

**saqarTvel os teqnikuri universiteti
informatikisa da marTvis sistemebis
instituti**

gia surgul aZe

daprogramebis safuZvl ebi

(C-enis bazaze, naw.II)



**dantkicebul ia
danxmare
saxel mZRvanel od stu-s
saswavi o-meToduri
sabWos mier**

Tbil isi 2005

II Tavi. C-enis rTul i konstruqci ul i el ementebi

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4. masivebis, struqturebisa da fail ebis
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II Tavi. C-enis rTul i konstruqciul i el ementebi

1. masivebi

mesame Tavis dasawyisSi Cven mokl ed vaxseneT masivebi da struqturebi, rogorc monacemTa kompl eqsuri tipebis magal iTebi. axl a ki detal urad ganvixil oT isini, vinaidan maT daprogramebis Teoriasa da praqtikaSi udidesi roli akisria.

masivi erTgvarovani cvl adebis mniSvnel obaTa erTobl iobaa, romel sac aqvs unikal uri saxel i. masivi SeiZl eba iyos erT, or, sam da met ganzomil ebiani. misi yvel a el ementi erTi tipisaa. masivis el ementi SeiZl eba iyos isev masivi.

magal iTad, veqtori aris erTganzomil ebiani masivi. igi SeiZl eba iyos mTel ricxva (int Vect[100]), simbol ur-striqonul i (char Name[20]) an namdvil ricxva (float Money[5]).

organzomil ebiania matrica int Mat[4][3], sadac 4-striqonebis, 3-svetebis raodenobaa. igi gamoisaxeba ase:

$$Mat = \begin{pmatrix} m[0][0], m[0][1], m[0][2] \\ m[1][0], m[1][1], m[1][2] \\ m[2][0], m[2][1], m[2][2] \\ m[3][0], m[3][1], m[3][2] \end{pmatrix}$$

matricis zogadi el ementia $m[i][j]$, sadac $i=1, m; j=1, n$. pirvel i el ementisTvis yovel Tvis $i=0, j=0$. masivis el ementebze mniSvnel obebis miniWebas Sesazl ebel ia mis gamocxadebisTanave.

mag.: int days[12]={31,28,31,30,31,30,31,31,30,31};

rogorc vxedavT, aq akl ia ori bol o mniSvnel oba. aseT SemTxvevaSi Sesabamis el ementebis avtomaturad eniWebasT Ovovani mniSvnel oba. anu, days[0]=31, ..., days[10]=0, days[11]=0.

Tu mocemul ia int days[]={1,3,7,9,8}, maSin el ementTa raodenobas avtomaturad daiTvl is kompil atori (am SemTxvevaSi gveqneba days[5]).

ganvixil oT programa ricxvebis SetaniT cikli is gamoyenebiT, maTi aj amvisa da am ricxvebidan minimum-maqsimumis sapovnel ad.

```
/* Pr_27.c Masivi-1 Min-Max */
#include <stdio.h>
#define N 10
main()
{
    int i, mas[N], Min, Max;
    float Sum, Average;
    clrscr();
    printf("SeitaneT 10 ricxvi :\n");
    for(i=0; i<N; i++)
        scanf("%d", &mas[i]);

    printf("Setani is Semowmeba :\n");
    for(i=0; i<N; i++)
        printf("%3d", mas[i]);
    printf("\n");

    for(i=0, Sum=0.0; i<N; i++)
        Sum += mas[i];

    Average=Sum/N;
    printf("jami=%0.0f, saSual o=%0.2f\n", Sum, Average);
    /* — Min & Max — */
    for(Min=mas[0], i=1; i<N; i++)
        if(mas[i] < Min)
            Min=mas[i];
    for(Max=mas[0], i=1; i<N; i++)
        if(mas[i] > Max)
            Max=mas[i];
    printf("Min=%d, Max=%d\n", Min, Max);
    getch();
}
```

strigonebis an simbol oebis miniWeba masivze SesaZl ebel ia extern an static mexsierebis kl asebiT. magal iTad,

```
static char Name[] = "Giorgi";    es igivea, rac:
```

```
static char Name[] = {'G', 'i', 'o', 'r', 'g', 'i', '\0'};
```

bol oSi '\0' miuTiTebS, rom esaa strigoni.

masivis saxel i asrul ebs maCvenebl is rol s masivis pirvel el ementze. Name da &Name[0] ekvival enturi mniSvnel oobia.

*Name eTanadeba pirvel i el ementis mniSvnel obas, anu 'G'-s.

