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KOMMUNIKATSIYALARNI RIVOJLANTIRISH VAZIRLIGI
TOSHKENT AXBOROT TEXNOLOGIYALARI UNIVERSITETI
SAMARQAND FILIALI

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Kompyuter tizimlari kafedrası

5302000 -“Informatika va axborot texnologiyalari” yo’nalishi bo’yicha
bakalavr akademik darajasini olish uchun

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MAVZU: Butun sonli parametrik dasturlash modelini baholash algoritmi va dasturiy ta’minotini shakllantirish

Ish kafedraning 2016 yil

_____dagi ____ - sonli

majlisda muhokama qilindi va

himoyaga tavsiya etildi.

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Samarqand – 2016

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KIRISH

Ishning dolzarbligi. Inson ongli faoliyatining juda qadimgi davrlaridanoq eng yaxshi (ma'qul, qulay) qaror qabul qilish bilan bog'liq masalalarga duch kelinib, ularni hal qilishga harakat qilingan. Bugungi kunda bunday masalalarni o'rganishning ahamiyati nihoyatda oshganligi ravshan. Amaliyotning xilma-xil sohalarida, jumladan, ishlab-chiqarishni va ta'minotni tashkillashtirishda, transportdan foydalanishda, sog'liqni saqlashda, aloqada, informasion texnologiyalarni qo'llashda va boshqa sohalarda murakkab chora-tadbirlar, harakatlar tizimini amalga oshirishga to'g'ri kelmoqda. Bunday vaziyatlarda ilmiy asoslangan, to'g'ri, oqilona qarorlar qabul qilishning ahamiyati juda kattadir. Matematik dasturlash esa ana shunday qarorlar qabul qilishni asoslashda matematik, miqdoriy usullarni qo'llash demakdir.

Murakkab tizimlar sintezi masalasining qo'yilishi va hal etilishiga optimallashtirish nuqtaiy nazaridan yondashuv boshqarish, rejalashtirish, loyihalash kabi sohalarda sifat jihatdan katta yutuqlarga erishish omili hisoblanadi.

Iqtisodiy rejalashtirish va modellashtirishda chiziqli dasturlashning matematik usullari erishgan natijalar ayniqsa sezilarlidir [4,9].

Bizga ma'lumki, axborot-kommunikatsiya texnologiyalari salohiyati o'zaro muomala qilish va axborot ayirboshlashning prinsipial jihatdan yangi shakllari va imkoniyatlarini ochadi, fuqarolik jamiyati barpo etilishi va mustahkamlanishiga ko'maklashadi, iqtisodiy islohotlar va mamlakatning demokratik rivojlanishi jarayonlarini jadallashtirish imkonini beradi [1].

O'zbekiston Respublikasi shakllanayotgan global axborot jamiyatida munosib o'rinni egallashga intilmoqda. Ushbu maqsadlarga erishish uchun mamlakat hukumati tomonidan O'zbekistonda axborotlashtirish jarayonlarini faollashtirish, zamonaviy axborot-kommunikatsiya texnologiyalarini tez sur'atlarda rivojlantirish, ularni iqtisodiyot va jamiyatning barcha sohalarida joriy etish hamda foydalanishning strategik ustuvorliklari belgilandi [2].

O'zbekiston Respublikasi Prezidenti Islom Abdug'aniyevich Karimov Tadbirkorlar va ishbilarmonlar harakati – O'zbekiston liberal-demokratik partiyasining VII syezdidagi ma'ruzasida yosh kadrlarni tayyorlash borasida shunday degan, “avvalo, biz uchun 2015-yilda va undan keyingi davrda eng ustuvor vazifa – bu tarkibiy o'zgarishlar siyosatini olib borish, sanoatni diversifikatsiya qilish, ishlab chiqarishni texnik va texnologik modernizatsiya qilish, axborot-kommunikatsiya tizimlarini keng joriy etish hisobidan iqtisodiyotimizning raqobatdoshligini oshirishni ta'minlashdan iboratdir” [3].

Hozirgi vaqtda texnikaning tez rivojlanishi, ishlab chiqarishni boshqarishning murakkablashishi va uni rejalashtirishga qo'yiladigan talablarni ortishi bozor iqtisodini rivojlanishlarini xarakterlovchi omillardan hisoblanadi. Bunday sharoitda iqtisodni boshqarishga ilmiy yondoshish, matematikani keng qo'llash, ayniqsa, matematik dasturlashning aniq usullaridan foydalanish zaruriy shartga aylandi. Zamonaviy kompyuter texnikasidan keng foydalangan holda, matematik dasturlash va optimallashtirish usullarini iqtisodiy izlanishlar va rejalashtirishda qo'llash muhim o'rin olmoqda.

Optimallashtirish usullari yordamida ekstremal iqtisodiy masalalarni yechishni to'rt bosqichga bo'lish mumkin:

- 1) Masalani chuqur o'rganib, unga tadbiriq qilish mumkin bo'ladigan usullarni tanlash, masalada qo'yilgan shartlarga asoslanib matematik model tuzish;
- 2) Agar masalaning chegaraviy shartlari maqsadga muvofiq kelsa, tegishli matematik usulni qo'llab masalaning optimal yechimini topish;
- 3) Yechimni iqtisodiy tahlil qilish va uni amaliyotga «imkoni boricha» tadbiriq qilish.
- 4) Amaliyotda matematik dasturlash va optimallashtirish usullarining taqribiy usullaridan foydalanish haqida tushunchalar berish.

Matematik dasturlash va optimallashtirish usullari masalalari chiziqli va chiziqli bo'lmagan, hamda dinamik dasturlashga bo'linib, umumiy holda ekstremal masalalarni yechishda qo'llaniladi. Masalan, maqsad funksiya deb ataluvchi

$f(x_1, x_2, \dots, x_n)$ funksiyaning eng katta yoki eng kichik qiymatlarini $g_i(x_1, x_2, \dots, x_n) \leq b_i$ ($i=1, m$) shartlarda aniqlash masalasidir.

Optimallashtirish masalalarini chiziqli dasturlash usullari bilan yechish uchun bu masalalardagi koeffitsiyentlar aniq, o'zgarmas son qiymatlarni qabul qiladi deb faraz qilinadi. Lekin amalda esa, ko'pchilik masalalarda bu koeffitsiyentlarning taqribiy qiymatlari yoki ularning o'zgarish oralig'i ma'lum bo'ladi. Shuning uchun chiziqli dasturlash masalasining optimal yechimi har bir koeffitsiyentning o'zgarishiga qanchalik bog'liqligi, ya'ni masaladagi koeffitsiyentlarning o'zgarishi uning yechimiga qanday ta'sir qilishini aniqlash masalasi qo'yiladi.

Ana shunday masalalarni hal qilish parametrli chiziqli dasturlashning predmetini tashkil qiladi.

Tadqiqot ob'yekti. Butun sonli parametrik dasturlash masalalari, Gomori usuli.

Tadqiqot usullari. Bitiruv ishida matematik modellashtirish, matematik dasturlash va matematik analiz nazariyasi usullaridan foydalanildi.

Ishning amaliy ahamiyati.

Hozirga vaqtga kelib hisoblash texnikasi va axborot texnologiyalarining rivojlanish natijasida optimallashtirish masalalari parametrli effektlarni hisobga olgan holda yechim usullarini ishlab chiqarishga bo'lgan qiziqish ortib bormoqda. Shunday masalalardan biri butun sonli parametrik dasturlash masalasidir. Butun sonli parametrik dasturlash Maqsad funksiyasida parametrga bog'liq, cheklashlar sistemasi ozod hadlari parametrga bog'liq, maqsad funksiyasi va cheklashlarining o'ng qismida parametrga bog'liq masalalarini optimallashtirish usulini ishlab chiqish mumkin bo'ladi.

Taklif qilingan protseduralar asosida yaratilgan algoritmlar kompleksi va dasturiy ta'minot quyidagi masalalarni yechishda qo'llaniladi:

- Simpleks va Gomori usulining qo'llanishining umumiy tartibi, iterasiya qadamini tanlashga oid umumiy tushuncha hamda ma'lumotlar tahlil etiladi.
- Butun sonli parametrik dasturlash masalalari sinflari bo'yicha nazariy ma'lumotlar o'rganiladi.
- Simpleks va Gomori usuli bilan butun sonli parametrik dasturlash masalasini yechish algoritmlari o'rganiladi.
- O'rganilgan algoritmlar asosida kompyuterda hisoblash ishlarini bajarish maqsadida tuzilgan zarur dastur tuziladi.

Bitiruv ishi mavzusi bo'yicha bajarilgan ish natijalaridan matematik modellashtirish usullari, zamonaviy hisoblash texnikasi va axborot texnologiyalarining yutuqlari keng qo'llaniladigan optimal qaror qabul qilish amaliy masalalarini hal etishda foydalanish mumkin.

Bitiruv malakaviy ishning tuzilishi va hajmi.

Ishning matni kompyuterda yozilgan 52 bet hajmidan iborat bo'lib, uning strukturasi kirish, 3 ta bob, xulosa, foydalanilgan adabiyotlar ro'yxati va 2 ta ilova tashkil qiladi.

Birinchi bob butun sonli chiziqli dasturlash masalasining asosiy tushunchalari, yechish usullari, chiziqli dasturlash masalasini yechishga misollar keltirilgan.

Ikkinchi bobda parametrik dasturlashning masalalari modellari turlari va ularni yechish algoritmi bayon etilgan.

Uchinchi bobda dasturlash parametrik dasturlashning masalasini yechish algoritmi dasturiy ta'minoti tasnifi va dasturiy ta'minotidan foydalanish tartibi bayon etilgan.

Adabiyotlar qismida bitiruv malakaviy ishini bajarishda foydalanilgan asosiy adabiyotlar ro'yxati keltirilgan.

Ilovalarda dasturning ishlash jarayoni, oynalarni hosil qilish kodi va dasturning kodi keltirilgan.

Butun sonli dasturlash masalasini umumiy holda quyidagi ko'rinishda ifodalash mumkin:

$$\sum_{j=1}^n a_{ij}x_j = b_i, \quad (i = \overline{1, m}) \quad (1.2.1)$$

$$x_j \geq 0 \quad x_j - \text{butun}, \quad (j = \overline{1, n}) \quad (1.2.2)$$

$$Y = \sum_{j=1}^n c_j x_j \rightarrow \min, \quad (1.2.3)$$

yoki vektor formada

$$AX = B,$$

$$X \geq 0, \quad \text{va butun},$$

$$Y = C'X \rightarrow \min. \quad (1.2.4)$$

Agar butun sonli dasturlash masalalaridagi noma'lumlarning hammasi uchun butun bo'lishlik sharti qo'yilsa, bunday masalalar to'la butun sonli dasturlash masalalari deb ataladi.

Noma'lumlarning ma'lum bir qismi uchun butun bo'lishlik sharti qo'yilgan masalalar qisman butun sonli dasturlash masalalari deb ataladi.

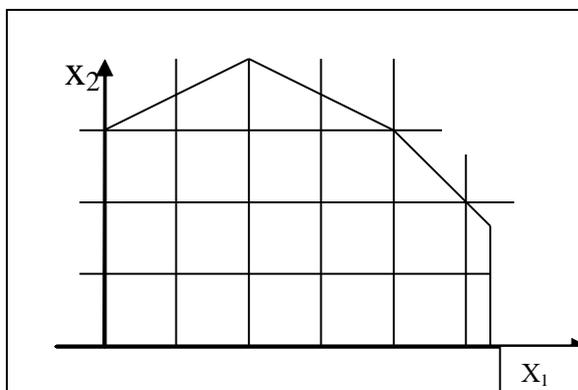
Noma'lumlarga butun bo'lishlik sharti qo'yilganligi sababli chiziqli dasturlash masalalarini yechish usullarini butun sonli dasturlash masalalarini yechish uchun qo'llab bo'lmaydi.

Butun sonli dasturlash masalalarini yechish uchun ularning xususiyatlarini nazarga oluvchi usullar yaratilgan bo'lib, ular orasida amerika olimi R.Gomori yaratgan usul optimal butun sonli yechimni beruvchi eng aniq usul hisoblanadi. Gomori usuli yordami bilan to'la butun sonli, hamda qisman butun sonli masalalarni yechish mumkin. Quyida biz R.Gomori usuli bilan to'la butun sonli dasturlash masalasini yechish jarayoni bilan tanishamiz [4].

Bu usulning g'oyasi quyidagidan iborat bo'lib, berilgan butun sonli dasturlash masalasini noma'lumlarning butun bo'lishlik shartiga e'tibor bermasdan, uni oddiy chiziqli dasturlash masalasi sifatida simpleks usuldan foydalanib yechamiz. Agar topilgan yechim butun sonli bo'lsa, u holda u butun sonli dasturlash masalasining ham yechimi bo'ladi. Aks holda noma'lumlarning butun sonli

bo'lishlik shartini e'tiborga oluvchi va «kesuvchi tenglama» deb ataluvchi qo'shimcha tenglama tuziladi. Bu tenglama asosiy tenglamalar sistemasiga kiritib yoziladi va bazis yechim almashtiriladi. Buning uchun noma'lum kesuvchi tenglamadan ajratiladi va uning qiymati boshqa tenglamalarga qo'yib chiqiladi. Bunday ishlar masalaning butun sonli yechimi topilguncha yoki uning mavjud emasligi aniqlanguncha takrorlanadi [13].

Har bir bosqichda tuzilgan qo'shimcha tenglama kesuvchi tenglama deb atalishiga sabab, bu tenglama yordamida berilgan butun sonli dasturlash masalasi yechimidagi kasr sonli yechimni o'z ichiga oluvchi qismi kesib boriladi. Bu aytilganlarni quyidagi shakl orqali tasvirlash mumkin.



Kesish jarayoni joriy rejalar to'plamining faqat butun sonli yechimlarni o'z ichiga oluvchi qismi K_I topilguncha takrorlanadi. K_I to'plamning chetki nuqtalarining koordinatalari butun sondan iborat bo'ladi.

Kesuvchi tenglamani tuzish

1. Faraz qilaylik, yuqorida berilgan (1.2.1)-(1.2.3) butun sonli programmalash masalasidagi noma'lumlarning butun son bo'lishlik shartiga e'tibor bermasdan uning optimal yechimi topilgan bo'lsin va bu optimal yechim $X=(x_1, x_2, \dots, x_n)$ bo'lsin. Oxirgi simpleks jadvaldagi bazis vektorlar $P_1, P_2, \dots, P_i, \dots, P_m$ lardan iborat bo'lsin. U holda bu simpleks jadval quyidagi ko'rinishda bo'ladi.

$$\mathbf{X} = \begin{pmatrix} \mathbf{x}_1 & 1 & 0 & \dots & 0 & \dots & 0 & \mathbf{x}_{1m+1} & \dots & \mathbf{x}_{1j} & \dots & \mathbf{x}_{1n} \\ \mathbf{x}_2 & 0 & 1 & \dots & 0 & \dots & 0 & \mathbf{x}_{2m+1} & \dots & \mathbf{x}_{2j} & \dots & \mathbf{x}_{2n} \\ \dots & \dots \\ \mathbf{x}_i & 0 & 0 & \dots & 1 & \dots & 0 & \mathbf{x}_{im+1} & \dots & \mathbf{x}_{ij} & \dots & \mathbf{x}_{in} \\ \dots & \dots \\ \mathbf{x}_m & 0 & 0 & \dots & 0 & \dots & 1 & \mathbf{x}_{mm+1} & \dots & \mathbf{x}_{mj} & \dots & \mathbf{x}_{mn} \end{pmatrix}$$

Agar barcha x_i lar butun sonlar bo'lsa, u holda topilgan yechim butun sonli programmash masalasining yechimi bo'ladi.

2. Faraz qilaylik, ba'zi x_i lar kasr sonlardan iborat bo'lsin, hamda ba'zi x_{ij} lar ham kasr sonlardan iborat bo'lsin. x_i va x_{ij} larning butun qismini mos ravishda $[x_i]$ va $[x_{ij}]$ bilan belgilaymiz. U holda bu sonlarning kasr qismlarini quyidagicha aniqlash mumkin.

$$\begin{cases} q_i = x_i - [x_i] \\ q_{ij} = x_{ij} - [x_{ij}] \end{cases} \quad (1.2.5)$$

Deylik, ba'zi $q_i \neq 0$ bo'lsin. U holda X matrisaning $\max q_i = q_k$ $q_i \neq 0$ tenglikni qanoatlantiruvchi k -qatori uchun kesuvchi tenglama tuziladi. Buning uchun eng avvalo

$$q_{k1}x_1 + q_{k2}x_2 + \dots + q_{kn}x_n \geq q_k \quad (1.2.6)$$

tengsizlik tuziladi, so'ngra uni (-1)ga ko'paytirib qo'shimcha o'zgaruvchi kiritiladi. Natijada quyidagi tenglama hosil bo'ladi.

$$-q_{k1}x_1 - q_{k2}x_2 - \dots - q_{kn}x_n + x_{n+1} = -q_k \quad (1.2.7)$$

Bu tenglama kesuvchi tenglama deb ataladi.

3. Kesuvchi tenglamani simpleks jadvalning $m+2$ qatoriga joylashtiriladi. Bu tenglamadagi x_{n+1} o'zgaruvchiga mos keluvchi P_{n+1} vektorni «bazis vektor» deb qabyl qilingan. By bazis vektorga mos kelyvshi x_i ozod had manfiy ishorali. Shuning uchun ikkilangan simpleks usulni qo'llab, P_{n+1} vektor bazisdan chiqariladi va uning o'rniga

$$\min_{q_{kj} < 0} \left(\frac{\Delta_j}{q_{kj}} \right) = \frac{\Delta_j}{q_{ki}}$$

shartni qanoatlantiruvchi P_7 vektor kiritiladi va simpleks jadval almashtiriladi. Agar hosil bo'lgan yangi simpleks jadvaldagi barcha x_j ozod hadlar butun sonli bo'lsa, u holda torilgan yechim butun sonli dasturlash masalasining yechimi bo'ladi. Aks holda yuqoridagi 2-3 punktlarda qilingan ishlarni yana qaytadan takrorlash kerak. Umuman, bu ishlarni masalaning butun sonli yechimi torilguncha, yoki uning butun sonli yechimini mavjud emasligi aniqlanguncha takrorlash kerak [6].

