,7),(2,4),(2,7),(3,4),(3,7),(4,5),(6,7)}).

9. G = (V,E) =(V={ 1,2,3,4,5,6},
E={(1,2),(1,3),(1,5),(1,6),(2,3),(2,4),(2,6),(3,4),(3,5),(4,5),(4,6),(5,6)}).

10. G = (V,E) =(V={ 1,2,3,4,5,6,7},
E={(1,2),(1,3),(1,4),(1,5),(2,4),(2,6),(2,7),(3,4),(4,5),(5,6),(5,7)}).

11. G = (V,E) =(V={ 1,2,3,4,5,6,7,8,9},
E={(1,4),(1,9),(2,5),(2,9),(3,5),(3,7),(4,6),(4,7),(4,9),(6,7),
(7,8),(8,9)}).

12. G = (V,E) =(V={ 1,2,3,4,5,6,7},
E={(1,2),(1,3),(1,6),(1,7),(2,3),(2,5),(2,6),(3,4),(3,7),(4,7),
(5,6),(6,7)}).

13. G = (V,E) =(V={ 1,2,3,4,5,6},
E={(1,2)(1,3),(1,5),(1,6),(2,6),(2,5),(3,7),(4,6),(4,7),(6,7)}).

14. G = (V,E) =(V={ 1,2,3,4,5,6,7},
E={(1,2),(1,3),(1,5),(1,7),(2,6),(3,4),(3,6),(3,7),(4,5),(4,6),
(4,7),(6,7)}).

15. G = (V,E) =(V={ 1,2,3,4,5,6,7,8},
E={(1,2),(1,8),(2,3),(2,5),(2,8),(3,4),(3,6),(3,7),(4,6),(5,6),
(5,7),(5,8),(6,8)}).

16. G = (V,E) =(V={ 1,2,3,4,5,6,7,8},
E={(1,2,(1,3),(1,5),(1,8),(2,3),(2,4),(2,6),(2,7),(2,8),(3,4),(3,7),(4,5),(4,6)})

17. G = (V,E) =(V={ 1,2,3,4,5},
E={(1,2),(1,3),1,4),(1,5),(2,3),(2,4),(2,5),(3,4),(3,5),(4,5)}).

18. G = (V,E) =(V={ 1,2,3,4,5},
E={(1,2),(1,3),1,4),(1,5),(2,3),(2,4),(2,5),(3,4),(3,5),(4,5)}).

19. G = (V,E) =(V={ 1,2,3,4,5,6,7,8},
E={(1,4),(1,5),(1,6),(1,7),(2,4),(2,5),(2,6),(2,7),(3,4),(3,5),(3,6),
(3,7),(4,8),(5,8),(6,8),(7,8)}).

20. G = (V,E) =(V={ 1,2,3,4,5,6,7,8},
E={(1,2),(1,4),(1,6),(1,8),(2,3),(2,5),(2,7),(3,4),(3,6),(3,8),
(4,5),(4,7),(5,6),(5,8),(6,7),(7,8)}).

21. G = (V,E) =(V={ 1,2,3,4,5,6,7,8,9},
E={(1,5),(1,6),(1,7),(1,9),(2,4),(2,5),(2,6),(2,7),(3,4),(3,5),
(3,6),(3,9),(4,8),(4,8),(6,8),(7,8),(7,9)}).

22. G = (V,E) =(V={ 1,2,3,4,5,6,7,8},
E={(1,2),(1,4),(1,7),(1,8),(2,3),(2,4),(2,6),(3,5),(3,7),(3,8),
(4,5),(4,8),(5,6),(7,8).

23. G = (V,E) =(V={ 1,2,3,4,5,6,7},
E={(1,2),(1,4),(1,5),(1,6),(2,3),(2,4),(2,7),(3,4),(3,5),(3,7),
(4,5),(4,6),(4,7),(5,6),(6,7)}).

24. G = (V,E) =(V={ 1,2,3,4,5,6,7,8},
E={(1,2),(1,3),(1,6),(1,7),(2,3),(2,7),(2,8),(3,4),(3,8),(4,5),
(4,7),(4,8),(5,6),(5,7),(5,8)}).

25. G = (V,E) =(V={ 1,2,3,4,5,6,7,8,9},
E={(1,7),(1,8),(2,4),(2,6),(2,8),(2,9),(3,6),(3,8),(4,8),
(5,6),(5,7),(6,8),(6,9),(7,8)}).

26. G = (V,E) =(V={ 1,2,3,4,5,6,7,8,9},
E={(1,2),(1,3),(1,5),(1,9),(2,3),(2,6),(2,8),(3,4),(3,9),(4,5),
(4,7),(4,8),(5,6),(5,7),(6,8),(6,9),(8,9)}).

27. G = (V,E) =(V={ 1,2,3,4,5,6,7,8,9,10,11},
E={(1,2),(1,6),(2,3),(2,4),(2,7),(3,6),(4,5),(4,9),(4,11),
(5,7),(6,8),(6,10),(7,9),(7,11),(8,9),(9,10)}).

28. G = (V,E) =(V={ 1,2,3,4,5,6,7,8,9,10},
E={(1,3),(1,5),(1,8),(1,10),(2,4),(2,7),(3,4),(3,6),(3,7),
(4,7),4,9),(5,10),(6,9),(7,10),(8,10)}).

29. G = (V,E) =(V={ 1,2,3,4,5,6,7},
E={(1,2),(1,3),(1,4),(1,5),(2,3),(2,4),(2,5),(3,4),(3,5),(4,5),
(4,6),(4,7),(5,6),(5,7)}).

30. G = (V,E) =(V={ 1,2,3,4,5,6,7,8,9},
E={(1,7),(1,8),(2,4),(2,6),(2,9),(3,6),(3,8),(4,8),(5,6),(5,7),
(6,8),(6,9),(7,8),(9,8)}).

## Adabiyotlar

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## Mundarija

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