*(Name+1)=Name[1]='i' da a.S.

simbol uri strigonebis Sesatanad gamoiyeneba gets(), xol o gamosatanad puts();

strigonebis dasamuSavebel i funqciebi mravl adaa C-enaSi. isini moTavsebul ia <string.h>, <stdlib.h>, <stdio.h> fail ebSi.

ganvixil oT ramdenime sail ustracio programa: ori strigonis gadabma (28), strigonebis mowesrigebul ad dal ageba (29) da sityvis Sebrunebul ad wakiTxva (30).

```
/*Pr_28 strcat() */
```

```
#include <stdio.h>
```

```
#define SIZE 80
```

```
main()
```

```
{
```

```
static char flower[SIZE];
```

```
static char add_str[]=" I amazi yvavil ia !";
```

```
clrscr();
```

```
puts("kiTxva: romel i yvavil i mogwons?");
```

```
gets(flower);
```

```
strcat(flower, add_str); /* gadabmis Sedegi iwereba flower-Si */
```

```
puts(flower);
```

```
getch();
```

```
}
```

2.1 naxazze naCvenebl Sedegi.

```

C:\WINNT\System32\cmd.exe
kiTxva: romeli yvavili mogcons ?
iasamani
iasamani lamazi yvavilia !

```

nax.2.1. ori striqonis gadabmis Sedegi

```

/*Pr_29.c qsort() */
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
char List[5][4]={"Lia","Eka","Ute","Tea","Ann"};
main()
{ int x;
  clrscr();
  puts("sortirebande: ");
  for(x=0; x<5; x++)
    printf("%s\n", List[x]);
  qsort(&List, 5, sizeof(List[0]), strcmp); /*mowesrigebis funqcia*/
  puts("sortirebis Semdeg:");
  for(x=0; x<5; x++)
    printf("%s\n", List[x]);
  getch();
}

```

2.2 naxazze naCvenebia Sedegi.

```

/* Pr_30.c Revers */

```

```

C:\WIN...
sortirebande:
Lia
Eka
Ute
Tea
Ann
sortirebis Semdeg:
Ann
Eka
Lia
Tea
Ute

```

nax.2.2.
al fabetiT
dal ageba

```

#include <stdio.h>
main()
{
char word[25];
clrscr();
printf("SemoitaneT sityva :");
scanf("%s", word);
Revers(word);
printf("Sebrunebis Semdeg : %s\n", word);
getch();
}

```

```

Revers(s)
char s[];
{
int i,j, temp;
for(i=0, j=strlen(s)-1; i<j; i++, j--)
{
temp=s[i];
s[i]=s[j];
s[j]=temp;
}
}

```

Sedegi naCvenebia 2.3 naxazze.

```

C:\WINNT\System32\cmd.e...
SemoitaneT sityva : saqarTvelo-lamazo
Sebrunebis Semdeg : ozamal-olevTraqas
|

```

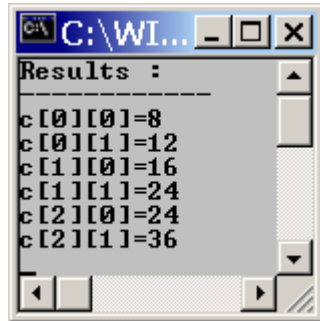
nax.2.3

masivebis gamoyenebis kl asikuri SemTxvevaa matricebTan muSaoba. magal iTad organzomil ebiani matricebis gadamravl ebis programa, roml is mTavar, sayuradRebo komponents Cadgmul i for-cikl ebi warmoadgens.

```

/* Pr_31.c Matric-Multiple */
#include <stdio.h>
#define M 3
#define N 4
#define K 2
main()
{ int a[3][4]={{ 1,1,1,1},
               {2,2,2,2},
               {3,3,3,3}};
  int b[4][2]={{ 2,3},
               {2,3},
               {2,3},
               {2,3}};
  int c[3][2], i, j, k;
  for(i=0; i<M; i++)
  { for(j=0; j<K; j++)
    { c[i][j]=0;
      for(k=0; k<N; k++)
        c[i][j] += a[i][k]*b[k][j];
    }
  }
  clrscr();
  printf("Results :\n—————\n");
  for(i=0; i<M; i++)
  { for(j=0; j<K; j++)
    { printf("c[%d][%d]=%d", i,j,c[i][j]);
      printf("\n");
    }
  }
  getch();
}

```



nax.2.4

}Sedegebi naCvenebia 2.4. naxazze.

matricę tan muSaobis kargi magal iTia samucnobia
gantol eBaTa sistemis amoxsna krameris wesiT, romel ic cnobil ia
determinantTa meTodis gamoyenebiT (samkuTxedis wesi).

davuSvaT mocemul ia gantol eBaTa sistema:

$$\begin{cases} 1x + 2y + 3z = 10 \\ 2x + 3y + 4z = -8 \\ -3x + 4y + 5z = 21 \end{cases} \quad x = \frac{\Delta_x}{\Delta}; y = \frac{\Delta_y}{\Delta}; z = \frac{\Delta_z}{\Delta}$$

qvemot mocemul ia programis fragmenti, romel ic gaiTvl is
determinantis (Δ) mniSvel obas, sadac rogorc viciT

$$\Delta = \begin{vmatrix} 1, & 2, & 3 \\ 2, & 3, & 4 \\ -3, & 4, & 5 \end{vmatrix}$$

/* Pr_32.c Kramer-Determ */

#include <stdio.h>

#define M 3

#define N 5

main()