Agar kasr sonli x_i ga mos keluvchi qatorda barcha x_{ij} lar butun sonli bo'lsa, u holda masala butun sonli yechimga ega bo'lmaydi.

1.3. Chiziqli dasturlash masalasini yechishga misollar

Misol 1.3.1. Berilgan cheklarshlarda $Z = x_1 - x_2 - 3x_3$ funksiyaning eng kichik qiymatini toping.

$$\begin{cases} 2x_1 - x_2 + x_3 \leq 1, \\ 4x_1 - 2x_2 + x_3 \geq -2, \\ 3x_1 + x_3 \leq 5, x_i (i = 1, 2, 3) \geq 0, \text{butun} \end{cases}$$

Yechilishi. Ikkinchi tengsizlikning (-1) ga ko'paytiramiz:

$$\begin{cases} 2x_1 - x_2 + x_3 \leq 1, \\ -4x_1 + 2x_2 - x_3 \geq 2, \\ 3x_1 + x_3 \leq 5. \end{cases}$$

Tengsizliklardan tenglikka o'tish uchun tengsizliklarning chap qismlariga qo'shimcha o'zgaruvchilarni kiritamiz:

$$\begin{cases} 2x_1 - x_2 + x_3 + x_4 = 1, \\ -4x_1 + 2x_2 - x_3 + x_5 = 2, \\ 3x_1 + x_3 + x_6 = 5. \end{cases}$$

Qo'shimcha x_4, x_5, x_6 o'zgaruvchilarning bazis o'zgaruvchi qilib olamiz, u holda x_1, x_2, x_3 o'zgaruvchilar erkli bo'ladi. Maqsad funksiyasi qo'shimcha o'zgarishlarni talab qilmaydi, chunki erkli o'zgaruvchilar bilan ifodalangan [6].

Jadval 1.3.1

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_4	1	2	-1	1	1	0	0
x_5	2	-4	2	-1	0	1	0
x_6	5	3	0	1	0	0	1
S	0	-1	1	3	0	0	0

Jadval 1.3.2

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	1	2	-1	1	1	0	0
x_5	3	-2	1	0	1	1	0
x_6	4	1	1	0	-1	0	1
S	-3	-7	4	0	0	0	0

Jadval 1.3.3

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	4	0	0	1	2	1	0
x_2	3	-2	1	0	1	1	0
x_6	1	3	0	0	-2	-1	1
S	-15	1	0	0	-7	-4	0

Jadval 1.3.4

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	4	0	0	1	2	1	0
x_2	11/3	0	1	0	-1/3	1/3	2/3
x_1	1/3	1	0	0	-2/3	-1/3	1/3
S	-46/3	0	0	0	-19/3	-11/3	-1/3

Natijada masalaning optimal yechimini $\bar{X} = \left(\frac{1}{3}; \frac{11}{3}; 4\right)$ oldik. Bu yerda x_1, x_2 - kasr. Eng katta kasr qismga ega o'zgaruvchi uchun qo'shimcha cheklash kiritamiz [9]. Quyidagiga ega bo'lamiz:

$$q_2 = x_2 - [x_2] = \frac{11}{3} - \left[\frac{11}{3}\right] = \frac{11}{3} - 3 = \frac{2}{3},$$

$$q_{21} = q_{22} = q_{23} = 0,$$

$$q_{24} = -\frac{1}{3} + 1 = \frac{2}{3}, \quad q_{25} = \frac{1}{3} - 0 = \frac{1}{3}, \quad q_{26} = \frac{2}{3} - 0 = \frac{2}{3}.$$

U holda qo'shimcha cheklash quyidagi qo'rinishga ega bo'ladi:

$$\frac{2}{3}x_4 + \frac{1}{3}x_5 + \frac{2}{3}x_6 - \frac{2}{3} \geq 0.$$

Oxirgi tengsizlikning har ikki qismini (-1) ga ko'paytirib, tenglamaga keltiramiz:

$$-\frac{2}{3}x_4 - \frac{1}{3}x_5 - \frac{2}{3}x_6 + x_7 = -\frac{2}{3}.$$

Bu tenglamaning koeffitsiyentlarini 1.3.4-jadvalga kiritamiz va quyidagi jadvalni hosil qilamiz.

Jadval 1.3.5

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	4	0	0	1	2	1	0	0
x_2	11/3	0	1	0	-1/3	1/3	2/3	0
x_1	1/3	1	0	0	-2/3	-1/3	1/3	0
x_7	-2/3	0	0	0	-2/3	-1/3	-2/3	1
S	-46/3	0	0	0	-19/3	-11/3	-1/3	0

Ikkilangan simpleks usulini qo'llash natijasida quyidagi hosil bo'ladi.

Jadval 1.3.6

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	4	0	0	1	2	1	0	0
x_2	3	0	1	0	-1	0	0	1
x_1	0	1	0	0	-1	-1/2	0	1/2
x_6	1	0	0	0	1	1/2	1	-3/2
S	-15	0	0	0	-6	-7/2	0	-1/2

Butun sonli optimal yechim: $\bar{X} = (0;3;4), Z_{\min} = -15$.

II BOB. PARAMETRIK DASTURLASHNING MASALALARINING TURLARI VA ULARNI YEChISH

2.1. *Maqsad funksiyasi parametrغا bog'liq masala va uning qo'yilishi*

Umumiy chiziqli dasturlash masalasi doimiy miqdorlardan, ya'ni C_j , a_{ij} koeffitsiyentlar va $b_i (i=1,2,\dots,m; j=1,2,\dots,n)$ ozod hadlardan iborat. Bir tomondan amaliyotda bu miqdorlarni aniqlashda bu miqdorlar doimiy emasligi, ularning qiymatlari ba'zi oraliqlarda o'zgarishini ko'rish mumkin. Ikkinchi tomondan a_{ij}, C_j, b_i larning fiksirlangan qiymatlarida optimal plani topganda, plan optimal bo'lib qolishi uchun ularning qiymatlarini qanday chegaralarda o'zgartirish mumkinligi bilish zarur.

Shuning uchun chiziqli dasturlash masalasining koeffitsiyentlari va ozod hadlari o'zgarganda optimal yechimi o'zgarishini tadqiq qilish zarur bo'ladi. Bu turdagi tadqiqot parametrik chiziqli dasturlash masalasi predmetini tashkil qiladi. Parametrik dasturlash ishlab chiqarishni rejalashtirish masalasini o'rganishda hosil bo'lgan va chiziqli matematik model bilan tavsiflanishi mumkin bo'lgan turli iqtisodiy jarayonlarni optimal rejalashtirishni boshqarish uchun imkoniyat beradi [11].

Faraz qilaylik, $Z = \sum_{j=1}^n c_j x_j$ chiziqli funksiyaning koeffitsiyentlari qandaydir $[c_j - c'_j; c_j + c'_j]$ mumkin bo'lgan chegaralarda o'zgarishi mumkin bo'lsin, u holda tadqiq etish qulayligi uchun chiziqli funksiyaning koeffitsiyentlarini $c_j(t) = c'_j + tc''_j$ ifoda bilan almashtirish mumkin, bu yerda c'_j, c''_j – doimiylar, t – qaysidir chegaralarda o'zgaruvchi parametr. Bu holda matematik masala quyidagicha berilishi mumkin [8].

$$Z = \sum_{j=1}^n (c'_j + tc''_j)x_j \rightarrow \max \quad (2.1.1) \text{ chiziqli funksiya va}$$

$$i = 1, 2, \dots, m, \quad (2.1.2)$$

$$x_j \geq 0, \quad j = 1, 2, \dots, n. \text{ chiziqli cheklashlar berilgan.}$$

t parametrning qiymatini qaydaydir $t_0 \in [\alpha; \beta]$ ga teng deb hisoblab, simpleks usuli yoki sun'iy bazis usuli bilan olingan chiziqli dasturlash masalasini yechimini topamiz.

Natijada t_0 berilgan qiymatida yoki optimal yechimni topamiz, yoki uning yechimi yo'qligini aniqlaymiz. Birinchi holda $(m+1)$ – elementdan foydalanib, simpleks jadvalning $\Delta_j(t_0) = \Delta'_j + t_0\Delta''_j$ sonlar yozilgan oxirgi satrida masalaning optimal yechimini aniqlaymiz:

$$\underline{t} = \begin{cases} \max(-\Delta'_j / \Delta''_j), & \text{agar } \exists \Delta''_j > 0; \\ -\infty, & \text{agar } \Delta''_j \leq 0; \end{cases}$$

$$\bar{t} = \begin{cases} \min(-\Delta'_j / \Delta''_j), & \text{agar } \exists \Delta''_j < 0; \\ \infty, & \text{agar } \Delta''_j \geq 0; \end{cases}$$

Barcha $\underline{t} \leq t \leq \bar{t}$ larda masala t_0 dagi kabi optimal yechimga ega.

Bu holda, agar masala t_0 da yechimga ega bo'lmasa, simpleks jadvalning $(m+1)$ – satrida $\Delta_k = \Delta'_k + t_0\Delta''_k < 0$ qiymat bo'ladi, bu yerda $x_{ik} \leq 0 (i = \overline{1, m})$.

Unda:

- 1) agar $\Delta''_k = 0$ bo'lsa, u holda masala ixtiyoriy t uchun yechimga ega emas;
- 2) agar $\Delta''_k < 0$ bo'lsa, u holda masala barcha $t < -\Delta'_k / \Delta''_k$ lar uchun yechimga ega emas;
- 3) agar $\Delta''_k > 0$ bo'lsa, u holda masala $t > -\Delta'_k / \Delta''_k$ lar uchun yechimga ega emas [7,8].

Masala aynan bir xil optimal yechimga bo'lgan yoki yechimga ega bo'lmagan $t \in [\alpha; \beta]$ parametrning qiymatini aniqlab, t parametrning o'zgarish oralig'ini olamiz va uni oraliqdan chiqarib tashlaymiz. Yana t parametrning

oraliqqa tegishli biror songa teng deb hisoblab, hosil bo'lgan masalaning yechimini topamiz.

Har bir iteratsiyadan so'ng parametrning har bir qiymati uchun masalaning optimal qiymati bir xil bo'lgan oralig'i, yoki parametrning barcha qiymatlari uchun masalaning yeichmi mavjud bo'lmagan oraliq aniqlanadi.

Masala yechimini topish jarayoni quyidagi bosqichlarni o'z ichiga oladi:

1. t parametrni biror $t_0 \in [\alpha; \beta]$ songa teng deb olib, olingan chiziqli dasturlash masalasining X^* optimal plan topiladi yoyei yechimga ega emasligi aniqlanadi.

2. $t_0 \in [\alpha; \beta]$ parametrning topilgan optimal plan optimal bo'ladigan yoki yeichimga ega bo'lmaydigan qiymatlari to'plami aniqlanadi. Parametrning shu qiymatlari chiqarib tashlanadi.

3. t parametrning qiymati $[\alpha; \beta]$ oraliqning qolgan qismidagi biror songa teng deb olib, hosil bo'lgan chiziqli dasturlash masalasining yechimi topiladi.

4. t parametrning optimal plan optimal bo'lib qoluvchi yoki yechimi bo'lmaydigan yangi optimal plan uchun qiymatlar to'plami aniqlanadi. Hisoblashlar $t \in [\alpha; \beta]$ parametrning barcha qiymatlari tadqiq etilmaguncha davom etiladi [7].

Misol 2.1.1. $t, (-\infty < t < \infty)$ barcha qiymatlari uchun

$Z = 2x_1 + (3 + 4t)x_2$ funksiyaning maksimal qiymatini

$$\begin{cases} x_1 + x_2 + x_3 = 12, \\ x_1 - x_2 + x_4 = 10, \\ -x_1 + x_2 + x_5 = 6. \end{cases}$$

shartlarda aniqlang.

Yechilishi. Ixtiyoriy tanlangan sonini olamiz va simleks usuli bilan optimal planni aniqlaymiz.

Jadval 2.1.1.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_3	12	1	1	1	0	0
x_4	10	1	-1	0	1	0
x_5	6	-1	1	0	0	1
S	0	-2	$-3-4t$	0	0	0

Jadval 2.1.2.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_3	6	2	0	1	0	0
x_4	16	0	0	0	1	0
x_2	6	-1	1	0	0	1
S	$18+24t$	$-5-4t$	0	0	0	$3+4t$

Jadval 2.1.3.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_1	3	1	0	1/2	0	-1/2
x_4	16	0	0	0	1	1
x_2	9	0	1	1/2	0	1/2
S	$33+36t$	0	0	$2,5+2t$	0	$0,5+2t$

2.1.3-jadvaldagi plan optimal bo'lib qoluvchi t ning qiymatini aniqlaymiz:

$$\begin{cases} 2,5+2t \geq 0, \\ 0,5+2t \geq 0. \end{cases} \Rightarrow t \geq -0,25.$$

Demak, $t \in [-0,25; \infty)$ da masala optimal yechimga ega $X_1 = (3,9,0,16,0), Z_{\max} = 33+36t$. $t < -0,25$ deb olamiz. U holda x_5 – ustun hal qiluvchi ustun bo'ladi. Yangi tayanch planga o'tamiz:

Jadval 2.1.4.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_1	11	1	0	1/2	1/2	0
x_5	16	0	0	0	1	1
x_2	1	0	1	1/2	-1/2	0
S	$25 + 4t$	0	0	$2,5 + 2t$	$-0,5 - 2t$	0

Bu plan

$$\begin{cases} 2,5 + 2t \geq 0, \\ -0,5 - 2t \geq 0. \end{cases} \Rightarrow -1,25 \leq t \leq -0,25.$$

shartda optimaldir. Demak $t \in [-1,25; -0,25]$, $X_2 = (11; 1; 0; 0; 16)$, $Z_{\max} = 25 + 4t$.

$t < -1,25$ da quyidagiga ega bo'lamiz:

Jadval 2.1.5.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_1	10	1	-1	0	1	0
x_5	16	0	0	0	1	1
x_3	2	0	2	1	-1	0
S	20	0	$-5 - 4t$	0	2	0

Bu plan $-5 - 4t \geq 0, \Rightarrow t \leq -1,25$ bo'lganda optimal. Demak, $t \in [-\infty; -1,25]$, $X_3 = (10; 0; 2; 0; 16)$, $Z_{\max} = 20$.

2.2. Cheklashlar sistemasi ozod hadlari parametrga bog'liq masala

Chiziqli funksiya va chiziqli cheklashlar berilgan bo'lsin

$$Z = \sum_{j=1}^n c_j x_j \rightarrow \max \quad (2.2.1)$$

$$\sum_{j=1}^n a_{ij} x_j = b_i' + b_i'' t, \quad i = 1, 2, \dots, m, \quad (2.2.2)$$

$$x_j \geq 0, \quad j = 1, 2, \dots, n.$$

(2.2.1)-(2.2.2) masalani yechish algoritmi yuqorida yechilgan (2.1.1)-(2.1.2) masalani yechish algoritmiga o'xshash. t parametrning qiymatini qandaydir $t_0 \in [\alpha; \beta]$ ga teng deb olib, chizikli dasturlash masalasining yechimini topamiz. Bunda t_0 parametrning berilgan qiymatida masalaning optimal yechimi mavjudligi yoki mavjud emasligini aniqlaymiz. Birinchi holda aniqlangan plan ixtiyoriy $\underline{t} \leq t \leq \bar{t}$ uchun optimal bo'ladi, bu yerda

$$\underline{t} = \begin{cases} \max(-q_i / p_i), & \text{agar } \exists p_i > 0; \\ -\infty, & \text{agar } p_i \leq 0; \end{cases}$$

$$\bar{t} = \begin{cases} \min(-q_i / p_i), & \text{agar } \exists p_i < 0; \\ \infty, & \text{agar } p_i \geq 0; \end{cases}$$

q_i i p_i sonlar optimal plan komponentalari bilan aniqlangan bo'lib, t_0 ga bog'liq:

$$x_i^* = q_i + t_0 p_i.$$

Agar $t = t_0$ da (2.2.1) - (2.2.2) masala yechimga ega bo'lmasa, u holda yoki (2.2.1) masalaning maqsad funksiyasi yechimlar to'plamida chegaralanmagan, yoki (2.2.2) tenglamalar sistemasi manfiymas yechimga ega emas. Birinchi holda masala barcha $t \in [\alpha; \beta]$ uchun yechimga ega emas, ikkinchi holda a va vtorom $t \in [\alpha; \beta]$ parametrning (2.2.2) tenglamalar sistemasiga mos bo'lmagan qiymatlarini aniqlaymiz va chiqarib tashlaymiz. (2.2.1) - 2.2.2) masala aynan bir xil yechimga ega yoki yechimga ega bo'lmagan oraliqni aniqlagandan so'ng, t parametrning topilgan oraliqqa tegishli bo'lmagan qiymatini olamiz va hosil bo'lgan masalaning yechimini topamiz. Bunda yangi masalaning yechimini ikkilangan simpleks usuli bilan izlaymiz. Iterasion jarayonni davom ettirib, sanoqli qadamda (2.2.1) - (2.2.2) masalaning yechimini olamiz [4,7]. Shunday qilib, (2.2.1) - (2.2.2) masalani yechish jarayoni o'z ichiga quyidagi bosqichlarni oladi:

1. t parametrni biror $t_0 \in [\alpha; \beta]$ songa teng deb olib, olingan chizikli dasturlash masalasining X^* optimal plan topiladi yoyei yechimga ega emasligi aniqlanadi.

