IKKI O'ZGARUVCHILI TENGLAMALAR SISTEMASI

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ABSTRACT

Maqolada ikki o'zgaruvchili tenglamalar sistemasi ,uni yechishning Kramer usullari o'rganilgan..

Ikki o'zgaruvchili tenglamalar sistemasi, matematikda, texnikada va boshqa sohalar bo'yicha juda muhim ahamiyatga ega.Ikki o'zgaruvchili tenglamalar sistemasi, har bir x qiymatiga mos keladigan y qiymatlarini hisoblash uchun amalga oshiriladi. Bu, grafiklar, ko'ordinatalar va Kramer usuli orqali ham yoritilishi mumkin.

Bunday tenglamalar sistemasining umumiy ko'rinishi

$$\begin{cases} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{cases} \qquad (1)$$

dan iborat bo'lib, u *ikki noma'lum (o'zgaruvchanli) chiziqli tenglamalar sistemasi* deb ataladi.

1–ta'rif. x va y o'zgaruvchilarning (2) sistemaning har bir tenglamasini to'g'ri sonli tenglikka aylantiruvchi α va β qiymatlari jufti (α, β) uning *yechimi* deyiladi. (2) sistemani yechish uchun uning birinchi tenglamasini b_2 ga, ikkinchisini b_1 ga ko'paytirib, ularni ayiramiz. U holda

$x(a_1b_2 - a_2b_1) = c_1b_2 - c_2b_1$ hosil bo'ladi, agar $a_1b_2 - a_2b_1 \neq 0$ bo'lsa,

$$x = \frac{c_1b_2 - c_2b_1}{a_1b_2 - a_2b_1} \quad (2)$$

ga ega bo'lamiz.

$$y = \frac{a_1c_2 - a_2c_1}{a_1b_2 - a_2b_1} \quad (3)$$

ni topamiz.

Shunday qilib, $a_1b_2 - a_2b_1 \neq 0$ bo'lsa, (1) sistema yagona yechimga ega bo'ladi. Ushbu

$$A = \begin{Vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{Vmatrix}$$

ko'rinishdagi jadval 2 sistemaning *matritsasi* deyiladi. A matritsaning gorizontal qatorlari uning *satrlari,* vertikal qatorlari esa - *ustunlari* deyiladi. a_1, b_1, a_2, b_2 lar uning *elementlari* deyiladi. Qaralayotgan matritsa, *ikkinchi tartibli kvadrat matritsa* deyiladi. Uning chap yuqori burchagidan o'ng pastki burchagiga boruvchi dioganal uning bosh dioganali deyiladi.

3 va 4 formulalardagi kasrlarning maxraji bosh dioganaldagi elementlar ko'paytmasidan, ikkinchi dioganalda turgan elementlarning ko'paytmasini ayirish natijasida tuzilganligi ko'rinib turibdi: $a_1b_2 - a_2b_1$. Bu ifoda A matritsaning *determinanti* deb ataladi va quyidagicha belgilanadi:

$$\Delta = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}$$

Demak, ta'rifga ko'ra,

$$\Delta = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = a_1b_2 - a_2b_1$$

Quyidagicha tasdiq o'rinli: ikkinchi tartibli determinant nolga teng bo'lishi uchun, uning satrlaridagi yoki ustunlaridagi elementlar proporsional bo'lishi zarur va yetarli.

Yuqoridagi belgilashlar asosida 3 tenglikning surati quyidagi determinantdan iborat:

$$\Delta_1 = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix} = c_1b_2 - c_2b_1.$$

Bu determinant Δ determinantdagi birinchi ustunni ozod hadlar ustuni bilan almashtirishdan hosil qilingan. Xuddi shunga o'xshash Δ determinantning ikkinchi ustunini ozod hadlar bilan almashtirsak, 4 tenglikning suratidagi ifoda hosil bo'ladi:

$$\Delta_2 = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix} = a_1c_2 - a_2c_1$$

Shunday qilib, agar $\Delta \neq 0$ bo'lsa, 2 sistemaning yechimi $x = \frac{\Delta_1}{\Delta}$, $y = \frac{\Delta_2}{\Delta}$ lardan iborat va yagonadir. Bu formulalar Kramer formulalari deyiladi.

Misol. Kramer formulalaridan foydalanib, 1 sistemani yechamiz.

$$\begin{cases} x + y = 20 \\ 4x + 2y = 76, \end{cases} \quad \Delta = \begin{vmatrix} 1 & 1 \\ 4 & 2 \end{vmatrix} = 1\cdot 2 - 4\cdot 1 = -2 \neq 0$$

$$\Delta_1 = \begin{vmatrix} 20 & 1 \\ 76 & 2 \end{vmatrix} = 20\cdot 2 - 76\cdot 1 = -36; \quad \Delta_2 = \begin{vmatrix} 1 & 20 \\ 4 & 76 \end{vmatrix} = 76\cdot 1 - 20\cdot 4 = -4.$$

U holda, $x = (-36):(-2) = 18$, $y = (-4):(-2) = 2$.