{

int a[M][N]={{ 1,2,3, 1,2}, /* bol o ori sveti pirveli ori sveti */
 { 2,3,4, 2,3}, /* xel ovnurad damatebuli */
 {-3,4,5,-3,4}};

int i,j,t, c1=1, c2=0, s1=0, s2=0;

int vect[N]={0,1,2,0,1}; /* svetebis indeqsebis veqtori */

clrscr();

/* Setani monacemTa kontrol i */

for(i=0; i<M; i++)

{

for(j=0; j<N-2; j++)

printf("%5d", a[i][j]);

printf("\n");

}

$$\begin{vmatrix} 1, & 2, & 3, & 1, & 2 \\ 2, & 3, & 4, & 2, & 3 \\ -3, & 4, & 5, & -3, & 4 \end{vmatrix}$$

```

/* matricis dadebiTi wevrebis gamoTvl a */
printf("\n");
for(t=0; t<M; t++)
{
    c1=1;
    for(i=0, j=t; i<M; i++, j++)
    {
        c1 *= a[i][vect[j]];
        printf("%5d", c1);
        s1 += c1;
    }
    printf("\ns1=%d \n", s1);
    getch();

/* matricis uaryofiTi wevrebis gamoTvl a */
for(t=0; t<M; t++)
{
    c2=1;
    for(i=M-1, j=t; i>=0; i--, j++)
    {
        c2 *= a[i][vect[j]];
        printf("%5d", c2);
        s2 +=c2;
    }
    printf("\ns2 =%d \n", s2);
    printf("sabol oo Sedegi : s=%d \n", s1-s2);
    getch();
}

```

Sedegbi asaxul ia 2.5 naxazze.

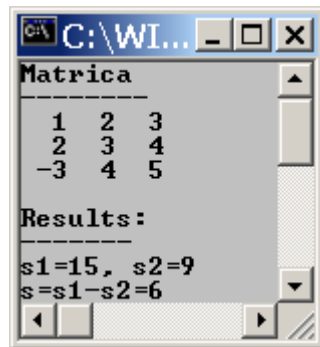
$$s1 = [1*3*5 + 2*4*(-3) + 3*2*4]$$

$$s2 = -[3*3*(-3) + 2*2*5 + 1*4*4]$$

$$\Delta = s1 - s2$$

/* x, y da z gamoiTval eT
TviTon !*/

nax.2.5



bol o magal iTi eZRvneba n-ganzomil ebiani matriciT warmodgenil i wrfiv gantol ebaTa sistemis amoxsnas gausis gamoricxvis meTodiT.

qvemot mocemul ia am programis teqsti, romel Sic ganixil eba konkretul i magal iTi.

```

/* Pr_33.c Gauss-Method */
#include <stdio.h>
#define N 4
main()
{ static float a[N][N][N+1]={ { { 7.9, 5.6, 5.7,-7.2, 6.68},
                                { 8.5,-4.8, 0.8, 3.5, 9.95},
                                { 4.3, 4.2,-3.2, 9.3, 8.6 },
                                { 3.2,-1.4,-8.9, 3.3, 1.0 } } };

  static float vect[N][N+1];
  static float x[N]; /* ucnobebi */
  int i, j, k, t;
  clrscr();
  printf("----- sawyisi matrica -----\n\n");
  for(k=0,i=0; i<N; i++)
  { for(j=0; j<N+1; j++)
    printf("%-10.4f", a[k][i][j]);
    printf("\n");
  }
  /* — koeficientebis angariSi gausis mixedvit — */
  for(k=0, i=k; k<N; k++,i++)
  { /* 1 */
    printf("bi j i-%d\n-----\n",k);
    for(j=k; j<N+1; j++)
    { /* 2 */
      if(a[k][i][i] == 0) /* 0-ze gayofis Tavidan acil eba */
        printf(" /0 : cikli dan gamosvl a\n");
      else { /* 3 */
        vect[k][j]=a[k][i][j]/a[k][i][i];
        printf("vect[%d][%d]=%-10.4f\n", k, j, vect[k][j]);
      }
    }
  }
}

```

```

if(j>k)
{ /* 4 */
for(t=i+1; t<N; t++)
{ /* 5 */
a[k+1][t][j]=a[k][t][j] - a[k][t][k]*vect[k][j];
printf("Rez->> a[%d][%d][%d]=%-10.4f \n",
k+1, t, j, a[k+1][t][j]);

} /* 5 */
printf("%d bij is dasarul i -----\n\n", k);
} /* 4 */
} /* 3 */
} /* 2 end for j */
} /* 1 end for k */
/* — ucnoebis angariSi gausis meTodiT — */
printf("\n Results:\n===== \n\n");
for(k=N-1, j=N; k>=0; k--)
{ x[k]=vect[k][j] - x[j-1]*vect[k][j-1] -
x[j-2]*vect[k][j-2] -x[j-3]*vect[k][j-3];
printf("\nx[%d]=%-10.4f\n", k,x[k]);
} getch();
} Sedegebi asaxul ia 2.6 naxazze.