2. $t_0 \in [\alpha; \beta]$ parametrning topilgan optimal plan optimal bo'ladigan yoki yeichimga ega bo'lmaydigan qiymatlari to'plami aniqlanadi. Parametrning shu qiymatlari chiqarib tashlanadi.

3. $t \in [\alpha; \beta]$ parametrning (2.2.1) - (2.2.2) masala aynan bir xil optimal yechimga egaligi yoki yechimga ega bo'lmagan qiymatlari topiladi.

4. $[\alpha; \beta]$ qolgan qismidan t parametr qiymati aniqlanib, yangi optimal plan qurish imkoniyati o'rnatiladi. Optimal plan mavjud bo'lgan holda, uni ikkilangan simpleks usuli bilan aniqlanadi [8.12].

Misol 2.2.1. Parametrning har bir qiymati uchun funksiyaning maksimal qiymati topilsin.

$$Z = 3x_1 - 2x_2 + 5x_3 - 4x_5$$

$$\begin{cases} x_1 + x_2 + x_3 = 12 + t, \\ 2x_1 - x_2 + x_4 = 8 + 4t, \\ -2x_1 + 2x_2 + x_5 = 10 - 6t. \end{cases}$$

Yechilishi. $t=0$ deb olib, yechimni topamiz:

Jadval 2.2.1.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_3	$12 + t$	1	1	1	0	0
x_4	$8 + 4t$	2	-1	0	1	0
x_5	$10 - 6t$	-2	2	0	0	1
S	$20 + 29t$	10	-1	0	0	0

Jadval 2.2.2.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_3	$7 + 4t$	2	0	1	0	-1/2
x_4	$13 + t$	1	0	0	1	1/2
x_2	$5 - 3t$	-1	1	0	0	1/2
S	$25 + 26t$	9	0	0	0	1/2

$t=0$ da optimal yechim: $X_1 = (0; 5 - 3t; 7 + 4t; 13 + t; 0)$, $Z_{\max} = 25 + 26t$. Bu plan uning komponentlari orasida manfiy son bo'lmaguncha optimal bo'lib qoladi:

$$\begin{cases} 7 + 4t \geq 0, \\ 5 - 3t \geq 0, \\ 13 + t \geq 0. \end{cases} \Rightarrow -\frac{7}{4} \leq t \leq \frac{5}{3}.$$

Demak, $t \in \left[-\frac{7}{4}; \frac{5}{3}\right]$, da $X_1 = (0; 5 - 3t; 7 + 4t; 13 + t; 0)$, $Z_{\max} = 25 + 26t$.

Masala $t > \frac{5}{3}$ da optimal yechimiga ega bo'lishi yoki bo'lmasligini tadqiq qilamiz. Agar $t > \frac{5}{3}$ bo'lsa, u holda $5 - 3t < 0$. Demak $X_1 = (0; 5 - 3t; 7 + 4t; 13 + t; 0)$ masala yechimi bo'lmaydi. Shuning uchun yangi planga o'tish zarur. Buni x_2 satrda manfiy son bo'lganda amalga oshirish mumkin.. Bu holda shart bajariladi Ikkilangan simpleks usulini qo'llash yordamida optimal planga o'tamiz.

Jadval 2.2.3.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_3	$17 - 2t$	0	2	1	0	1/2
x_4	$18 - 2t$	0	1	0	1	1
x_1	$-5 + 3t$	1	-1	0	0	-1/2
S	$70 - t$	0	9	0	0	5

$X_2 = (-5 + 3t; 0; 17 - 2t; 18 - 2t; 0)$, $Z_{\max} = 70 - t$. Bu plan

$$\begin{cases} 17 - 2t \geq 0, \\ 18 - 2t \geq 0, \\ -5 + 3t \geq 0. \end{cases} \Rightarrow \frac{5}{3} \leq t \leq \frac{17}{2} \quad \text{da optimalligicha qoladi.}$$

Agar $t > \frac{17}{2}$ bo'lsa, u holda bu yechim bo'lmaydi, chunki $17 - 2t < 0$. x_3 satrda manfiy sonlar bo'lmagani uchun, berilgan boshlang'ich masala yechimga ega emas.

$t > \frac{7}{4}$ da, $X = (0; 5 - 3t; 7 + 4t; 13 + t; 0)$ yechim bo'lmaydi, chunki $7 + 4t < 0$. S

2.2.2-jadval yordamida keyingi yechimga o'tamiz:

Jadval 2.2.4.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5
x_5	$-14 - 8t$	-4	0	-2	0	1
x_4	$20 + 5t$	3	0	1	1	0
x_2	$12 + t$	1	1	1	0	0
S	$32 + 30t$	11	0	1	0	0

$X_3 = (0; 12 + t; 0; 20 + 5t; -14 - 8t)$, $Z_{\max} = 32 + 30t$. Bu yechim $-4 \leq t \leq \frac{7}{4}$ da optimal.

$t < -4$ da yechimga ega emas, chunki x_4 satrda manfiy son yo'q.

2.3. Maqsad funksiyasi va cheklashlarining o'ng qismi parametrga bog'liq masala

Misol 2.3.1. Parametrning barcha qiymatlari uchun funksiyaning maksimal qiymatini aniqlang

$$Z = (8 - 5t)x_1 + (9 - 3t)x_2 + (-3 + 5t)x_3 - (2 + 4t)x_4$$

$$\begin{cases} x_1 - x_2 + x_3 = 24 - 12t, \\ -x_1 + 2x_2 + x_4 = -18 + 10t, \\ x_1, x_2 \geq 0, t \in (-\infty; \infty). \end{cases}$$

Yechilishi. $t = 2$ ga teng bo'lsin. Simpleks-usuli bilan masala yechimini topamiz.

Jadval 2.3.1.

Bazis	Ozod had	x_1	x_2	x_3	x_4
x_3	$24 - 12t$	1	-1	1	0
x_4	$-13 + 10t$	-1	2	0	1
S	$-36 + 208t - 100t^2$	$-9 + 14t$	$-10 - 10t$	0	0

Jadval 2.3.2.

Bazis	Ozod had	x_1	x_2	x_3	x_4
x_3	$15 - 7t$	1/2	0	1	1/2

x_2	$-9 + 5t$	$-1/2$	1	0	$1/2$
S	$-126 + 168t - 50t^2$	$-9t - 14$	0	0	$5t + 5$

$X_1 = (0; -9 + 5t; 15 - 7t; 0)$ plan

$$\begin{cases} 9t - 14 \geq 0, \\ 5t + 5 \geq 0. \end{cases} \Rightarrow t \geq \frac{14}{9}, \text{ shartda optimal.}$$

X_1 vektor komponentlari orasida manfiylari yo'q:

$$\begin{cases} 15 - 7t \geq 0, \\ -9 + 5t \geq 0. \end{cases} \Rightarrow \frac{9}{5}t \geq \frac{15}{7}.$$

Demak, $\frac{9}{5} \leq t \leq \frac{15}{7}$ da $X_1 = (0; -9 + 5t; 15 - 7t; 0)$, $Z_{\max} = 126 + 168t - 50t^2$.

Agar $t < \frac{9}{5}$ bo'sa, u holda $-9 + 5t < 0$ va X_1 masalaning yechimi emas.

Ikkilangan simpleks-usulni qo'llab yangi jadval o'tamiz:

Jadval 2.3.3.

Bazis	Ozod had	x_1	x_2	x_3	x_4
x_3	$6 - 2t$	0	1	1	1
x_1	$18 - 10t$	1	-2	0	-1
S	$-126 + 134t + 40t^2$	0	$-28 + 18t$	0	$14t - 9$

$X_2 = (18 - 10t; 0; 6 - 2t; 0)$ vektor

$$\begin{cases} 6 - 2t \geq 0, \\ 18 - 10t \geq 0. \end{cases} \Rightarrow t \leq \frac{9}{5}, \text{ da optimal}$$

ya'ni $t \in \left[\frac{14}{9}; \frac{9}{5} \right]$, $Z_{\max} = 126 - 134t + 40t^2$.

Agar $t > \frac{17}{5}$ bo'lsa, u holda to'iz simpleksnoy tablisı 2.3.2 simpleks-jadvaldan masala optimal yechimga ega emasligi kelib chiqadi, chunki x_3 satrda manfiy sonlar yo'q.

Biz $t \in \left[\frac{14}{9}; \infty \right)$ oraliqni qaradik. $t < \frac{14}{9}$ bo'lsin, u holda yangi optimal planga

o'tamiz:

Jadval 2.3.4.

Bazis	Ozod had	x_1	x_2	x_3	x_4
x_2	$6-2t$	0	1	1	1
x_1	$30-14t$	1	0	2	1
S	$294-298t+76t^2$	0	0	$28-18t$	$19-4t$

Shunday qilib, $t < \frac{14}{9}$ da, $X_3 = (30-14t; 6-2t; 0; 0)$, $Z_{\max} = 294-298t+76t^2$.

2.4. Butun sonli chiziqli parametrik masalalarga doir sonli misollar

Misol 2.4.1. t ($-\infty < t < \infty$) har bir qiymati uchun $Z = (t+1) \cdot x_1 - x_2 - (3+4 \cdot t) \cdot x_3$ funksiyani minimallashtiruvchi manfiy mas qiymatini $Z = (t+1) \cdot x_1 - x_2 - (3+4 \cdot t) \cdot x_3$

$$\begin{cases} 2 \cdot x_1 - x_2 + x_3 \leq 1, \\ -4 \cdot x_1 + 2 \cdot x_2 - x_3 \leq 2, \\ 3 \cdot x_1 + x_3 \leq 5, \end{cases}$$

x_i - butun shartlarda aniqlang.

Yechilishi.

I usul. Tengsizliklarning chap qismiga qo'shimcha o'zgaruvchilarni kiritib tengliklarga keltiramiz:

$$\begin{cases} 2 \cdot x_1 - x_2 + x_3 + x_4 = 1, \\ -4 \cdot x_1 + 2 \cdot x_2 - x_3 + x_5 = 2, \\ 3 \cdot x_1 + x_3 + x_6 = 5, \end{cases}$$

$t=0$ (0 soni ixtiyoriy tanlangan) deb olamiz va simpleks-usuli bilan optimal plani aniqlaymiz.

Jadval 2.4.1.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_4	1	2	-1	1	1	0	0
x_5	2	-4	2	-1	0	1	0
x_6	5	3	0	1	0	0	1

S	0	$-t+1$	1	$3+4t$	0	0	0
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Jadval 2.4.2.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	1	2	-1	1	1	0	0
x_5	3	-2	1	0	1	1	0
x_6	4	1	1	0	-1	0	1
S	$-3-4t$	$-9t-7$	$4t+4$	0	$-3-4t$	0	0

Jadval 2.4.3.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	4	0	0	1	2	1	0
x_2	3	-2	1	0	1	1	0
x_6	1	3	0	0	-2	-1	1
S	$-15-16t$	$-t+1$	0	0	$-8t-7$	$-4t-4$	0

Jadval 2.4.4.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	4	0	0	1	2	1	0
x_2	$11/3$	0	1	0	$-1/3$	$1/3$	$2/3$
x_1	$1/3$	1	0	0	$-2/3$	$-1/3$	$1/3$
S	$\frac{-47t-46}{3}$	0	0	0	$\frac{-26t-19}{3}$	$\frac{-13t-11}{3}$	$\frac{t-1}{3}$

t parametring 2.4.4-jadval mos plani optimal bo'lib qoladigan qiymatini aniqlaymiz:

$$\begin{cases} \frac{-26t-19}{3} \leq 0 \\ \frac{-13t-11}{3} \leq 0 \\ \frac{t-1}{3} \leq 0 \end{cases} \Rightarrow t \in \left[-\frac{19}{26}; 1 \right].$$

Demak, $t \in \left[-\frac{19}{26}; 1\right]$ da masala optimal yechim: $X = \left(\frac{1}{3}; \frac{11}{3}; 4\right)$,

$Z_{\min} = \frac{-47t - 46}{3}$ ga ega. Bu yechim butun sonli emas: x_1, x_2 - kasr. x_2 o'zgaruvchi

uchun qo'shimcha cheklash tuzamiz. Quyidagiga egamiz:

$$q_2 = x_2 - [x_2] = \frac{11}{3} - \left[\frac{11}{3}\right] = \frac{11}{3} - 3 = \frac{2}{3},$$

$$q_{21} = q_{22} = q_{23} = 0, \quad q_{24} = -\frac{1}{3} - \left[-\frac{1}{3}\right] = -\frac{1}{3} + 1 = \frac{2}{3}, \quad q_{25} = \frac{1}{3}, \quad q_{26} = \frac{2}{3}.$$

$$\frac{2}{3}x_4 + \frac{1}{3}x_5 + \frac{2}{3}x_6 - \frac{2}{3} \geq 0,$$

$$-\frac{2}{3}x_4 - \frac{1}{3}x_5 - \frac{2}{3}x_6 + x_7 = -\frac{2}{3}.$$

Jadval 2.4.5.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	4	0	0	1	2	1	0	0
x_2	11/3	0	1	0	-1/3	1/3	2/3	0
x_1	1/3	1	0	0	-2/3	-1/3	1/3	0
x_7	-2/3	0	0	0	-2/3	-1/3	-2/3	1
S	$\frac{-47t - 46}{3}$	0	0	0	$\frac{-26t - 19}{3}$	$\frac{-13t - 11}{3}$	$\frac{t - 1}{3}$	0

Ikkilangan ismpleks-usulni qo'llaymiz va quyidagi natijani olamiz:

Jadval 2.4.6.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	4	0	0	1	2	1	0	0
x_2	3	0	1	0	-1	0	0	1
x_1	0	1	0	0	-1	-1/2	0	1/2
x_6	1	0	0	0	1	1/2	1	-3/2
S	$-16t - 15$	0	0	0	$-9t - 6$	$\frac{-9t - 7}{2}$	0	$\frac{t - 1}{2}$

Butun sonli yechimni oldik. Barcha $t \in \left[-\frac{19}{26}; 1\right]$ uchun qarab chiqamiz

$$\begin{cases} -9t - 6 \leq 0 \\ -9t - 7 \leq 0 \\ \frac{2}{t-1} \leq 0 \end{cases} \Rightarrow t \in \left[-\frac{2}{3}; 1 \right].$$

Demak, $t \in \left[-\frac{2}{3}; 1 \right]$ da butun sonli optimal yechim $X = (0; 3; 4)$, $Z_{\min} = -16t - 15$

ni oldik. $t \in \left[-\frac{19}{26}; -\frac{2}{3} \right]$ uchun butun sonli optimal yechimni topamiz.

2.4.6 jadvaldan quyidagini olamiz.

Jadval 2.4.7.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	2	0	0	1	0	1	-2	3
x_2	4	0	1	0	0	1/2	1	-1/2
x_1	1	1	0	0	0	0	1	-1
x_4	1	0	0	0	1	1/2	1	-3/2
S	$-7t - 9$	0	0	0	0	-1/2	$9t + 6$	$\frac{-26t - 19}{2}$

Butun sonli yechimni oldik, endi uni optimalikka tekshiramiz:

$$\begin{cases} 9t + 6 \leq 0 \\ \frac{-26t - 19}{2} \leq 0 \end{cases} \Rightarrow t \in \left[-\frac{19}{26}; -\frac{2}{3} \right].$$

Demak, $t \in \left[-\frac{19}{26}; -\frac{2}{3} \right]$ uchun butun sonli optimal yechim: $X = (1, 4, 2)$,

$Z_{\min} = -7t - 9$. $t \in [1; +\infty)$ parametring qiymati uchun optimal yechim topamiz. $t = 2$ bo'lsin, u holda - x_6 hal qiluvchi ustunni, x_1 - hal qiluvchi satr hosil qilamiz. Bitta iteratsiyani o'tkazib, hosil qilamiz.

Jadval 2.4.8.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	4	0	0	1	2	1	0
x_2	3	-2	1	0	1	1	0

x_6	1	3	0	0	-2	-1	1
S	$-16t - 15$	$-t + 1$	0	0	$-8t - 7$	$-4t - 4$	0

Yechim butun sonli. Bu plan optimal bo'lib qoluvchi t ning qiymatini topamiz.

$$\begin{cases} -t + 1 \leq 0 \\ -8t - 7 \leq 0 \\ -4t - 4 \leq 0 \end{cases} \Rightarrow t \in [1; +\infty)$$

Demak, $t \in [1; +\infty)$ uchun butun sonli yechim $X = (0; 3; 4)$, $Z_{\min} = -16t - 15$.