Endi

$$\Delta = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = a_1b_2 - a_2b_1 = 0 \qquad (4)$$

holni qaraymiz. 5 tenglikni $\frac{a_1}{a_2}=\frac{b_1}{b_2}$ ko'rinishda yozish mumkin, ya'ni bu holda noma'lumlarning koeffisentlari proporsionaldir.

Bundan tashqari, agar

$\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}=0$ ya'ni $\frac{c_1}{c_2}=\frac{b_1}{b_2}$

ham o'rinli bo'lsa,

$$\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$$

bo'lib, biz ikki noma'lumli bitta tenglamaga ega bo'lamiz. Bu holda u sistema *cheksiz ko'p* yechimga ega bo'ladi.

Nihoyat, agar

$\Delta=\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}=0$ lekin, $\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}\neq 0$ bo'lsa,

ya'ni

$$\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$$

bo'lsa, u holda sistema ziddiyatli bo'ladi va yechimga ega bo'lmaydi.

1- sistemaning $x=\alpha, y=\beta$ yechimi Dekart koordinatalari sistemasida $a_1x+b_1y=c_1$ va $a_2x+b_2y=c_2$ to'g'ri chiziqlarning kesishish nuqtasini ifodalaydi.

Agar $\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}\neq 0$ bo'lsa, to'g'ri chiziqlar har xil bo'lib, yagona umumiy nuqtaga ega bo'ladi. $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$ bo'lsa, har ikkala tenglama bitta tenglamani ifodalaydi va uning har bir nuqtasi, berilgan to'g'ri chiziqning «kesishish nuqtalari» bo'ladi, ya'ni ular ustma-ust tushadi. Nihoyat, agar $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$ bo'lsa, to'g'ri chiziqlar parallel va ular bitta ham umumiy nuqtaga ega bo'lmaydi.

Shuni ta'kidlab o'tamizki, maktab matematika kursida 2 sistemani o'rniga qo'yish va qo'shish usullari yordamida yechilar edi. Bu yerda yana bitta usulni o'rgandik. Ushbu usulning bitta qulayligi shundaki, uning yordamida n noma'lumli n–ta chiziqli tenglamalar sistemasini ham yechish mumkin. Bunga qiziqqan o'quvchilar [1] adabiyotga murojaat qilishlari mumkin.

Umuman, $f(x,y)=0$ ва $\varphi(x,y)=0$ tenglamalar sistemasi deb, ularning $(f(x,y)=0)\wedge(\varphi(x,y)=0)$ kon'yunksiyasiga, maktabda belgilangandek,

$$\begin{cases} f(x,y)=0 \\ \varphi(x,y)=0 \end{cases} (5)$$

sistemaga aytiladi. 6 sistemaning har birini to'g'ri sonli tenglikka aylantiruvchi α ва β sonlar jufti (α,β) uning *yechimi* deyiladi.

Bizga ma'lumki, ikki predikat kon'yunksiyasining rostlik to'plami, shu predikatlar rostlik to'plamlari kesishmasidan iborat. Xuddi shunga o'xshash 6 sistema yechimlarining to'plami, $f(x,y)=0$ ва $\varphi(x,y)=0$ tenglamalar yechimlari to'plamining kesishmasidan iborat. Geometrik yo'l bilan bu to'plam quyidagicha topiladi: $f(x,y)=0$ ва $\varphi(x,y)=0$ tenglamalarning grafigi chiziladi, so'ngra bu grafiklarning kesishish nuqtalari topiladi.

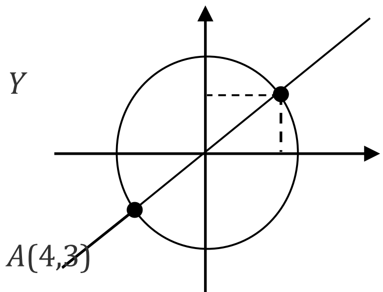
Misol. (4; 3), (-4; -3) juftliklar

$$\begin{cases} 3x-4y=0 \\ x^2+y^2=25 \end{cases}$$

sistema yechimlari to'plamiga tegishli bo'ladi. Haqiqatdan, $x=4, y=3$ hamda $x=-4, y=-3$ lar tenglamalarning har birini qanoatlantiradi:

$$3\cdot 4-4\cdot 3=0, 4^2+3^2=25.$$ ва

$$3\cdot(-4)-4\cdot(-3)=0, (-4)^2+(-3)^2=25$$



Berilgan sistema boshqa yechimlarga ega emasligini ko'rsatish mumkin. Sistema yechi-mini grafik tasvirlaymiz. Sistemaning birinchi tenglamasining grafigi to'g'ri chiziq, ikkinchisiniki esa markazi koor-dinata boshida va radiusi 5 ga teng bo'lgan aylana. Ular $A(4,3)$ va $B(-4,-3)$ nuqtalarda kesishadi.

Bunday sistemalar, statistik hisob-kitoblarda, matematik modellarda, injenerlik amaliyotlarda, kriptografiyada, hisoblash texnologiyalarida va boshqalar kabi ko'plab sohalarda foydalaniladi.

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