```

```

C:\WINNT\System32\cmd...
----- Matric -----
7.9000  5.6000  5.7000  -7.2000  6.6800
8.5000  -4.8000  0.8000  3.5000  9.9500
4.3000  4.2000  -3.2000  9.3000  8.6000
3.2000  -1.4000  -8.9000  3.3000  1.0000

Results with Gauss:
=====
x[4]=0.5679
x[3]=0.4263
x[2]=0.1248
x[1]=0.9671

nax.2.6

```

2. struqturebi

struqtura araerTgvarovani cvl adebis mniSvnel obaTa erTobi iobaa, romel sac aqvs unikal uri saxel i. struqtura, SeiZl eba SevardarOT organzomil ebian cxril s (Table),romel sac eqneba svetebi (Columns) da striqonebi (Rows). svetis yvel a el ementi erTi tipisaa,igi SeiZl eba warmovidginoT rogorc masivi. svetebi SeiZl eba sxvadasxva tipisa iyos.

ganvixil oT dokumentis magal iTi "TanaSromel Ta sia". misi forma mocemul ia qvemoT cxril Si:

TanamSr omel Ta sia

gvar i	saxel i	Tanamdebob a	xel fasi	kaT .#
gabedava	omari	docenti	350.00	94
gul ua	daviTi	asistent i	155.00	94
CaCaniZe	gurami	profesori	450.00	94
t orCinava	Zuku	biznesmeni	1500.00	205
j anel iZe	j aniko	asistent i	200.00	100

rogor SevqmnaT aseTi struqtura ? C-enaSi amisaTvis ori xerxi arsebobs:

1. typedef struct {A,B,C}BTanamshromeli;
 2. struct Tanamshromeli {A,B,C};
- sadac A,B,C svetis (atributebis) dasaxel ebebia. programis teqsts eqneba aseTi saxe:

```
/* Pr_34.c struct_1 */  
#include <stdio.h>  
#include <alloc.h> /* mexsierebis marTvis h-fail i*/  
main()  
{
```

```

typedef struct { char Gvari [15];
                char Saxeli[10];
                char Tanamd[10];
                float Xelfasi;
                int Katedr_N;} Tanamshromeli;
Tanamshromeli *st; /* st - maCvenebel ia tipiT Tanamshromeli */
st = (Tanamshromeli *) malloc(sizeof(Tanamshromeli));
    /* mexsierebis gamoyofa 15+10+10+4+2=41 bai ti */
strcpy(st->Gvari, "gabedava");
strcpy(st->Saxeli, "omari");
strcpy(st->Tanamd, "docenti");
st->Xelfasi = 350.00;
st-> Katedr_N=94;
clrscr();
printf("gvari: %s \nsaxeli: %s \nTanamdeboba: %s \n
      xel fasi: %.2f \nkatedr_N: %d", st->Gvari, st->Saxeli,
      st->Tanamd, st->Xelfasi, st->Katedr_N);
getch();
}
    Sedegebi asaxul ia 2.7 naxazze.

```

nax.2.7

"->" special uri operaciaa, romli Tac mimarTva xdeba strukturis elementze. strcpy(st->Gvari, "gabedava") gamosaxul eba, magaliTad, miniWebis (=) funqcias asrul ebs striqonul icvl adebisavis. ricxviT cvl adebs is ar swirdeba.

amgvarad, structurebTan muSaobisas sami ZiriTadi sakiTx
gamoikveTeba:

- 1 - struqturis formis, anu Sabl onis gansazRvra;
- 2 - struqturis saxel isa da cvl adebis gamocxadeba;
- 3 - cvl adebze mimarTva maTi mniSvnel obebis misaRebad.

axl a ganvixil oT struqturis agebis al ternatiul i
variantis programa.

```
/* Pr_35.c struct_2 */
```

```
#include <stdio.h>
```

```
#define Max 15
```

```
#define Min 10
```

```
struct Tanamshromeli {
```

```
    char Gvari [15];
```

```
    char Saxeli[10];
```

```
    char Tanamd[10];
```

```
    float Xelfasi;
```

```
    int Katedr_N; };
```

```
main()
```

```
{
```

```
    struct Tanamshromeli Person;
```

```
    /* Person - obieqtia tipi T Tanamshromeli */
```

```
    printf("gvari : "); gets(Person.Gvari);
```

```
    printf("saxeli : "); gets(Person.Saxeli);
```

```
    printf("Tanamdeboba : "); gets(Person.Tanamd);
```

```
    printf("xelfasi : "); scanf("%f", &Person.Xelfasi);
```

```
    printf("kaTedr_N : "); scanf("%d", &Person.Katedr_N);
```

```
    printf("\nTanamshromeli:\n—————\n");
```

```
    printf("%s %s aris N%d kaTedris %s \nda aqvs %.2f Lari  
            xelfasi\n", Person.Saxeli, Person.Gvari,
```

```
            Person.Katedr_N, Person.Tanamd, Person.Xelfasi);
```

```
    getch();
```

```
}
```

Sedegebi asaxul ia 2.8 naxazze.