$t \in \left(-\infty; -\frac{19}{26}\right]$ parametr uchun butun sonli shartsiz optimal yechimni topamiz. $t = -1$

bo'lsin, x_4 - hal qiluvchi uchun, x_3 - hal qiluvchi satrdir. Bitta iterasiya o'tkazamiz

Jadval 2.4.9.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_4	2	0	0	1/2	1	1/2	0
x_2	13/3	0	1	1/6	0	1/2	2/3
x_1	5/3	1	0	1/3	0	0	1/3
S	$\frac{5t - 8}{3}$	0	0	$\frac{26t + 19}{6}$	0	-1/2	$\frac{t - 1}{3}$

t parametrning plan optimal bo'lib qoluvchi qiymatini topamiz.

$$\begin{cases} \frac{26t + 19}{6} \leq 0, \\ \frac{t - 1}{3} \leq 0. \end{cases} \Rightarrow t \in \left(-\infty; -\frac{19}{26}\right].$$

Endi butun sonli shart bilan yechamiz. x_1 i x_2 - kasr. x_2 o'zgaruvchi qo'shimcha cheklashni tuzamiz.

$$q_2 = x_2 - [x_2] = \frac{13}{3} - \left[\frac{13}{3}\right] = \frac{13}{3} - 4 = \frac{1}{3},$$

$$q_{21} = q_{22} = q_{24} = 0, \quad q_{23} = \frac{1}{6}, \quad q_{25} = \frac{1}{2}, \quad q_{26} = \frac{2}{3}.$$

$$\frac{1}{6}x_3 + \frac{1}{2}x_5 + \frac{2}{3}x_6 - \frac{1}{3} \geq 0,$$

$$-\frac{1}{6}x_3 - \frac{1}{2}x_5 - \frac{2}{3}x_6 + x_7 = -\frac{1}{3}.$$

Jadval 2.4.10.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_4	2	0	0	1/2	1	1/2	0	0
x_2	13/3	0	1	1/6	0	1/2	2/3	0
x_1	5/3	1	0	1/3	0	0	1/3	0
x_7	-1/3	0	0	-1/6	0	-1/2	-2/3	1
S	$\frac{5t-8}{3}$	0	0	$\frac{26t+19}{6}$	0	-1/2	$\frac{t-1}{3}$	0

Jadval 2.4.11.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_4	2	0	0	1/2	1	1/2	0	0
x_2	4	0	1	0	0	0	0	1
x_1	3/2	1	0	1/4	0	-1/4	0	1/2
x_6	1/2	0	0	1/4	0	3/4	1	-3/2
S	$\frac{3t-15}{2}$	0	0	$\frac{51t+39}{12}$	0	$\frac{-t-1}{4}$	0	$\frac{t-1}{2}$

x_1 va x_6 - kasr. x_1 uchun qo'shimcha cheklashlar tuzamiz:

$$\frac{1}{4}x_3 + \frac{3}{4}x_5 + \frac{1}{2}x_6 - \frac{1}{2} \geq 0, \quad -\frac{1}{4}x_3 - \frac{3}{4}x_5 - \frac{1}{2}x_6 + x_8 = -\frac{1}{2}.$$

Jadval 2.4.12.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8
x_4	2	0	0	1/2	1	1/2	0	0	0
x_2	4	0	1	0	0	0	0	1	0
x_1	3/2	1	0	1/4	0	-1/4	0	1/2	0
x_6	1/2	0	0	1/4	0	3/4	1	-3/2	0
x_8	-1/2	0	0	-1/4	0	-3/4	0	-1/2	1

S	$\frac{3t-15}{2}$	0	0	$\frac{51t+39}{12}$	0	$\frac{-t-1}{4}$	0	$\frac{t-1}{2}$	0
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Jadval 2.4.13.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8
x_4	2	0	0	1/2	1	1/2	0	0	0
x_2	3	0	1	1/2	0	-3/2	0	0	2
x_1	1	1	0	0	0	-1	0	0	1
x_6	2	0	0	1	0	3	1	0	-3
x_7	1	0	0	1/2	0	3/2	0	1	-2
S	$t-7$	0	0	$\frac{8t+7}{2}$	0	$\frac{-2t+1}{2}$	0	0	$t-1$

$$\begin{cases} \frac{8t+7}{2} \leq 0, \\ \frac{-2t+1}{2} \leq 0, \\ t-1 \leq 0. \end{cases} \Rightarrow \text{sistema yechimga ega emas.}$$

Butun sonli yechim yechim optimal bo'luvchi t parametr qiymatini mavjud emasligini topdik. Demak $t \in \left(-\infty; -\frac{19}{26}\right]$ uchun butun sonli yechim mavjud emas.

Parametrning turli qiymatlari uchun butun sonli planlarning optimallik intervallari:

$$t \in \left(-\infty; -\frac{19}{26}\right] - \text{planlar mavjud emas;}$$

$$t \in \left[-\frac{19}{26}; -\frac{2}{3}\right] - X = (1,4,2), Z_{\min} = -7t - 9.$$

$$t \in \left[-\frac{2}{3}; +\infty\right) - X = (0;3;4), Z_{\min} = -16t - 15.$$

Butun sonli parametrik dasturlash masalalarini yechishning asosiy bosqichlari quyidagilardan iborat:

1. $t = t_0 \in [\alpha; \beta]$ da butun sonli shartsiz optimal plan topiladi yoki masalaning yechimi yo'qligi aniqlanadi.

2. $t \in [\alpha; \beta]$ uchun masala aynan bir xil yechimga ega ekanligi, yoki yechimga ega bo'lmaydigan qiymatlari topiladi.

3. Agar topilgan plan butun sonli bo'lsa, keyingi punktga o'tiladi. Agar topilgan yechim butun sonli bo'lmasa, o'qshimcha cheklashlar kiritiladi va yangi optimal yechim topilmaguncha hisoblashlar davom ettiriladi. Agar u yechim ham butun sonli bo'lmasa, yangi cheklashlar kiritiladi. Jarayon butun sonli yechim topilmaguncha yoki butun sonli masala yechimga ega emasligi aniqlanmaguncha davom ettiriladi. Naxodyat znacheniya $t \in [\alpha; \beta]$ ning masala aynan bir xil butun sonli optimal yechimga ega bo'ladigan yoki yechimga ega bo'lmaydigan qiymati topiladi.

4. $[\alpha; \beta]$ ning qolgan qismidan t tanlanadi va yangi optimal plan aniqlash imkoniyati o'rnatiladi. Agar u butun sonli bo'lmasa, uni butun sonlikka keltiriladi yoki butun sonli optimal yechimga ega emasligi isbotlanadi.

5. Hisoblashlar $t \in [\alpha; \beta]$ parametrning barcha qiymatlari tadqiq qilinmaguncha davom ettiriladi [8].

II usul. Oldingi misolni yechishda optimal plan topilgandan keyin, t parametrning plan optimal bo'lib qoluvchi qiymatini aniqlardik, shunday keyingina masalani butun sonli ko'rinishga keltirdik. Bu masalani yechishda avval butun sonli optimal yechimni aniqlab, shundan so'ng bu yechimni qanoatlantiruvchi t ning qiymatlar oralig'ini aniqlashga harakat qilib ko'ramiz. Tengsizlikning chap qismiga qo'shimcha o'zgaruvchi kiritib, tengsizliklardan tenglikka o'tkazamiz:

$$\begin{cases} 2 \cdot x_1 - x_2 + x_3 + x_4 = 1, \\ -4 \cdot x_1 + 2 \cdot x_2 - x_3 + x_5 = 2, \\ 3 \cdot x_1 + x_3 + x_6 = 5, \end{cases}$$

$t=0$ (0 soni ixtiyoriy tanlangan) deb olamiz va simpleks-usul bilan optimal planni topamiz.

Jadval 2.4.14.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6

x_4	1	2	-1	1	1	0	0
x_5	2	-4	2	-1	0	1	0
x_6	5	3	0	1	0	0	1
S	0	$-t+1$	1	$3+4t$	0	0	0

Jadval 2.4.15.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	1	2	-1	1	1	0	0
x_5	3	-2	1	0	1	1	0
x_6	4	1	1	0	-1	0	1
S	$-3-4t$	$-9t-7$	$4t+4$	0	$-3-4t$	0	0

Jadval 2.4.16.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	4	0	0	1	2	1	0
x_2	3	-2	1	0	1	1	0
x_6	1	3	0	0	-2	-1	1
S	$-15-16t$	$-t+1$	0	0	$-8t-7$	$-4t-4$	0

Jadval 2.4.17.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6
x_3	4	0	0	1	2	1	0
x_2	$11/3$	0	1	0	$-1/3$	$1/3$	$2/3$
x_1	$1/3$	1	0	0	$-2/3$	$-1/3$	$1/3$
S	$\frac{-47t-46}{3}$	0	0	0	$\frac{-26t-19}{3}$	$\frac{-13t-11}{3}$	$\frac{t-1}{3}$

Plan optimal, lekin butun sonli emas. x_2 o'zgaruvchi uchun qo'shimcha cheklash tuzamiz:

$$q_2 = x_2 - [x_2] = \frac{11}{3} - \left[\frac{11}{3} \right] = \frac{11}{3} - 3 = \frac{2}{3},$$

$$q_{21} = q_{22} = q_{23} = 0, \quad q_{24} = -\frac{1}{3} - \left[-\frac{1}{3}\right] = -\frac{1}{3} + 1 = \frac{2}{3}, \quad q_{25} = \frac{1}{3}, \quad q_{26} = \frac{2}{3}.$$

Qo'shimcha cheklash quyidagi ko'rinishga ega:

$$\frac{2}{3}x_4 + \frac{1}{3}x_5 + \frac{2}{3}x_6 - \frac{2}{3} \geq 0,$$

$$-\frac{2}{3}x_4 - \frac{1}{3}x_5 - \frac{2}{3}x_6 + x_7 = -\frac{2}{3}.$$

Jadval 2.4.18.

Bazis	Ozod Had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	4	0	0	1	2	1	0	0
x_2	11/3	0	1	0	-1/3	1/3	2/3	0
x_1	1/3	1	0	0	-2/3	-1/3	1/3	0
x_7	-2/3	0	0	0	-2/3	-1/3	-2/3	1
S	$\frac{-47t - 46}{3}$	0	0	0	$\frac{-26t - 19}{3}$	$\frac{-13t - 11}{3}$	$\frac{t - 1}{3}$	0

Ikkilangan simpleks usulini qo'llaymiz va natijani olamiz:

Jadval 2.4.19.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	4	0	0	1	2	1	0	0
x_2	3	0	1	0	-1	0	0	1
x_1	0	1	0	0	-1	-1/2	0	1/2
x_6	1	0	0	0	1	1/2	1	-3/2
S	$-16t - 15$	0	0	0	$-9t - 6$	$\frac{-9t - 7}{2}$	0	$\frac{t - 1}{2}$

$t=0$ da butun sonli optimal yechimni oldik. Yechim o'zgarmaydigan t , ning qiymatini topamiz:

$$\begin{cases} -9t - 6 \leq 0 \\ -9t - 7 \leq 0 \\ \frac{2}{t-1} \leq 0 \end{cases} \Rightarrow t \in \left[-\frac{2}{3}; 1\right].$$

Demak, $t \in \left[-\frac{2}{3}; 1\right]$ da butun sonli optimal yechimni oldik $X = (0; 3; 4)$,

$Z_{\min} = -16t - 15$. $t \in [1; +\infty)$ uchun butun sonli optimal yechimni topamiz. $t = 2$ bo'lsin.

Jadval 2.4.20.

Bazis	Ozod Had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	4	0	0	1	2	1	0	0
x_2	3	-2	1	0	1	1	0	0
x_7	0	2	0	0	-2	-1	0	1
x_6	1	3	0	0	-2	-1	1	0
S	$-16t - 15$	$-t + 1$	0	0	$-8t - 7$	$-4t - 4$	0	0

$t = 2$ da butun sonli optimal yechimni oldik, t ning plan o'zgarmaydigan yechimini topamiz:

$$\begin{cases} -t + 1 \leq 0 \\ -8t - 7 \leq 0 \\ -4t - 4 \leq 0 \end{cases} \Rightarrow t \in [1; +\infty)$$

Demak, $t \in [1; +\infty)$ da butun sonli optimal yechim $X = (0; 3; 4)$, $Z_{\min} = -16t - 15$ oldik. Masalaning parametrning $t \in \left(-\infty; -\frac{2}{3}\right]$ dagi optimal yechimini topamiz.

2.4.19-jadvalga qaytamiz. $t = -1$ bo'lsin, u holda stolbes - x_4 - hal qiluvchi ustun, x_6 -hal qiluvchi satr bo'ladi.

Jadval 2.4.21.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_3	2	0	0	1	0	0	-2	3
x_2	4	0	1	0	0	1/2	1	-1/2

x_1	1	1	0	0	0	0	1	-1
x_4	1	0	0	0	1	1/2	1	-3/2
S	-7t-9	0	0	0	0	-1/2	9t+6	(-26t-19)/2

Masalaning butun sonli yechimini topdik, endi parametarning yechim optimal bo'ladigan qiymatini topamiz:

$$\begin{cases} 9t+6 \leq 0 \\ \frac{-26t-19}{2} \leq 0 \end{cases} \Rightarrow t \in \left[-\frac{19}{26}; -\frac{2}{3} \right].$$

Demak, , $t \in \left[-\frac{19}{26}; -\frac{2}{3} \right]$ butun sonli optimal yechim $X = (1; 4; 2)$, $Z_{\min} = -7t - 9$

ni oldik. Agar $t \in \left(-\infty; -\frac{19}{26} \right)$ bo'lsa, u holda , to v stroke S stolbsa x_7 ustunning S satrida musbat element bo'ladi [6]. Keyingi jadvalga o'tamiz.

Jadval 2.4.22.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_7	2/3	0	0	1/3	0	0	-2	1
x_2	13/3	0	1	1/6	0	1/2	1	0
x_1	5/3	1	0	1/3	0	0	1	0
x_4	2	0	0	1/2	1	1/2	1	0
S	(5t-8)/3	0	0	(26t+19)/6	0	-1/2	(t-1)/3	0

Optimal plan hosil qildik, lekin u butun sonli emas. x_2 o'zgaruvchi uchun qo'shimcha cheklash tuzamiz:

$$q_2 = x_2 - [x_2] = \frac{13}{3} - \left[\frac{13}{3} \right] = \frac{13}{3} - 4 = \frac{1}{3},$$

$$q_{21} = q_{22} = q_{24} = q_{27} = 0, \quad q_{23} = \frac{1}{6}, \quad q_{25} = \frac{1}{2}, \quad q_{26} = \frac{2}{3}.$$

$$\frac{1}{6}x_3 + \frac{1}{2}x_5 + \frac{2}{3}x_6 - \frac{1}{3} \geq 0,$$

$$-\frac{1}{6}x_3 - \frac{1}{2}x_5 - \frac{2}{3}x_6 + x_8 = -\frac{1}{3}$$

Jadval 2.4.23.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8
x_7	2/3	0	0	1/3	0	0	-2	1	0
x_2	13/3	0	1	1/6	0	1/2	1	0	0
x_1	5/3	1	0	1/3	0	0	1	0	0
x_4	2	0	0	1/2	1	1/2	1	0	0
x_8	-1/3	0	0	-1/6	0	-1/2	-2/3	0	1
S	(5t-8)/3	0	0	(26t+19)/6	0	-1/2	(t-1)/3	0	0

Jadval 2.4.24.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8
x_7	2	0	0	5/6	0	3/2	0	1	-3
x_2	4	0	1	0	0	0	0	0	3/2
x_1	3/2	1	0	1/4	0	-1/4	0	0	3/2
x_4	2	0	0	1/2	1	1/2	0	0	3/2
x_6	1/2	0	0	1/4	0	3/4	1	0	-3/2
S	(3t-15)/2	0	0	(51t+39)/12	0	(-t-1)/2	0	0	(t-1)/2

x_1 va x_6 - kasr. x_1 uchun qo'shimcha cheklash tuzamiz:

$$\frac{1}{4}x_3 + \frac{3}{4}x_5 + \frac{1}{2}x_8 - \frac{1}{2} \geq 0, \quad -\frac{1}{4}x_3 - \frac{3}{4}x_5 - \frac{1}{2}x_8 + x_9 = -\frac{1}{2}.$$

Jadval 2.4.25.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
x_7	2	0	0	5/6	0	3/2	0	1	-3	0
x_2	4	0	1	0	0	0	0	0	3/2	0
x_1	3/2	1	0	1/4	0	-1/4	0	0	3/2	0
x_4	2	0	0	1/2	1	1/2	0	0	3/2	0
x_6	1/2	0	0	1/4	0	3/4	1	0	-3/2	0
x_9	-1/2	0	0	-1/4	0	-3/4	0	0	-1/2	1
S	(3t-15)/2	0	0	(51t+39)/12	0	(-t-1)/2	0	0	(t-1)/2	0

Jadval 2.4.26.

Bazis	Ozod had	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
x_7	5	0	0	7/3	0	6	0	1	0	-6
x_2	3	0	1	1/2	0	-3/2	0	0	0	3
x_1	1	1	0	0	0	-1	0	0	0	3
x_4	2	0	0	1/2	1	1/2	0	0	0	3
x_6	2	0	0	1	0	3	1	0	0	3
x_8	1	0	0	1/2	0	3/2	0	0	1	-2
S	$t-7$	0	0	$(8t+7)/2$	0	$(-2t+1)/2$	0	0	0	$t-1$

Yechim optimal, shuning uchun t parametrning qanday qiymatida bu yechim optimal bo'lishini qaraymiz:

$$\begin{cases} \frac{8t+7}{2} \leq 0, \\ \frac{-2t+1}{2} \leq 0, \\ t-1 \leq 0. \end{cases} \Rightarrow \text{sistema yechimga ega emas.}$$

Demak, $t \in \left(-\infty; -\frac{19}{26}\right]$ uchun butun sonli optimal yechim mavjud emas.

Parametrning turli qiymatlari uchun butun sonli yechimlarning optimallik intervallari:

$$t \in \left(-\infty; -\frac{19}{26}\right] - \text{yechim mavjud emas;}$$

$$t \in \left[-\frac{19}{26}; -\frac{2}{3}\right] - X = (1, 4, 2), Z_{\min} = -7t - 9.$$

$$t \in \left[-\frac{2}{3}; +\infty\right) - X = (0, 3, 4), Z_{\min} = -16t - 15.$$

3- BOB. DASTURIY TA'MINOTNING TASNIFI VA UNDAN FOYDALANISH TARTIBI

3.1. Dasturiy ta'minotning tasnifi

Bilamizki, Delphi muhitida ko'plab komponentalar mavjud bo'lib, ularning vazifasi ham turlichadir. Qo'yilgan masalani hal qilish uchun zarur bo'ladigan komponentalarni to'g'ri tanlab olish juda muhimdir. Qo'yilgan masalani hal qilishda quyidagi komponentalardan foydalanildi:

- MainMenu – yuqori asosiy menyuni yaratishda qo'llaniladi.
- Button – bosiluvchi tugma.
- Memo - ma'lumotlarni namoyish etuvchi maxsus oyna (taxrirlash imkoniyati bor).
- Edit – ma'lumot kiritish uchun qo'llaniladi.
- SpeedButton – sichqoncha yordamida bosiluvchi tugma.
- SaveDialog - ma'lumotni faylga saqlash uchun qo'llaniladi.
- Label – turli qisqa ma'lumotlarni chiqarish uchun foydalaniladi.