The screenshot shows a Windows command prompt window titled "C:\WINNT\System32\cmd.exe". The output of a program is displayed as follows:

```

gvani : Topuria
saxeli : Niniko
Tanamdeboba : asistenti
xelfasi : 190.55
kaTedr_N : 94

Tanamshromeli:
-----
Niniko Topuria aris N94 kaTedris asistenti
da aqvs 190.55 Lari xelfasi
  
```

The window has a scrollbar on the right and a status bar at the bottom showing "max.2.8".

ამ SemTxvevaSi Cven სტრუქტურული - Tanamshromeli ტიპი არაა Person (ცული და არა მაკენებელი, ი.ე. *სტრუქტურული პროგრამა). ამიტომ SemdგომSi გამოიყენება Person-ის ატრიბუტები მიმართული " " - იტი და არა " -> " -იტი. ეს კარგად უნდა დავიმასშობროთ, ვინაიდან გამოიყენება xსირად და Secდომების სტატისტიკაც აკმაყრია.

ახლა გავართოთ პროგრამა და დავსვათ ამოცანა არაერთი, არამედ რამდენიმე სტრუქტურული სესატანად სტრუქტურული. ამასთანავე დავაყენოთ ისეტი სიგნალი კოდი, რომლის არცევიტაც სეუდებდა სტრუქტურების სეტანის პროცესი.

დავუსვათ, უნდა სევიტანოთ მონაცემები ვიგნების სესახებ: მათი ავტორების, დასახლებების, გამოცემის ადგილი და ვიგნების, ფაზების მიტიტები. ვთხოვთ მოცემულია პროგრამის ტესტი.

```

/* Pr_36.c struct_3 Books */
#include <stdio.h>
#define MAXTIT 40 /* ვიგნის დასახლებების მაქს. სიგრძე */
#define MAXAUT 40 /* ავტორის გვარების მაქს. სიგრძე */
#define MAXBKS 100 /* ვიგნების რაოდენობა */
#define STOP "" /* დამთავრება ENTER-იტი */
struct book {
    char Title[MAXTIT];
    char Author[MAXAUT];
    char City[18];
    char Year[4];
    float Price; };
  
```



```

main()
{
struct book libry[MAXBKS];
int i, count = 0;
printf("Book's Title : \n");
printf("press <Enter> if the End : \n");
while (strcmp(gets(libry[count].Title), STOP) != 0 &&
count<MAXBKS)

{
printf("Author: ");
gets(libry[count].Author);
printf("City: ");
gets(libry[count].City);
printf("Year: ");
gets(libry[count].Year);
printf("Price : ");
scanf("%f", &libry[count++].Price);

while(getchar() != '\n'); /* Setanis striqonis gawmenda */
if (count < MAXBKS)
printf("get the next book's title : \n");
} /* end while */

printf("List of books : \n-----\n");
for (i=0; i < count; i++)
printf("%s, %s, %s-%s, %.2f \n",
libry[i].Title,
libry[i].Author,
libry[i].City,
libry[i].Year,
libry[i].Price);
}
Sedegebi asaxul ia 2.9 naxazze.

```

```

C:\WINNT\System32\cmd.exe
modelireba
Author: buadze
City: tbilisi
Year: 1999
Price : 20
get the Next book's Title :
info-baza
Author: martin
City: calif
Year: 1990
Price : 35.65
get the Next book's Title :
internet
Author: gvinepadze
City: kutaisi
Year: 2000
Price : 55
get the Next book's Title :

List of books :
-----
modelireba buadze      tbilisi    1999 20.00
info-baza  martin      calif     1990 35.65
internet  gvinepadze kutaisi   2000 55.00

```

როგორც არწმუნებ, სტრუქტურის ელემენტზე მიმართვა
 შეიძლება ინდექსის გამოყენებით. მაგალითად, მე-*n* უიჯნისათვის
 საჭიროა მიწერა `libry[n].Title`;

შეიძლება აგრეთვე შემდეგი კონსტრუქციების გამოყენება:
`gets(libry[i].Title)`;
`scanf("%f", &libry[i].Price)`; და ა.შ.

გამოსახულ ელემენტს `libry[i].Title[j]` მიუთითებს *i*-ური უიჯნის
 დასახელება *j*-ური პოზიციის (სიმბოლოს) მნიშვნელობა.

ცნობის გამოყენება აგრეთვე სტრუქტურის უფრო რთული
 შემთხვევების [1]. ამჯერად ცნობა მართარს განვიხილავთ.

36-ე პროგრამით ცნობის შევსების სტრუქტურის 100-მდე უიჯნის,
 მაგრამ მათი დამახსოვრება დისკოზე არ ხდება. ე.ი. პროგრამის
 დამთავრებისთანავე იკარგება ყველაფერი. ეს რომ არ მოხდეს, საჭიროა
 ფაილების გამოყენება. გავცნობთ ამ მნიშვნელოვან თემას.