Dastur formasida yuqoridagi komponentalarning xar biridan bir nechtdan bo'lishi mumkin. Xar biri uchun o'z vazifasiga ko'ra qism dasturlar yaratiladi.

Qism dasturlar o'z navbatida operatorlar, ya'ni buyruqlar ketma-ketligidan iborat bo'ladi. Quyida Delphi muhitida qo'llaniladigan asosiy operatorlar bilan tanishamiz [5].

- Boshlash operatori

Begin

- Tamomlash operatori

End

- Shartlar

if S then S1 else S2;

bu yerda S-mantiqiy ifoda;

S1–S mantiqiy ifoda rost qiymat qabul qilganda ishlovchi

operator.

S2-S mantiqiy ifoda yolg'on qiymat qabul qilganda ishlovchi operator.

- Parametrli takrorlash operatori (*For*).

Operatorni quyidagi ko'rinishdagi holi amalda ko'proq ishlatiladi:

for k:= k1 to k2 do S;

bu yerda *for*(uchun), *to*(gacha), *do*(bajarmoq) - xizmatchi so'zlari;

k - sikl parametri (haqiqiy tipli bo'lishi mumkin emas);

k1 - sikl parametrining boshlang'ich qiymati;

k2 - sikl parametrining oxirgi qiymati;

S - sikl tanasi.

- While takrorlash (sikl) operatori

while B do S;

bu yerda *while* (hozir), *do* (bajarmoq) - xizmatchi so'zlari;

B - sikldan chiqishni ifodalovchi mantiqiy ifoda;

S - siklning tanasini tashkil etuvchi operator [5].

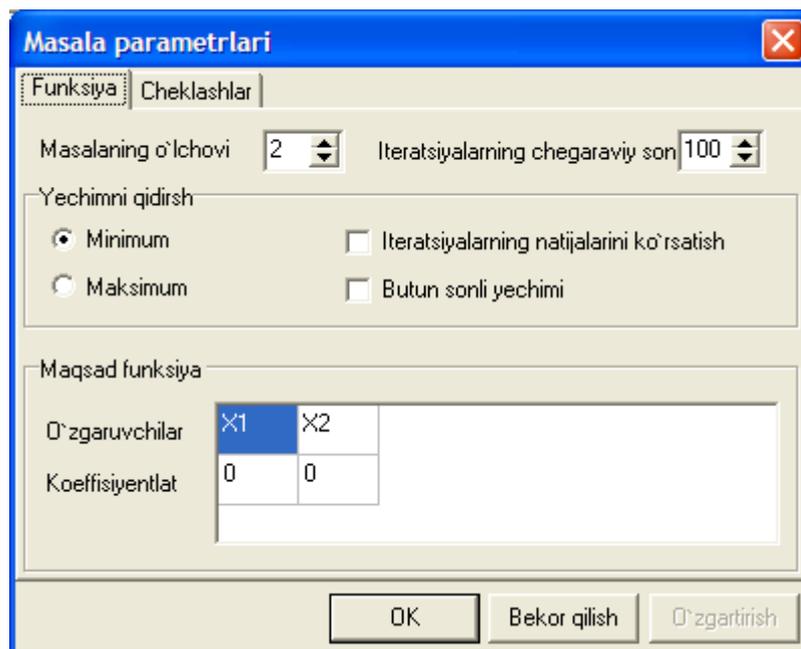
ShD dasturi chiziqli va butun sonli chiziqli dasturlash masalalarini yechish uchun mo'ljallangan. Dastur ikkita hisoblash modullaridan iborat: birinchi moduli butun bo'lmagan chiziqli dasturlash masalasini, ikkinchisi butun sonli dasturlash masalasini yechish uchun mo'ljallangan. Butun bo'lmagan chiziqli dasturlash asosida simleks usuli olingan. Butun sonli dasturlash moduli Gomori usuli asosida amalga oshirilgan bo'lib, hisoblashlarning har bir iteratsiyasini birinchi modulga murojaat qiladi.

Dastur quyidagi vazifalarni bajaradi: maqsad funksiya, mos o'zgaruvchilarni tasvirlovchi koeffitsiyentlardan iborat chiziqli cheklashlar ega bo'lgan chiziqli dasturlash masalasini kiritish va tahrirlash (qo'shish, o'chirish, nusxalash, qo'yish, bekor qilish va oxirgi amalni takrorlash), masalaning boshlang'ich ma'lumotlarini diskdan yuklash va saqlash, asosiy oyna va ilova oynalarini sozlash va ekranga natijalarni chiqarish.

ShD dasturi Borland Delphi 5.0, Microsoft Help Workshop i 3D Studio Max 3.1 dasturiy vositalar yordamida yaratilgan.

Dastur 699 Kbayt disk hajmini egallaydi. Dastur iteratsiyalar natijalarini qarab borish orqali masalani yechish jarayoni nazorat qilish imkoniyatiga ega.

Boshlang'ich bazisni shakllantirish moduli dasturni ixtiyoriy chiziqli dasturlash masalasi uchun universal qiladi. Foydalanuvchi bilan muloqot yuqorida aytib o'tilgan funksiyalardan iborat menyu yordamida amalga oshiraladi.

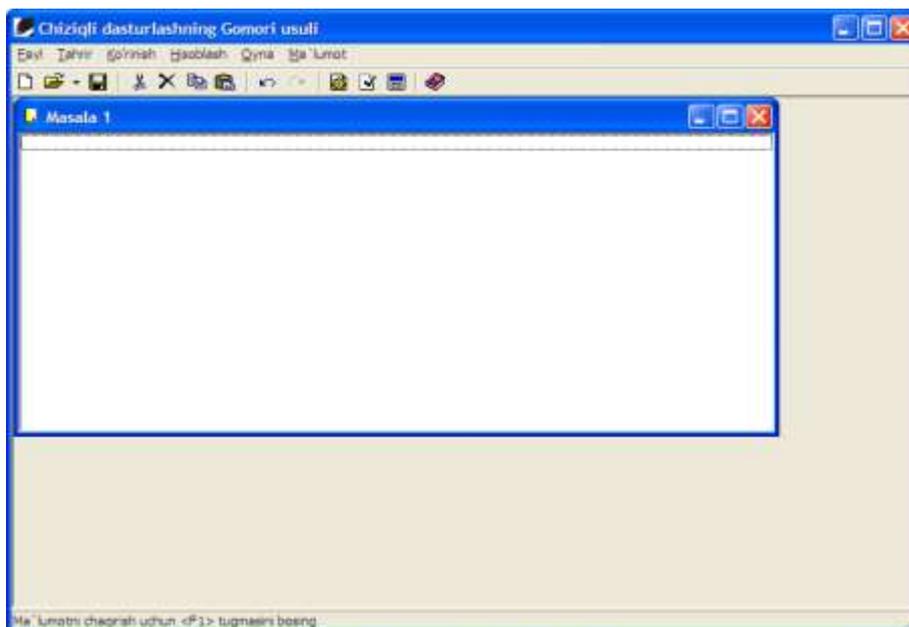


3.1. rasm – Dasturning muloqot oynasi

Bajaruvchi fayl ShD.exe deb nomlanadi. Dasturga butun bo'lmagan va butun sonli modullar o'rnatilgan bo'lib, «Simpleks-usul» va «Gomori usuli» deb nomlangan.

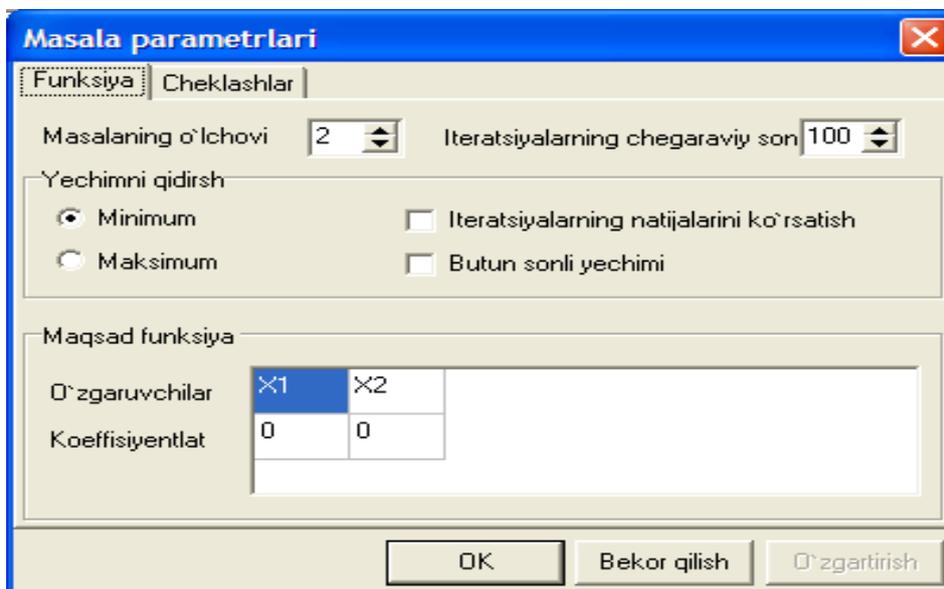
3.2. Dasturiy ta'minotdan foydalanish tartibi

Dasturning kirish parametrlari bo'lib, maksimum yoki minimum qiymati topilishi talab etiladigan maqsad funksiyasi va chiziqli cheklashlar sistemasi hisoblanadi. Koeffisientlarni kiritish uchun masala redaktoridan foydalanamiz.



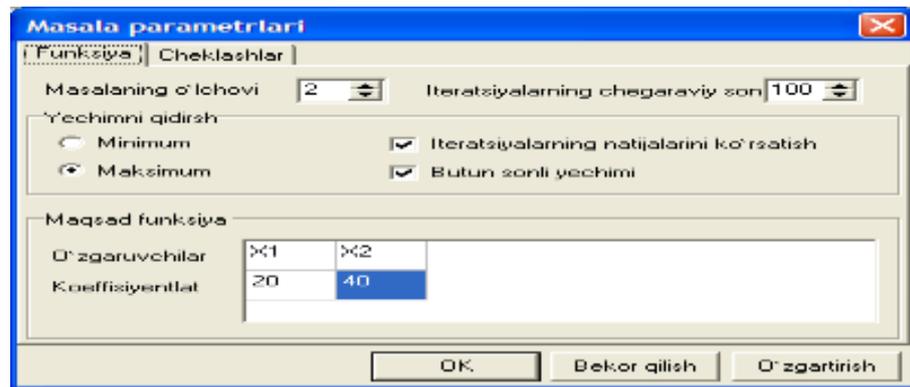
3.2.1. rasm – masala redaktori oynasi

Koeffitsiyentlarni kiritish uchun funksiya va cheklashlarni kiritish, o'zgartirish va o'chirish imkoniyatini beruvchi masala tahrirlagichidan foydalanamiz.



3.2.2. rasm – masala parametrlari oynasi

Masala parametrlari oynasi ikkita menyudan iborat: maqsad funksiyasini o'zgartirish uchun xizmat qiluvchi «Funksiya» menyusidan



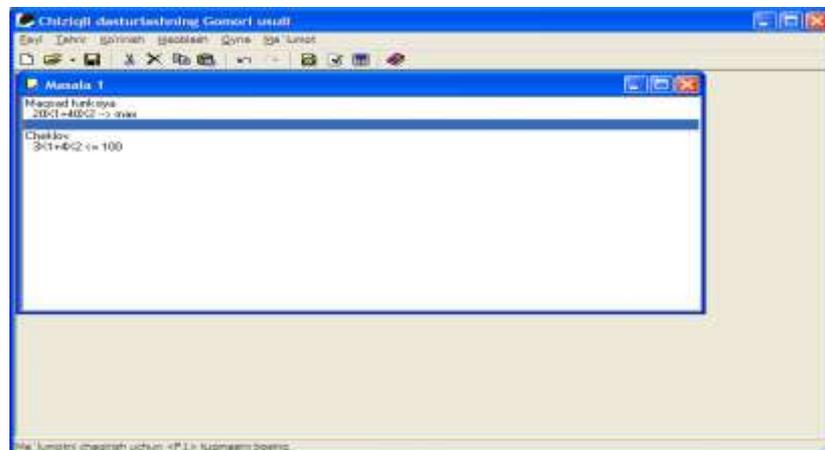
3.2.3. rasm – maqsad funksiyasini kiritish oynasi

va chiziqli cheklashlarni tahrirlovchi «Cheklashlar» menyusidan iborat.

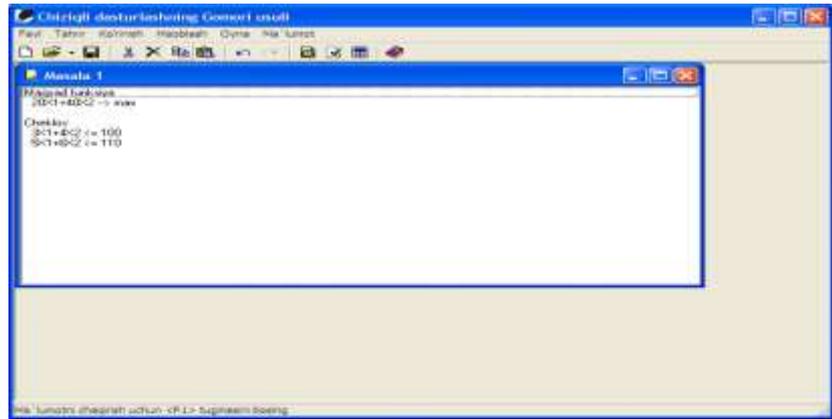


3.2.4. rasm – cheklashlar koeffitsiyentlarini kiritish oynasi

Qulaylik uchun dasturda kirish ma'lumotlarni kodlashtirish talab etilmaydi. Kirish ma'lumotlarini qayta ishlash va tasvirlash avtomatik ravishda amalga oshiriladi.

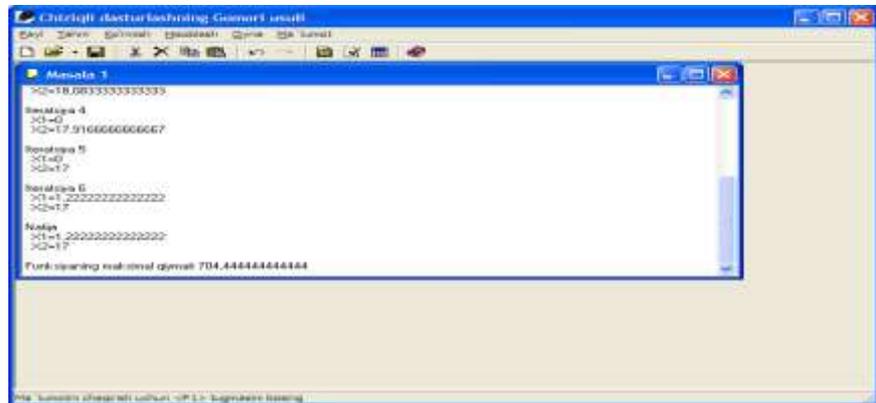


3.2.5 rasm – kirish parametrlari oynasi



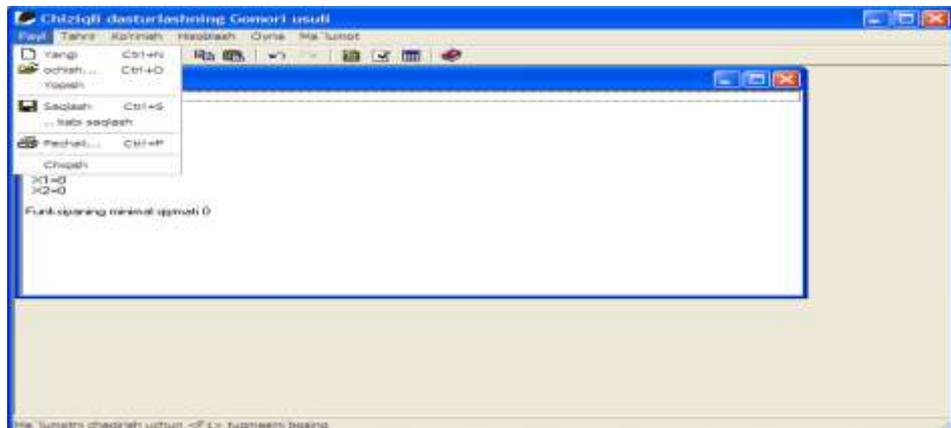
3.2.6 rasm – Dasturning muloqot oynasi

Chiqish ma'lumotlari optimal bazis va maqsad funksiyasining qiymatlari bo'ladi. Bu ma'lumotlarni ekranga va printerga chiqarish mumkin.



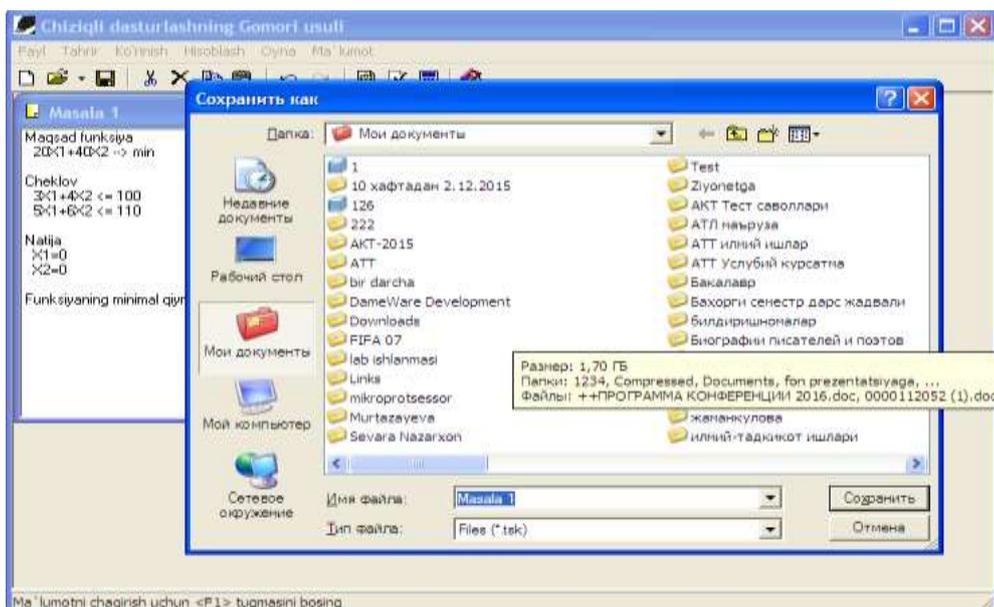
3.2.7 rasm – natijalar ko'rsatish

Kirish va chiqish ma'lumotlarni diskda saqlash imkoniyati mavjud. Bu operatsiyalar bosh menyuda joylashgan «Ochish...», «Saqlash» i «... kabi saqlash» buyruqlar yordamida amalga oshiriladi.



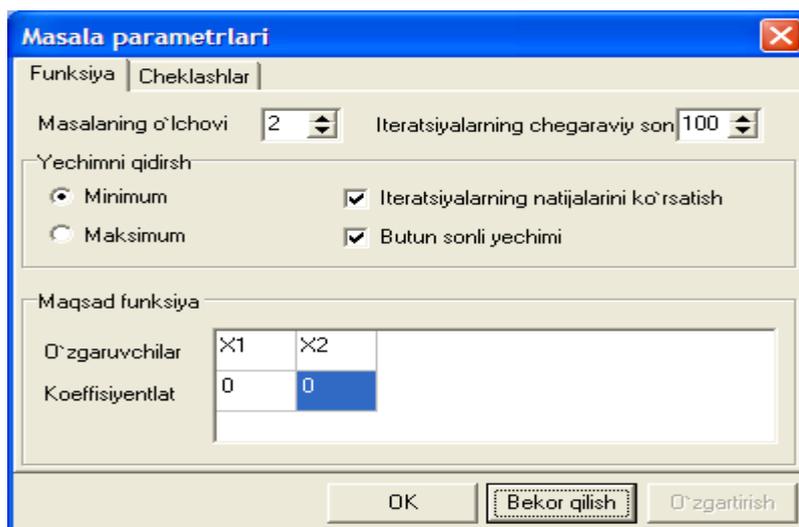
3.2.8 rasm – menyular oynasi

Ma'lumotlarni saqlash va yuklash muloqot oynasi standart ko'rinishga ega bo'lib, fayllar bilan operatsiyalar bajarish imkoniyatini beradi.



3.2.9 rasm – ma'lumotlarini saqlash

Dastur ishlash davomida turli xabarlarini berishi mumkin. Masalan, chiziqli dasturlash masalasini yechishda maqsad funksiyasi chegaralanmagan, cheklashlar umumiy yechim sohasiga ega emas yoki boshlang'ich bazisni qurib bo'lmayligi mumkin. Dasturni ishlash algoritmini natijasi ushbu xabarlardan iborat bo'ladi. Dasturda iteratsiyalar sonini chegaralash mumkin. Kiritilmaganda bu son 100 ga teng deb olinadi.



3.2.10. rasm – dastur chegaraviy iteratsiyalar soniga teng.

3.3. Kompyuter bilan ishlashda sodir bo'ladigan xavfli omillar to'g'risida ma'lumot

Ionlovchi nurlar va ularning turlari. Kompyuter bilan ishlashda sanoat korxonalarida ilmiy tadqiqot ishlarida, texnologik jarayonlarda, mahsulotlar, moddalar sifati va kamchiliklarini aniqlashda radiaktiv moddalar va ular bilan jihozlangan o'lchov asboblaridan foydalaniladi. Shu sababli ulardan foydalanishda, insonlar uchun sog'lom muhit yaratishda, radiasiya xavfsizligi qoidalariga qat'iy amal qilish talab etiladi.

Oxirgi yillarda radiasiya xavfsizligi normalari (NRB-76) va ionlovchi nurlar manbalari bilan xavfsiz ishlash koidalari (OSP-72) ishlab chiqildi va shu asosda ishlar tashkil etilmoqda. Bular asosida ikki yo'nalishda xavfsizlik qoidalari ta'minlanmoqda.

1. Loyiha, texnik, tibbiy, sanitariya va gigiyena chora tadbirlarini qullash orqali ishlovchi xodimlar va aholini nurlanish darajasini yo'l qo'yiladigan darajagacha kamaytirish.

2. Aholi va xududlarni radioaktiv ifloslanishi, nurlanishi haqida ma'lumotlar berish, samarali nazorat tizimini yaratish.

Muhit bilan ta'sirlanib, turli sonlarda elektr razryadlarini hosil qiladigan nurlar ionlovchi nurlar deb ataladi.

Bu turdagi nurlarga: $\alpha\beta$ - zarrachalar, h - neytronlar, (P) - protonlar va boshqalar misol bo'ladi.

α - **nurlanishi** - geliy atomi yadrosi oqimidan iborat bo'lib, kamroq o'tish va yuqori darajada ionlash qobiliyatiga ega.

β - **nurlanishi** - elektronlar va pozitronlar oqimidan iborat bo'lib - α - zarrachaga nisbatan ko'prok o'tish va kamroq ionlash qobiliyatiga ega.

Foton nurlanish - 300000 km/s doimiy tezlikda tarqaladigan elektromagnit tebranish oqimidan iborat bo'ladi. Foton nurlanishga γ -nuri, rentgen nuri misol bo'ladi.

γ - **nurlanish** - gamma kvantlar oqimi hisoblanib, tulqinligi ($10^9 - 10^{12}$ sm bo'lgan elektromagnit nurlardan iborat bo'ladi [11].

Rentgen nurlanish quvvati 1 keV - 1 MeV bo'lgan nurlar yig'indisidan iborat bo'lib, qisqa to'lqinda ($10^{10} - 10^{13}$ sm) va chastotada ($10^{18} - 10^{22}$ Gs) mavjuddir.

Ionlovchi nurlarning odam organizmiga ta'siridan ham murakkab fizik va biologik jarayonlar sodir bo'ladi. Natijada ichki organlarning normal ishlash faoliyati buziladi, qattiq va saqlanuvchi turdagi «nur» kasalligi paydo bo'ladi. Bu holatda bosh og'riydi, uyqu rejimi buziladi, ishtaha kamayadi, modda almashinuvi, oshqozon va yurak faoliyati) o'zgaradi. Yurak muskulida qon quyilishi va jinsiy organlarni ishdan chiqishi sodir bo'ladi. Ko'p hollarda terini qurib qolishi, mo'rtlashishi, sochning to'kilishi, ko'r bo'lib qolish hollari uchraydi. Shu sababli, barcha ishlar «Nurlanish xavfsizligi maxsus xizmati» nazorati asosida amalga oshiriladi[21].

Elektromagnit nurlanishlar turli chastotalarda, aloqa tarmog'ida, xususan, kompyuterda sodir bo'ladi. Radio texnika qurilmalarida antenaga generatorlar, antena qurilmalari, yuqori chastotali transformatorlar, fider yo'nalishlar, materiallarni termik ishlov berish uchun qurilmalarda - elektromagnitlar, kondensatorlar elektromagnit nurlanish manbai sanaladi.

Ko'rsatilgan qurilmalar ishida ularni o'rab turgan hajmda ya'ni joyda elektromagnit maydonlar bunyod bo'ladi. Elektromagnit maydonlar foydali harakati bilan bir qatorda inson tanasiga kirib, unga noqulay, salbiy ta'sir ko'rsatishi va kasbiy kasalliklarga sabab bo'lishi mumkin. Ular asab, endokrinologik va yurak-qon tomirlari tizimi kasallanishini chaqirishi mumkin, insonda qon bosimi pasayadi, pulsi sekinlashadi, reflekslar tormozlanadi, qon tarkibi o'zgaradi. Elektromagnit maydonlar organizmga issiqlik ta'sirida o'z aksini berishi mumkin. Inson tanasiga yutilgan elektromagnit maydonlar quvvati tanani va ayrim organlarni qizishini yuzaga keltirib, issiqlikka aylanib, kasalliklarga olib kelishi mumkin. Ayniqsa, miya, ko'z, ichak, buyrak va urug'donlar elektromagnit maydonlar ta'siriga yo'naladi. Elektromagnit

maydonlarining ta'siri subyektiv bunyod bo'lishi juda toliqish, bosh og'riq, jizzakilikda, seruyqulik, nafas siqishi, ko'rish qobiliyatining yomonlashuvi, tana haroratining ko'tarilishida o'z ifodasini topadi.

Elektromagnit maydonlar ta'sirida zararlanish darajasi nurlanish sur'ati, harakat chastotasi davriga bog'liq. Elektromagnit maydonlar sur'ati, harakat chastotasi va davri qanchalik ko'p bo'lsa, inson organizmiga ta'siri shunchalik kuchli bo'ladi [11].

Elektromagnit maydonlarning insonga zararli ta'sirlarini ogohlantirish maqsadida ish joylarida elektromagnit maydonlar energiya oqimi mustaxkamliligini ta'minlovchi moslamalardan foydalaniladi.

Elektromagnit maydonlarni ta'siridan himoyalashning asosiy usullari va vositalariga quyidagilar kiradi:

1. Kompyuyer xonasini himoyalashning tashkiliy choralari.
2. Manbadan nurlanishning jadalligini kamaytirish, yangi ekranlardan foydalanish.
3. Nurlanish manbaining ekranlashuvi.
4. Nurlanish manбайдan ishchi o'rinlarini ekranlashtirish va yoki ajratish.
5. Xabar berish vositalarini qo'llash.
6. Individual himoya vositalaridan foylalanish.

Ishning muayyan sharoitlariga bog'lik tarzda shu vositalardan biri yoki ularning ixtiyoriy kombinasiyasidan foydalanish mumkin.

Tashkiliy choralar: uskunalarning rasional joylashuvi, qurilmalar va xizmat kursatilayotgan xodim ishi muayyan rejimini belgilashdir.

Yuqori va o'ta yuqori chastotali qurilmalar ishiga tibbiy kurikdan o'tgan 18 yoshdan kichik bo'lmagan, texnika xavfsizligi bo'yicha o'qib, imtixon topshirgan shaxslarga ruxsat etiladi. Har yili xizmat ko'rsatayotgan xodim tibbiy ko'rikdan o'tkaziladi. Agar ish yuqori xavfli sharoitlarda, nurlanishda, ketayotgan bo'lsa, xodimlar uchun qisqartirilgan ish kuni va qo'shimcha ta'til belgilanadi[18].

Nurlanish dozasi deb - ionlash va malekulyar muhitni uyg'otishga sarf bo'ladigan massa birligidagi nurlanuvchi modda yutadigan energiya miqdoriga aytiladi.

Nurlanish miqdorlari turli ifodalanadi. Masalan, yutiladigan (jalb qilingan) doza birligini grey (Gy) dj/kg, rad, erg/g larda ifodalash qabul qilingan. 1 Gy - 1,0 Dj/kg, 1rad=100 erg/g=1.10 Dj / kg. ga teng. Ekspozision miqdor uchun birlik sifatida kulon kilogramm (Kl/kg) rentgen qabul qilingan.

Rentgen zaryad (r) yig'indisi bir elektro statik birlikka teng elektr tashkil qiladigan (1sm. kub havoda normal sharoitda) 0,001292 g.havodagi ionlar hosil qiluvchi rentgen yoki nurni ifodalaydi.

Nurlanish kasalligidan saqlanish, ishlayotgan xodimlarni xavfsiz mehnat sharoiti bilan ta'minlash va ularni xavfli vaziyatlardan ogohlantirish maqsadida yo'l qo'yiladigan doza miqdori (YQDM) va yo'l qo'yiladigan izotopning aktivligi (YQIA), radiasiya xavfsizligi normalariga (RXN-76) asosan belgilanadi.

Vaqt birligida nurlanish miqdori energiyasi R/soat, MkR/soat, mber/yil (biologik rentgenning ekvivalent) birligida o'lchanadi [11].

Nurlanish xavfsizligi normalariga asosan (NXN-76) shaxslar kasbiga mos ravishda quyidagi guruhlarga bo'linadi.

A-guruh-ionlavchi nurlar manbalari bilan doimiy muloqatda ishlaydigan kasb egalari.

B-guruh-radiaktiv nurlar manbalari bilan ishlamaydigan, lekin ish joyi va yashash sharoiti bo'yicha radiaktiv moddalar yoki boshqa manbalar ta'sirida bo'ladigan shaxslar.

V-guruh- barcha yashaydigan aholiga mansub.

Tana a'zolarini ham nurlar ta'siri bo'yicha quyidagicha guruhlash mumkin.

Birinchi guruh - badan, suyak, qizil tanacha va boshqalar.

Ikkinchi guruh - qalqonsimon bez, yog'li tuqima, jigar, buyrak, taloq, oshqozon, ichak yo'llari. upka, ko'z qorachig'i va boshqalar.

Uchinchi guruh - teri qoplamasi, suyak tuqimachasi, ko'l barmoqlari, bilak, kaft, tovon kiradi. Bu nurlar bilan ishlovchi kasb egalari uchun tashqi nurlanish doza yig'indisi (biologik ekvivalent radiasiya) bir yilga 5 ber va 30 yilda yig'iladigan miqdori esa 60 berdan oshmasligi kerak.

Izotoplarni yo'l qo'yiladigan aktivligi bo'yicha (kyuri/letr) radiaktiv moddalar 4 guruhga bo'linadi.

Birinchi guruhga – o'ta yuqori radiaktiv izotoplar. Masalan: S, S₂, R₃ va boshqalar. Bu moddalar uchun IYKA = 1.10¹³ kyuri/letrni tashkil etadi.

Ikkinchi guruhga - yuqori radiaktiv izotoplar (Na, Co, S, Ag , va boshqalar) IYKA=1,10¹³ - 1,10¹⁶ kyuri/letr belgilangan.

Uchinchi guruhga- o'rtacha radiaktiv izotoplar (Va, Na, S, Mn, Zn, R va boshqalar) IYKA=1,10¹⁶ - 1.10¹⁹ kyuri/letr belgilangan.

Turtinchi guruhga - aktivligi 1.10¹⁹ kyuri/letr bo'lgan vodorod N, karbon SO, azot, argon, indiy va boshqalar kiradi[19].

Radiaktiv moddalar bilan ishlashga mo'ljallangan korxonalar va tashkilotlar, muassasa va ayniqsa turli laboratoriyalar va kompyuterlardan foydalanishdan oldin maxsus komissiya tomonidan qabul qilinishi talab qilinadi va 3 yil muddatga belgilangan pasportni taqdim etadi. Albatta, konteynerlar, vositalar, asboblari, binolarga radiasiya xavfsizligiga oid tegishli belgilar o'rnatiladi.

Korxonalar ham bir yilda ishlatiladigan radiaktiv moddalar miqdoriga qarab 3 toifaga bo'linadi:

1-toifa 100 kyu dan ko'p radiaktivlik mavjud.

2-toifaga -10-100 kyu oralig'idagi korxonalar.

3-toifa esa 10 kyu gacha bo'lgan korxonalar.

Korxonalar rahbariyati tomonidan ishning tartibi, shaxsiy profilaktika ishlari, ko'rsatmalar tayyorlash, dozimetrik nazorat, ishlarni to'g'ri tashkil etish vazifasi yuklatiladi.

Himoyalash chora-tadbirlarini ishlab chiqishda, ishlab chiqarishda qo'llaniladigan manbaning xususiyati, moddaning turi, fizik holati, nurlanish turi

va energiyasi, aktivligi, parchalanish davri, zaharli xossalari, manba bilan ishlash vaqti e'tiborga olinishi zarur.

Tashqi nurlanish - oqimidan himoyalash, nurlanish vaqtini kamaytirish, manbagacha bo'lgan masofani kamaytirish yoki ko'paytirish, himoya ekranlaridan foydalanish orqali amalga oshiriladi.

Ichki nurlanishdan himoyalashda ochiq holdagi radiaktiv moddalar bilan aloqani bo'lmasligi, havoni radiaktiv moddalar ifloslanmasligi, ish zonasidagi havoda radiaktiv moddalarning bo'lmasligi choralari ko'riladi. 18 yoshga to'lmaganlarga bunday joylarda ishlashga ruxsat berilmaydi. Moddalar maxsus idishlarda tashiladi va shkaf-bokslarda saqlanadi. Himoya vositalari sifati rezina qo'lqop, xalatlar, oyok kiyim, oynaklar, gazniqoblar, raspiratorlardan foydalaniladi.

Radiaktiv chiqindilar maxsus joylarga ko'miladi va doimiy nazoratda bo'ladi.

Nurlanishni o'lchash- (rengen va gamma) nurlar (PM-IM), Argun dozimetrlari (RGTS-1, ID-1) tipidagi asboblar bilan o'lchanadi.

Bugungi kunda – zamonaviy axborot vositalari orqali himoyalashni yangi usul va vositalari tavsiya etilmoqda [22].