3. fail ebi

monacemTa fail i aris saxel miniWebul i, diskur mexsierebaSi damoukidebl ad moTavsebul i, winaswar gansazRvrul i struqturis mqone monacemTa agregatul i erTobl ioba.

C-enis <stdio.h> saTavo-fail iSi gansazRvrul ia standartul ad `fail is--tipi: FILE. Cven aq mas detal urad ar SevexebiT, mxol od arVniSnavT misi gamoyenebis saSual ebas.

fail ebis gamocxadebisas unda daiweros, magal iTad,

```
FILE *file_1, *file_2;
```

es niSnavs, rom *file_1 da *file_2 aris fail is tipis maCvenebl ebi, roml ebzec momaval Si mimagrebul iqneba monacemTa fail ebi. ganvixil oT fail ebis gaxsnis fopen(), daxurvis fclose(), wakiTxvis fscanf(), Caweris fprintf(), Zebnis fseek() da sxv. funqciebis gamoyenebis magal iTebi.

fail is gaxsnis funqcias fopen("file_name", "p"), ori argumenti aqvs. pirveli fail is saxel i, romel ic aqtiur direqtorიაSi (folder) moiZebneba, da meore, ofciapam fail is parametrისაTvis:

p={r-wakiTxva, w-Cawera, a-damateba bol oSi, t-teqsturi}.

fail is daxurvisas mieTiteba maCvenebl is saxel i:

```
fclose(*file_1);
```

ganvixil oT pirveli programis teqsti, romel ic muSaobs monacemTa fail Tan "test-2003". amisaTvis winaswar SevqmnaT Cvens direqtorიაSi es fail i, davuSvaT teqsturi tipuri gafarToebis gareSe (an SevqmnaT Cveul ebrivi test-2003.txt fail i Notepad-Si).

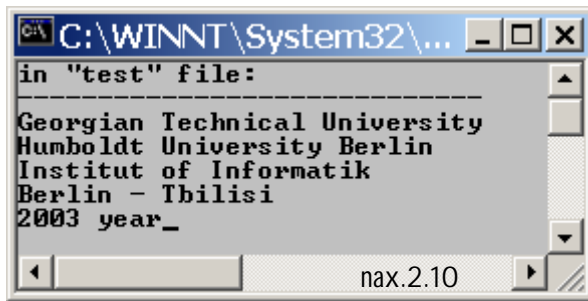
```
/* Pr-37.c file_1 fopen(), fclose() */
#include <stdio.h>
main()
{
FILE *in; /* pointer for file*/
int ch;
```

```

/* fail is gaxsna wasakiTxad misi arsebobis SemowmebiT */
if ((in=fopen("test", "r")) != NULL) /*test-fail i miemagreba in-s*/
{
    while ( (ch = getc(in)) != EOF ) /* simbol os miReba in - dan */
        putchar(ch, stdout); /* simbol os gamotana ekranze */
    fclose(in);
}
else
    printf("ver gaxsna fail i \"test\".\n");
getch();
}

```

Sedegebi asaxul ia 2.10 naxazze.



axl a ganvixil oT SemTxveva, rodesac "new-test"-fail is gaxsnisa da misi informaciis (Year) operatiul mexsierebaSi gadmotanis Semdeg unda davamatoT axal i strigonul i monacemebi programidan da CavveroT diskoze axal "test-2"-fail Si.

```

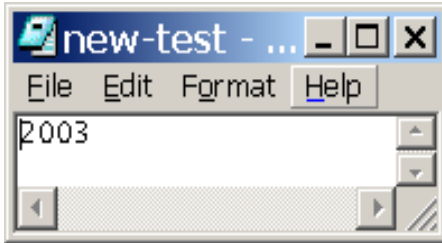
/* Pr_38.c file_2.c fscanf(), fprintf() */
#include <stdio.h>
main()
{
    FILE *fi;
    int Year;
    fi = fopen("new-test", "r");
    /* new-test fail idan gadmoiwereba mniSvnel oba Year cvl adSi */
    fscanf( fi, "%d", &Year);
    fclose(fi);
}

```

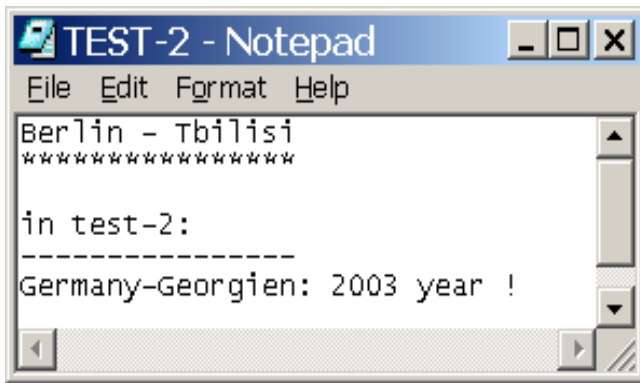
```

/* ixsneba axal i test-2 fail i damatebaze */
fi = fopen("test-2", "a");
fprintf( fi, "in test-2: Germany-Georgien: %d \n", Year);
fclose(fi);
}