XULOSA

Bitiruv ishida butun sonli parametrik dastulash masalasini yechish algoritmlari va ularga mos dasturiy ta'minot bo'yicha quyidagilar bajarildi:

- Butun sonli dasturlash masalalariga doir nazariy ma'lumotlar o'rganilgan.
- Amaliyotda ko'p qo'llaniladigan algoritmlar: simpleks va Gomori usullari haqida zarur ma'lumotlar berilgan va ularning qanday masalalarda ishlatish maqsadga muvofiqli ko'rib chiqilgan.
- butun sonli parametrik dastulash masalalariga Gomori usulini qo'llanish natijalari amaliy iqtisodiy masala uchun qarab chiqilgan va yechimning mumkin bo'lgan variantlari tahlil etilgan.
- O'rganilgan algoritmlar asosida optimal qaror qabul qilish maqsadida hisoblash algoritmlari hamda shu algoritmlarning kompyuterda realizatsiyasi uchun dasturiy ta'minot ishlab chiqilgan.

Ishda olingan natijalardan butun sonli dasturlash masalariga keluvchi masalalarda optimal qaror qabul qilish uchun hisoblash texnikasidan foydalanish maqsadida qo'llash mumkin.

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Ilova. Dasturning kodi

unit Main;

interface

uses

Windows, Messages, SysUtils, Classes, Graphics, Controls, Forms, Dialogs,
Menus, ImgList, Child, StdCtrls, ComCtrls, Buttons, ExtCtrls, ToolWin;

type

```
TMainForm = class(TForm)
  ImageList1: TImageList;
  SaveDialog1: TSaveDialog;
  StatusBar1: TStatusBar;
  OpenFileDialog1: TOpenDialog;
  PrintDialog1: TPrintDialog;
  ToolBar1: TToolBar;
  ToolButton1: TToolButton;
  ToolButton2: TToolButton;
  ToolButton3: TToolButton;
  ToolButton4: TToolButton;
  ToolButton6: TToolButton;
  ToolButton7: TToolButton;
  ToolButton8: TToolButton;
  ToolButton5: TToolButton;
  ToolButton9: TToolButton;
  ToolButton10: TToolButton;
  ToolButton11: TToolButton;
  ToolButton12: TToolButton;
  ToolButton13: TToolButton;
  ToolButton14: TToolButton;
  ToolButton15: TToolButton;
  ToolButton16: TToolButton;
  ToolButton17: TToolButton;
  MainMenu1: TMainMenu;
  FileMenu: TMenuItem;
  New: TMenuItem;
  Open: TMenuItem;
  CloseChild: TMenuItem;
  N9: TMenuItem;
  Save: TMenuItem;
  SaveAs: TMenuItem;
  N10: TMenuItem;
  Print: TMenuItem;
  N11: TMenuItem;
  N1Name1: TMenuItem;
  N2Name1: TMenuItem;
  N3Name1: TMenuItem;
  N4Name1: TMenuItem;
  N12: TMenuItem;
  ExitP: TMenuItem;
  Edit: TMenuItem;
  N20: TMenuItem;
  N21: TMenuItem;
  N19: TMenuItem;
  N22: TMenuItem;
```

```

N24: TMenuItem;
N25: TMenuItem;
N23: TMenuItem;
ChangeFun: TMenuItem;
AddLim: TMenuItem;
DelLim: TMenuItem;
N8: TMenuItem;
N26: TMenuItem;
N27: TMenuItem;
N28: TMenuItem;
N5: TMenuItem;
N6: TMenuItem;
N7: TMenuItem;
N29: TMenuItem;
N30: TMenuItem;
N13: TMenuItem;
N14: TMenuItem;
N15: TMenuItem;
N16: TMenuItem;
N17: TMenuItem;
N18: TMenuItem;
N1: TMenuItem;
N4: TMenuItem;
N3: TMenuItem;
N2: TMenuItem;
procedure ExitPClick(Sender: TObject);
procedure NewClick(Sender: TObject);
procedure FileMenuClick(Sender: TObject);
procedure CloseChildClick(Sender: TObject);
procedure EditClick(Sender: TObject);
procedure ChangeFunClick(Sender: TObject);
procedure AddLimClick(Sender: TObject);
procedure N2Click(Sender: TObject);
procedure N14Click(Sender: TObject);
procedure N15Click(Sender: TObject);
procedure N16Click(Sender: TObject);
procedure N18Click(Sender: TObject);
procedure N5Click(Sender: TObject);
procedure N13Click(Sender: TObject);
procedure N4Click(Sender: TObject);
procedure N6Click(Sender: TObject);
procedure SaveAsClick(Sender: TObject);
procedure PrintClick(Sender: TObject);
procedure OpenClick(Sender: TObject);
procedure N27Click(Sender: TObject);
procedure N28Click(Sender: TObject);
procedure N7Click(Sender: TObject);
procedure SaveClick(Sender: TObject);
procedure DelLimClick(Sender: TObject);
procedure N8Click(Sender: TObject);
procedure N1Name1Click(Sender: TObject);
private
  { Private declarations }
  procedure CreateChild(const Name: String);
public
  { Public declarations }

```

```

end;

var
  MainForm: TMainForm;
  ItemDel: integer;
implementation

uses Parameters, About;

{$R *.DFM}

procedure TMainForm.CreateChild(const Name: String);
var
  Child: TChildForm;
begin
  Child:=TChildForm.Create(Application);
  child.Caption:=Name;
end;

procedure TMainForm.ExitPClick(Sender: TObject);
begin
  Close;
end;

procedure TMainForm.NewClick(Sender: TObject);
begin
  CreateChild('Masala '+IntToStr(MDICHildCount+1));
end;

procedure TMainForm.FileMenuClick(Sender: TObject);
begin
  if ActiveMDICHild<>nil then
    begin
      MainForm.CloseChild.Enabled:=true;
      MainForm.Save.Enabled:=true;
      MainForm.SaveAs.Enabled:=true;
      MainForm.Print.Enabled:=true
    end
  else
    begin
      MainForm.CloseChild.Enabled:=false;
      MainForm.Save.Enabled:=false;
      MainForm.SaveAs.Enabled:=false;
      MainForm.Print.Enabled:=false
    end
  end;

procedure TMainForm.CloseChildClick(Sender: TObject);
begin
  if ActiveMDICHild<>nil then ActiveMDICHild.Close;
end;

procedure TMainForm.EditClick(Sender: TObject);
begin
  if ActiveMDICHild<>nil then

```

```

begin
MainForm.ChangeFun.Enabled:=true;
MainForm.AddLim.Enabled:=true;
MainForm.DelLim.Enabled:=true;
MainForm.N8.Enabled:=true;
MainForm.N20.Enabled:=true;
MainForm.N22.Enabled:=true;
MainForm.N24.Enabled:=true;
MainForm.N25.Enabled:=true;
end
else
begin
MainForm.ChangeFun.Enabled:=false;
MainForm.AddLim.Enabled:=false;
MainForm.DelLim.Enabled:=false;
MainForm.N8.Enabled:=false;
MainForm.N20.Enabled:=false;
MainForm.N22.Enabled:=false;
MainForm.N24.Enabled:=false;
MainForm.N25.Enabled:=false;
end
end;

procedure TMainForm.ChangeFunClick(Sender: TObject);
begin
ParametersForm.PageControl1.ActivePageIndex:=0;
ParametersForm.ShowModal;
end;

procedure TMainForm.AddLimClick(Sender: TObject);
begin
ParametersForm.PageControl1.ActivePageIndex:=1;
ParametersForm.ShowModal;
end;

procedure TMainForm.N2Click(Sender: TObject);
begin
MainForm.Enabled:=False;
AboutForm.Visible:=true;
end;

procedure TMainForm.N14Click(Sender: TObject);
begin
Cascade
end;

procedure TMainForm.N15Click(Sender: TObject);
begin
Tile
end;

procedure TMainForm.N16Click(Sender: TObject);
begin
ArrangeIcons
end;

```

```

procedure TMainForm.N18Click(Sender: TObject);
var i: integer;
begin
for i:=mdichildcount-1 downto 0 do
mdichildren[i].WindowState:=wsminimized;
end;

procedure TMainForm.N5Click(Sender: TObject);
begin
if ActiveMDIChild<>nil then
begin
MainForm.N6.Enabled:=true;
MainForm.N7.Enabled:=true;
MainForm.N30.Enabled:=true
end
else
begin
MainForm.N6.Enabled:=false;
MainForm.N7.Enabled:=false;
MainForm.N30.Enabled:=false;
end
end;

procedure TMainForm.N13Click(Sender: TObject);
begin
if ActiveMDIChild<>nil then
begin
MainForm.N14.Enabled:=true;
MainForm.N15.Enabled:=true;
MainForm.N16.Enabled:=true;
MainForm.N18.Enabled:=true;
end
else
begin
MainForm.N14.Enabled:=false;
MainForm.N15.Enabled:=false;
MainForm.N16.Enabled:=false;
MainForm.N18.Enabled:=false;
end;
end;
procedure TMainForm.N4Click(Sender: TObject);
begin
//Application.HelpCommand(3, 0);
end;

procedure TMainForm.N6Click(Sender: TObject);
var
SimplexTable,SimplexTableNew:array of array of extended;
GoalFun:array of extended;
ArtFun:array of extended;
ExtrEstimation:extended;
k,i,j,MoreCount,LessCount,EquallyCount,extrItem,WLine,IterCount: integer;
Art,bil:boolean;
label fin,up;
begin
Art:=true;bil:=false;IterCount:=0;

```

```

SimplexTable:=nil;
MoreCount:=0;LessCount:=0;EquallyCount:=0;
with MainForm.ActiveMDIChild as TChildForm do
begin
for i:=1 to SignsChild.RowCount-1 do
begin
if (SignsChild.Cells[0,i]='>') or (SignsChild.Cells[0,i]='>=') then
begin
inc(MoreCount);
SetLength(SimplexTable,LimChild.ColCount+2,MoreCount);
for j:=0 to LimChild.ColCount-1 do
SimplexTable[j+2,MoreCount-1]:=StrToFloat(LimChild.cells[j,i]);
SimplexTable[0,MoreCount-1]:=0;
SimplexTable[1,MoreCount-1]:=StrToFloat(BChild.cells[0,i]);
end;
end;

for i:=1 to SignsChild.RowCount-1 do
begin
if SignsChild.Cells[0,i]='=' then
begin
inc(EquallyCount);
SetLength(SimplexTable,LimChild.ColCount+2,MoreCount+EquallyCount);
for j:=0 to LimChild.ColCount-1 do
SimplexTable[j+2,MoreCount+EquallyCount-1]:=StrToFloat(LimChild.cells[j,i]);
SimplexTable[0,MoreCount+EquallyCount-1]:=0;
SimplexTable[1,MoreCount+EquallyCount-1]:=StrToFloat(BChild.cells[0,i]);
end;
end;

for i:=1 to SignsChild.RowCount-1 do
begin
if (SignsChild.Cells[0,i]='<') or (SignsChild.Cells[0,i]='<=') then
begin
inc(LessCount);
SetLength(SimplexTable,LimChild.ColCount+2,MoreCount+EquallyCount+LessCount);
for j:=0 to LimChild.ColCount-1 do
SimplexTable[j+2,MoreCount+EquallyCount+LessCount-1]:=StrToFloat(LimChild.cells[j,i]);
SimplexTable[0,MoreCount+EquallyCount+LessCount-1]:=0;
SimplexTable[1,MoreCount+EquallyCount+LessCount-1]:=StrToFloat(BChild.cells[0,i]);
end;
end;
end;

for j:=0 to MoreCount-1 do
begin
Setlength(SimplexTable,length(SimplexTable)+1,MoreCount+EquallyCount+LessCount);
for i:=length(SimplexTable)-MoreCount+1 to length(SimplexTable)-1 do
SimplexTable[i,j]:=0;
SimplexTable[length(SimplexTable)-1,j]:=-1;
end;

for j:=MoreCount+EquallyCount to MoreCount+EquallyCount+LessCount-1 do
begin
Setlength(SimplexTable,length(SimplexTable)+1,MoreCount+EquallyCount+LessCount);
for i:=length(SimplexTable)-LessCount+2 to length(SimplexTable)-1 do
SimplexTable[i,j]:=0;

```

```

SimplexTable[length(SimplexTable)-1,j]:=1;
end;

for j:=0 to MoreCount+EquallyCount-1 do
begin
  Setlength(SimplexTable,length(SimplexTable)+1,MoreCount+EquallyCount+LessCount);
  for i:=length(SimplexTable)-MoreCount+1 to length(SimplexTable)-1 do
    SimplexTable[i,j]:=0;
    SimplexTable[length(SimplexTable)-1,j]:=1;
  end;
end;

GoalFun:=nil;
with MainForm.ActiveMDIChild as TChildForm do
begin
  SetLength(GoalFun,GoalChild.ColCount+1);
  for i:=1 to GoalChild.ColCount do
    begin
      if parametersForm.Min.Checked then GoalFun[i]:=StrToFloat(goalChild.Cells[i-1,1])
      else GoalFun[i]:=-1*StrToFloat(goalChild.Cells[i-1,1]);
    end;
  end;
ArtFun:=nil;
SetLength(ArtFun,length(SimplexTable)-1-MoreCount);
//i=1 - for i:=1 to length(SimplexTable)-3 do
for j:=0 to MoreCount-1 do ArtFun[i-1]:=ArtFun[i-1]-SimplexTable[i,j];

if MoreCount>0 then
begin
  for j:=0 to MoreCount-1 do
    SimplexTable[0,j]:=length(simplexTable)-MoreCount+j-1;
    for i:=MoreCount to length(simplexTable[0])-1 do
      SimplexTable[0,i]:=length(simplexTable)-(LessCount+EquallyCount+MoreCount)+(i-MoreCount)-1;
    end
  end
else
for i:=0 to LessCount+EquallyCount-1 do
  SimplexTable[0,i]:=length(simplexTable)-(LessCount+EquallyCount+MoreCount)+i-1;

SetLength(SimplexTable,length(SimplexTable),length(SimplexTable[0])+2);
for i:=0 to length(GoalFun)-1 do SimplexTable[i+1,length(SimplexTable[0])-2]:=goalFun[i];
for i:=0 to length(ArtFun)-1 do SimplexTable[i+1,length(SimplexTable[0])-1]:=ArtFun[i];

SimplexTableNew:=nil;
SetLength(SimplexTableNew,length(SimplexTable),length(SimplexTable[0]));
repeat
if not art then inc(IterCount);
if IterCount=Parametersform.CountIteration.Value then
begin
  with MainForm.ActiveMDIChild as TChildForm do
  begin
    task.Items.Add("");
    task.Items.Add('Iteretsiyalarning chegaraviy soniga erishildi. Yechim topilmadi');
    exit;
  end;
end;
end;
{
k:=0;

```

```

if art then
for i:=2 to length(simplexTable)-1 do
begin
if simplexTable[i,length(SimplexTable[0])-1]<0 then
begin
// k:=0;
for j:=0 to length(SimplexTable[0])-3 do
if simplexTable[i,j]<=0 then inc(k);
if k=length(SimplexTable[0])-2 then
begin
with MainForm.ActiveMDIChild as TChildForm do
begin
task.Items.Add("");
task.Items.Add();
exit;
end;
k:=0;
end;
end;
end;
end;
k:=0;
if not art then
for i:=2 to length(simplexTable)-1 do
begin
if simplexTable[i,length(SimplexTable[0])-1]<0 then
begin
k:=0;
for j:=0 to length(SimplexTable[0])-2 do
if simplexTable[i,j]<=0 then inc(k);
if k=length(SimplexTable[0])-1 then
begin
with MainForm.ActiveMDIChild as TChildForm do
begin
task.Items.Add("");
task.Items.Add();
exit;
end;
end;
end;
end;
end;
end;
}

ExtrEstimation:=100000;
extrItem:=0;
for i:=2 to length(simplexTable)-1 do
if (SimplexTable[i,length(SimplexTable[0])-1]<ExtrEstimation) and
(SimplexTable[i,length(SimplexTable[0])-1]<0) then
begin
extrItem:=i-1; {новый базис}
ExtrEstimation:=SimplexTable[i,length(SimplexTable[0])-1];
end;
if ExtrEstimation=100000 then goto fin;

ExtrEstimation:=100000;
WLine:=0;
for j:=0 to length(simplexTable[0])-2 do

```

```

begin
if SimplexTable[extrItem+1,j]<>0 then
if (SimplexTable[1,j]/SimplexTable[extrItem+1,j]<ExtrEstimation) and
(SimplexTable[1,j]*SimplexTable[extrItem+1,j]>0) then
begin
WLine:=j;
ExtrEstimation:=SimplexTable[1,j]/SimplexTable[extrItem+1,j];
end;
end;
for i:=0 to length(SimplexTable[0])-1 do SimplexTableNew[0,i]:=SimplexTable[0,i];
SimplexTableNew[0,WLine]:=extrItem;
//перерасчет рабочей строки
for i:=1 to length(SimplexTable)-1 do
SimplexTableNew[i,WLine]:=SimplexTable[i,wLINE]/SimplexTable[extrItem+1,wLINE];
for i:=1 to length(SimplexTable)-1 do
for j:=0 to length(SimplexTable[0])-1 do
if j<>WLine then
SimplexTableNew[i,j]:=SimplexTable[i,j]-
SimplexTable[i,Wline]*SimplexTable[extrItem+1,j]/SimplexTable[extrItem+1,WLine];
for i:=0 to length(SimplexTable)-1 do for j:=0 to length(SimplexTable[0])-1 do
SimplexTable[i,j]:=SimplexTableNew[i,j];
if ParametersForm.CheckBox1.Checked then begin
bil:=false;
if not art then
with MainForm.ActiveMDIChild as TChildForm do
begin
task.Items.Add("");
task.Items.Add('Iteratsiya '+InttoStr(IterCount));
for i:=0 to GoalChild.ColCount-1 do
begin
for j:=0 to length(SimplexTable[0])-1 do
if i+1=SimplexTable[0,j] then
begin
task.Items.Add(' '+GoalChild.Cells[i,0]+'='+FloatToStr(SimplexTable[1,j]));
bil:=true;
end;
if not bil then task.Items.Add(' '+GoalChild.Cells[i,0]+'=0');
bil:=false;
end;
end;
end;
end;
until false;
fin:
if art then
begin
art:=false;
SetLength(SimplexTable,Length(SimplexTable)-MoreCount,Length(SimplexTable[0])-1);
goto up;
end;
with MainForm.ActiveMDIChild as TChildForm do
begin
task.Items.Add("");
task.Items.Add('Natija');