```



nax.2.11



monacemi "2003" new-test fail i dan gadmova fscanf()-iT cvl adSi &Year, Semdeg gaisneba fail i test-2 da striqoni "in test-2: Germany-Georgien:" damatebul i Year-mniSvnel obiT fprintf() funqciiT damateba test-2 -s bol oSi.'Sedegebi asaxul ia 2.11 naxazze.

fail ebSi Zebnis proceduris Sesasrul ebl ad iyeneben fseek() funqcias, roml is sintaksi Semdegia:

fseek(*file_point, index, p) , sadac

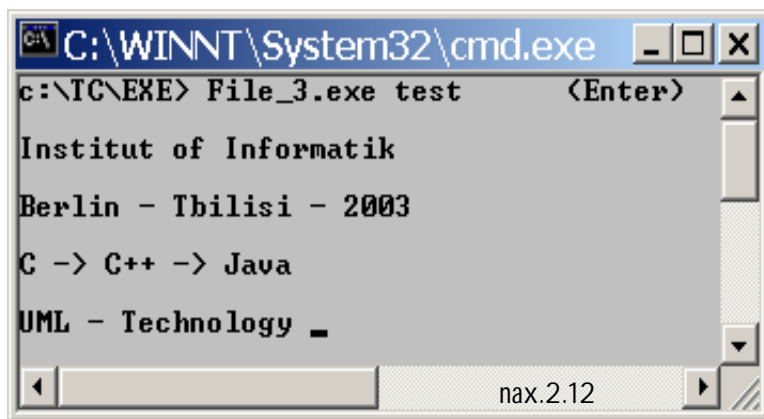
*file_point - fail is *maCvenebel ia;

index - fail Si moZraobis argumentia ("+" - win, "-" - ukan);
p - argumentia Zebnis sawyisi wertil is dasadgenad, mag., 0-
fail is dasawyisidan, 1-mimdinare poziciidan, 2-fail is bol odan.

ganvixil oT teqsturi fail is damuSavebis C-programa. misi
Sesabamisi .exe-fail i moiTxovs main()-Si argumentad
dasamuSavebel i fail is saxel is miTiTebas. frCxil ebSi Tavsdeba
ori argumenti: number - akontrol ebs situacias, aris Tu ara
miTiTebul i fail is saxel i (Tu araa, maSin gamoaqvs Setyobineba),
da names - monacemTa fail is saxel i, romel ic iZebneba miTiTebul
direqtorias i (an im direqtoriasia, sadac .exe fail ia).

```
/* Pr_39.c file_3 fseek() */  
#include <stdio.h>  
main(int number, char *names[])  
{ FILE *fp;  
  long i = 0L;  
  if ( number < 2 )  
    puts ("saWi roa fail is saxel i argumentad !\n");  
  else  
  {  
    if ((fp = fopen(names[1], "r")) == 0)  
      printf("ver gavxseni %s.\n", names[1]);  
    else  
    { int a=0;  
      char b;  
      while (fseek(fp, i++, 0) == a)  
      {  
        b = putchar(getc(fp));  
        if (b == EOF)  
          a = 2;  
      }  
      fclose(fp);  
    }  
  }  
  getch();  
}
```

programis asamuSavebl ad brZanebis striqonSi (ix. nax.2.12 pirvel i striqoni) Caweril ioa exe-programis saxel i da Semdeg, me-2 parametrad dasamuSavebel i monacemTa fail i, bol os Enter.



test-fail Si Caweril i striqonebi (teqsti) mTlianad gamoitaneba, vinaidan Zebnis fseek() funqciaSi miTiTebul ia i++ bij i, rac niSnavs yvel a simbol os gavl as.

Tu bij i iqneboda sxva, magal iTad, i+=5, maSin programa SedegSi gamoitanda yovel me-5 simbol os (6,11,16 da a.S).

axl a ganvixil oT ramdenime modul isagan Semdgari kl asikuri programis magal iTi, romel sac monacemTa fail is teqsti gadahyavs mTavrul an striqonul simbol oebSi.

```

/* Pr_40.c file_4 Up <==> Low */
#include <stdio.h>
#include <ctype.h>
#define UPPER 1
#define LOWER 0
main()
{ int par;
  /* sawyisi da saSedego fail Ta saxel ebi */
  char file1[14], file2[14];
  par = choose();
  getch();
}