```

```

for i:=0 to GoalChild.ColCount-1 do
begin
  for j:=0 to length(SimplexTable[0])-1 do
  if i+1=SimplexTable[0,j] then
  begin
    task.Items.Add(' '+GoalChild.Cells[i,0]+'='+FloatToStr(SimplexTable[1,j]));
    bil:=true;
  end;
  if not bil then task.Items.Add(' '+GoalChild.Cells[i,0]+'=0');
  bil:=false;
  end;
  task.Items.Add("");
  if parametersForm.Min.Checked then
  task.Items.Add('Funksiyaning minimal qiymati '+FloatToStr(-
1*(SimplexTable[1,length(SimplexTable[0])-1]))
  else
  task.Items.Add('Funksiyaning maksimal qiymati
'+FloatToStr(SimplexTable[1,length(SimplexTable[0])-1]));
  end;
end;

```

```

procedure TMainForm.SaveAsClick(Sender: TObject);
var
  FExt: String;
begin
  with SaveDialog1 do
  begin
    if ActiveMDIChild.Caption[1]='3' then
      FileName:=ActiveMDIChild.Caption+'.tsk'
    else
      FileName:=ActiveMDIChild.Caption;
      FExt:=ExtractFileExt(FileName);
      if length(FExt)=0 then
        FExt:='.tsk';
      filter:='Files (*'+FExt+')*'+FExt;
      if Execute then
        with ActiveMDIChild as TChildForm do
          SaveData(FileName);
        end;
  end;
end;

```

```

procedure TMainForm.PrintClick(Sender: TObject);
begin
  PrintDialog1.Execute;
end;

```

```

procedure TMainForm.OpenClick(Sender: TObject);
var
  s:string;
  i,k:integer;
begin
  if OpenFileDialog1.Execute then
  begin
    with fileMenu do
    begin
      if not N11.Visible then N11.Visible:=true;

```

```

k:=IndexOf(N1Name1);
for i:=count-3 downto k+1 do
begin
s:=items[i-1].caption;
s[2]:=chr(ord('0')+(i-k+1));
Items[i].Caption:=S;
Items[i].Visible:=Items[i-1].Visible;
end;
n1name1.Caption:='&1 '+OpenDialog1.FileName;
n1name1.Visible:=true;
end;
CreateChild(OpenDialog1.FileName);
with ActiveMDIChild as TChildForm do
LoadData(OpenDialog1.FileName);
ParametersForm.FormShow(Sender);
ParametersForm.Button3Click(Sender);
end;
end;

procedure TMainForm.N27Click(Sender: TObject);
begin
N27.checked:=not N27.checked;
if N27.checked then toolbar1.Visible:=true else toolbar1.Visible:=false;
end;

procedure TMainForm.N28Click(Sender: TObject);
begin
N28.checked:=not N28.checked;
if N28.checked then statusBar1.Visible:=true else statusBar1.Visible:=false;
end;

procedure TMainForm.N7Click(Sender: TObject);
var
SimplexTable,SimplexTableNew:array of array of extended;
GoalFun:array of extended;
ArtFun:array of extended;
ExtrEstimation:extended;
k,i,j,MoreCount,LessCount,EquallyCount,extrItem,WLine,IterCount: integer;
Art,bil:boolean;
label fin,up,up2;
begin
Art:=true;bil:=false;IterCount:=0;
SimplexTable:=nil;
MoreCount:=0;LessCount:=0;EquallyCount:=0;
with MainForm.ActiveMDIChild as TChildForm do
begin
for i:=1 to SignsChild.RowCount-1 do
begin
if (SignsChild.Cells[0,i]='>') or (SignsChild.Cells[0,i]='>=') then
begin
inc(MoreCount);
SetLength(SimplexTable,LimChild.ColCount+2,MoreCount);
for j:=0 to LimChild.ColCount-1 do
SimplexTable[j+2,MoreCount-1]:=StrToFloat(LimChild.cells[j,i]);
SimplexTable[0,MoreCount-1]:=0;

```

```

SimplexTable[1,MoreCount-1]:=StrToFloat(BChild.cells[0,i]);
end;
end;

for i:=1 to SignsChild.RowCount-1 do
begin
if SignsChild.Cells[0,i]='=' then
begin
inc(EqualsCount);
SetLength(SimplexTable,LimChild.ColCount+2,MoreCount+EqualsCount);
for j:=0 to LimChild.ColCount-1 do
SimplexTable[j+2,MoreCount+EqualsCount-1]:=StrToFloat(LimChild.cells[j,i]);
SimplexTable[0,MoreCount+EqualsCount-1]:=0;
SimplexTable[1,MoreCount+EqualsCount-1]:=StrToFloat(BChild.cells[0,i]);
end;
end;

for i:=1 to SignsChild.RowCount-1 do
begin
if (SignsChild.Cells[0,i]='<') or (SignsChild.Cells[0,i]='<=') then
begin
inc(LessCount);
SetLength(SimplexTable,LimChild.ColCount+2,MoreCount+EqualsCount+LessCount);
for j:=0 to LimChild.ColCount-1 do
SimplexTable[j+2,MoreCount+EqualsCount+LessCount-1]:=StrToFloat(LimChild.cells[j,i]);
SimplexTable[0,MoreCount+EqualsCount+LessCount-1]:=0;
SimplexTable[1,MoreCount+EqualsCount+LessCount-1]:=StrToFloat(BChild.cells[0,i]);
end;
end;
end;
end;
{2}//-----

for j:=0 to MoreCount-1 do
begin
Setlength(SimplexTable,length(SimplexTable)+1,MoreCount+EqualsCount+LessCount);
for i:=length(SimplexTable)-MoreCount+1 to length(SimplexTable)-1 do
SimplexTable[i,j]:=0;
SimplexTable[length(SimplexTable)-1,j]:=-1;
end;

for j:=MoreCount+EqualsCount to MoreCount+EqualsCount+LessCount-1 do
begin
Setlength(SimplexTable,length(SimplexTable)+1,MoreCount+EqualsCount+LessCount);
for i:=length(SimplexTable)-LessCount+2 to length(SimplexTable)-1 do
SimplexTable[i,j]:=0;
SimplexTable[length(SimplexTable)-1,j]:=1;
end;

for j:=0 to MoreCount+EqualsCount-1 do
begin
Setlength(SimplexTable,length(SimplexTable)+1,MoreCount+EqualsCount+LessCount);
for i:=length(SimplexTable)-MoreCount+1 to length(SimplexTable)-1 do
SimplexTable[i,j]:=0;
SimplexTable[length(SimplexTable)-1,j]:=1;
end;
end;

```

```

GoalFun:=nil;
with MainForm.ActiveMDIChild as TChildForm do
begin
SetLength(GoalFun,GoalChild.ColCount+1);
for i:=1 to GoalChild.ColCount do
begin
if parametersForm.Min.Checked then GoalFun[i]:=StrToFloat(goalChild.Cells[i-1,1])
else GoalFun[i]:=-1*StrToFloat(goalChild.Cells[i-1,1]);
end;
end;
ArtFun:=nil;
SetLength(ArtFun,length(SimplexTable)-1-MoreCount);
for i:=1 to length(SimplexTable)-3 do
for j:=0 to MoreCount-1 do ArtFun[i-1]:=ArtFun[i-1]-SimplexTable[i,j];

if MoreCount>0 then
begin
for j:=0 to MoreCount-1 do
SimplexTable[0,j]:=length(simplexTable)-MoreCount+j-1;
for i:=MoreCount to length(simplexTable[0])-1 do
SimplexTable[0,i]:=length(simplexTable)-(LessCount+EquallyCount+MoreCount)+(i-MoreCount)-1;
end
else
for i:=0 to LessCount+EquallyCount-1 do
SimplexTable[0,i]:=length(simplexTable)-(LessCount+EquallyCount+MoreCount)+i-1;

SetLength(SimplexTable,length(SimplexTable),length(SimplexTable[0])+2);
for i:=0 to length(GoalFun)-1 do SimplexTable[i+1,length(SimplexTable[0])-2]:=goalFun[i];
for i:=0 to length(ArtFun)-1 do SimplexTable[i+1,length(SimplexTable[0])-1]:=ArtFun[i];

up:
repeat
if not art then inc(IterCount);
if IterCount=Parametersform.CountIteration.Value then
begin
with MainForm.ActiveMDIChild as TChildForm do
begin
task.Items.Add("");
task.Items.Add('Iteretsiyalarning chegaraviy soniga erishildi. Yechim topilmadi');
exit;
end;
end;

k:=0;
if art then
for i:=2 to length(simplexTable)-1 do
begin
if simplexTable[i,length(SimplexTable[0])-1]<0 then
begin
// k:=0;
for j:=0 to length(SimplexTable[0])-3 do
if simplexTable[i,j]<=0 then inc(k);
if k=length(SimplexTable[0])-2 then
begin
with MainForm.ActiveMDIChild as TChildForm do
begin

```

```

    task.Items.Add("");
    task.Items.Add('Boshlang`ich bazisni topish mumkin emas');
    exit;
    end;
    k:=0;
    end;
    end;
end;
k:=0;
if not art then
for i:=2 to length(simplexTable)-1 do
begin
    if simplexTable[i,length(SimplexTable[0])-1]<0 then
    begin
        k:=0;
        for j:=0 to length(SimplexTable[0])-2 do
        if simplexTable[i,j]<=0 then inc(k);
        if k=length(SimplexTable[0])-1 then
        begin
            with MainForm.ActiveMDIChild as TChildForm do
            begin
                task.Items.Add("");
                task.Items.Add('Maqsad funksiyay cheklanmagan');
                exit;
                end;
            end;
        end;
    end;
end;
end;

```

```

ExtrEstimation:=100000;
extrItem:=0;
for i:=2 to length(simplexTable)-1 do
if (SimplexTable[i,length(SimplexTable[0])-1]<ExtrEstimation) and
(SimplexTable[i,length(SimplexTable[0])-1]<0) then
begin
    extrItem:=i-1; {новый базис}
    ExtrEstimation:=SimplexTable[i,length(SimplexTable[0])-1];
    end;
if ExtrEstimation=100000 then goto fin;

```

```

ExtrEstimation:=100000;
WLine:=0;
for j:=0 to length(simplexTable[0])-2 do
begin
    if SimplexTable[extrItem+1,j]<>0 then
    if (SimplexTable[1,j]/SimplexTable[extrItem+1,j]<ExtrEstimation) and
    (SimplexTable[1,j]*SimplexTable[extrItem+1,j]>0) then
    begin
        WLine:=j;
        ExtrEstimation:=SimplexTable[1,j]/SimplexTable[extrItem+1,j];
        end;
    end;
end;

```

up2:

```

SimplexTableNew:=nil;
SetLength(SimplexTableNew,length(SimplexTable),length(SimplexTable[0]));
for i:=0 to length(SimplexTable[0])-1 do SimplexTableNew[0,i]:=SimplexTable[0,i];
SimplexTableNew[0,WLine]:=extrItem;
for i:=1 to length(SimplexTable)-1 do
SimplexTableNew[i,WLine]:=SimplexTable[L,wLINE]/SimplexTable[extrItem+1,wLINE];
for i:=1 to length(SimplexTable)-1 do
for j:=0 to length(SimplexTable[0])-1 do
if j<>WLine then
SimplexTableNew[i,j]:=SimplexTable[i,j]-
SimplexTable[i,WLine]*SimplexTable[extrItem+1,j]/SimplexTable[extrItem+1,WLine];
for i:=0 to length(SimplexTable)-1 do for j:=0 to length(SimplexTable[0])-1 do
SimplexTable[i,j]:=SimplexTableNew[i,j];
if ParametersForm.CheckBox1.Checked then begin
bil:=false;
if not art then
with MainForm.ActiveMDIChild as TChildForm do
begin
task.Items.Add("");
task.Items.Add('Iteratsiya '+IntToStr(IterCount));
for i:=0 to GoalChild.ColCount-1 do
begin
for j:=0 to length(SimplexTable[0])-1 do
if i+1=SimplexTable[0,j] then
begin
task.Items.Add(' '+GoalChild.Cells[i,0]+'='+FloatToStr(SimplexTable[1,j]));
bil:=true;
end;
if not bil then task.Items.Add(' '+GoalChild.Cells[i,0]+'=0');
bil:=false;
end;
end;
end;
end;
until false;
fin:
if art then
begin
art:=false;
SetLength(SimplexTable,Length(SimplexTable)-MoreCount,Length(SimplexTable[0])-1);
goto up;
end;
bil:=false;
for i:=0 to ParametersForm.dim1.Value-1 do
if (SimplexTable[0,i]<=ParametersForm.dim1.Value) and
(SimplexTable[1,i]<>trunc(SimplexTable[1,i])) then bil:=true;
if not bil then
begin
with MainForm.ActiveMDIChild as TChildForm do
begin
task.Items.Add("");
task.Items.Add('Natija');
for i:=0 to GoalChild.ColCount-1 do
begin
for j:=0 to length(SimplexTable[0])-1 do

```

```

    if i+1=SimplexTable[0,j] then
    begin
    task.Items.Add(' '+GoalChild.Cells[i,0]+'='+FloatToStr(SimplexTable[1,j]));
    bil:=true;
    end;
    if not bil then task.Items.Add(' '+GoalChild.Cells[i,0]+'=0');
    bil:=false;
    end;
    task.Items.Add("");
    if parametersForm.Min.Checked then
    task.Items.Add('Функцияның minimal qiymati '+FloatToStr(-
1*(SimplexTable[1,length(SimplexTable[0])-1]))
    else
    task.Items.Add('Функцияның maksimal qiymati
'+FloatToStr(SimplexTable[1,length(SimplexTable[0])-1]));
    end;
    exit;
    end;
SetLength(SimplexTable,Length(SimplexTable)+1,Length(SimplexTable[0])+1);
For i:=0 to Length(SimplexTable)-1 do
SimplexTable[i,Length(SimplexTable[0])-1]:=SimplexTable[i,Length(SimplexTable[0])-2];
for i:=0 to Length(SimplexTable[0])-1 do SimplexTable[Length(SimplexTable)-1,i]:=0;
SimplexTable[Length(SimplexTable)-1,Length(SimplexTable[0])-2]:=1;
ExtrEstimation:=0;
WLine:=0;
for i:=0 to Length(SimplexTable[0])-3 do
begin
if (abs(SimplexTable[1,i]-trunc(SimplexTable[1,i]))>ExtrEstimation) and (abs(SimplexTable[1,i]-
round(SimplexTable[1,i]))>0.001) then
begin
ExtrEstimation:=abs(SimplexTable[1,i]-trunc(SimplexTable[1,i]));
WLine:=i;
end;
end;
SetLength(goalfun,Length(goalfun)+1);
GoalFun[Length(goalfun)-1]:=0;
SimplexTable[0,Length(SimplexTable[0])-2]:=Length(SimplexTable)-2;
SimplexTable[1,Length(SimplexTable[0])-2]:=-ExtrEstimation/ExtrEstimation;
for i:=2 to Length(SimplexTable)-2 do
begin
SimplexTable[i,Length(SimplexTable[0])-2]:=-((abs(SimplexTable[i,WLine]-
trunc(SimplexTable[i,WLine])))/ExtrEstimation);
end;
SimplexTable[round(SimplexTable[0,WLine])+1,Length(SimplexTable[0])-2]:=0;
ExtrEstimation:=100000;
extrItem:=0;
for i:=2 to length(simplexTable)-1 do
if (SimplexTable[i,length(SimplexTable[0])-1]<ExtrEstimation) and
(SimplexTable[i,length(SimplexTable[0])-1]>0) then
begin
extrItem:=i-1; {новый базис}
ExtrEstimation:=SimplexTable[i,length(SimplexTable[0])-1];
end;
//??? if ExtrEstimation=-100000 then goto fin;
WLine:=length(SimplexTable[0])-2;
goto up2;

```

```

end;
procedure TMainForm.SaveClick(Sender: TObject);
begin
if pos('Masala',activemdichild.caption)=1 then
  SaveAsClick(Sender) else with activemdichild as TChildForm do
    SaveData(Caption);
end;

procedure TMainForm.DelLimClick(Sender: TObject);
var i:byte;
begin
with ActiveMDIChild as TChildForm do
begin
if ItemDel<4 then MessageDlg('Cheklash kiritilmagan',mtWarning,[mbOK],0) else
begin
  ParametersForm.FormShow(Sender);
  for i:=0 to ItemDel-5 do ParametersForm.BitBtn3Click(Sender);
  ParametersForm.BitBtn1Click(Sender);
  ParametersForm.Button3Click(Sender);
end;
end;
end;

procedure TMainForm.N8Click(Sender: TObject);
var i:byte;
begin
with Mainform.ActiveMDIChild as TChildForm do
begin
  GoalChild.ColCount:=2;
  LimChild.ColCount:=2;
  LimChild.RowCount:=1;
  BChild.RowCount:=1;
  SignsChild.RowCount:=1;
  for i:=0 to 1 do
    GoalChild.Cells[i,1]:='0';
    GoalChild.Cells[0,0]:='X1';
    GoalChild.Cells[1,0]:='X2';
  Task.Clear;
end;
end;

procedure TMainForm.N1Name1Click(Sender: TObject);
var FileName:string;
begin
with sender as TMenuItem do
begin
  FileName:=caption;
  System.Delete(FileName,1,2);
end;
CreateChild(OpenDialog1.FileName);
with ActiveMDIChild as TChildForm do
  LoadData(OpenDialog1.FileName);
ParametersForm.FormShow(Sender);
ParametersForm.Button3Click(Sender);
end;
end.

```