```

```

/* fail Ta saxel ebis miReba */
getfiles(file1, file2);
getch();
/* gardaqmnis procedura */
conv(file1, file2, par);
getch();
}

choose()
{
int ch;
printf("SeitaneTU, Tu mTavrul i teqsti gnebavT \n");
printf("an SeitaneTL, Tu strigonul i \n");
while ((ch=getchar()) != 'U' && ch != 'u' && ch != 'L' && ch != 'l');
    printf("SeitaneTU an L! \n");
while (getchar() != '\n')
    ; /* Camoacil ebs axal i strigonis simbol os '\n' bol oSi */
if (ch == 'U' || ch == 'u')
    {
    printf("Ok! didi asoebis registri \n");
    return(UPPER);
    }
else
    {
    printf("Ok! patara asoebis registri \n");
    return(LOWER);
    }
}

getfiles(char *name1, char *name2)
{
printf("romel i fail is gardaqmna gnebavT ?\n");
gets(name1);
printf("esaa \" %s\". \n", name1);
printf("axal i saSedego fail is saxel i aris ?\n");
}

```



```

while(strcmp(gets(name2), name1) == NULL)
    printf("SearCieT sxva saxel i \n");

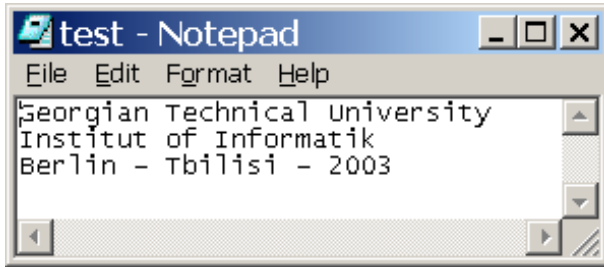
    printf("Tqveni gamomaval i fail ia \"%s\".\n", name2);
}

conv(char *name1, char *name2, int par)
{
    FILE *f1, *f2;
    int ch;
    if ( (f1 = fopen(name1, "r")) == NULL)
        printf("ver vxsni %s-s. \n", name1);
    else
        {
            puts("proceSiS dawyeBa !");
            f2 = fopen(name2, "w");
            while((ch = getc(f1)) != EOF)
                {
                    if (par == UPPER)
                        ch = islower(ch) ? toupper(ch) : ch;
                    else
                        ch = isupper(ch) ? tolower(ch) : ch;

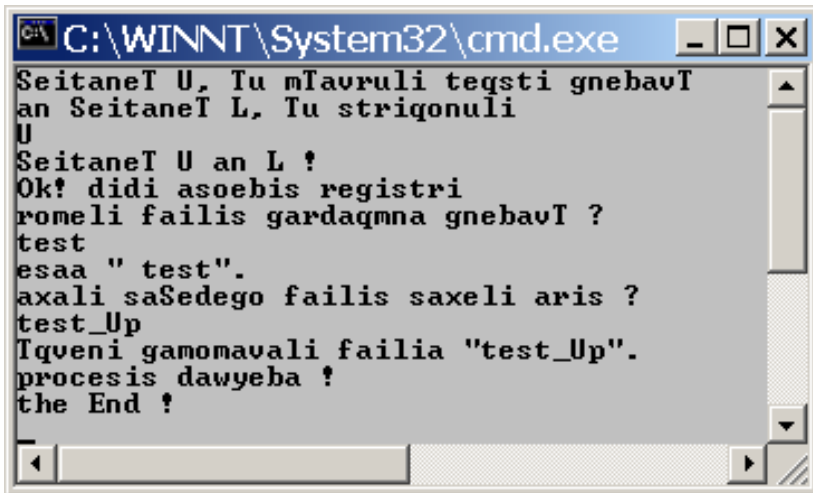
                    putc(ch, f2);
                }
            fclose(f2);
            fclose(f1);
            puts("the End !");
        }
}

am programaSi sawyis fail ad miTiTebul ia name_1="test",
xol o gamomaval fail is saxel ad name_2="test_UP". orive
fail is teqstebi moTavsebul ia 2.13 da 2.15 naxazebze, xol o
dial oguri proceSiS aRwera naCvenebia 2.14 naxazze.

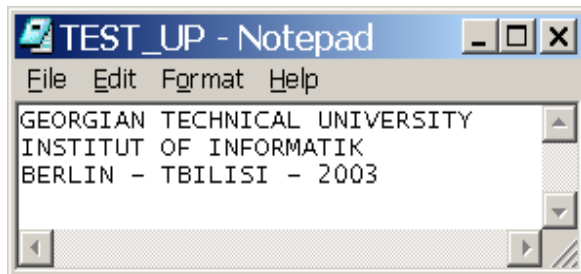
```



nax.2.13



nax.2.14



nax.2.15

4. masivebis, struqtur ebisa da fail ebis erToblivi gamoyeneba

monacemTa faili Cven SeiZl eba ganvixil oT rogorc garkveuli struqturis mqone organzomil ebiani cxril i (Table), romel sacaqvs svetebi (vel ebi, atributebi) da strigonebi (Canawerebi). TiToeuli vel i erTgvarovani monacemebia, e.i. masivia. magal iTad, gvarebi, Tanamdebobebi, akad-j gufebis-# da a.S.

Canaweri aris l ogikurad dakavSirebuli vel ebis jgufi. "l ogikurad dakavSireba" swored garkveul struqturas gul isxmobs. **faili (cxrili)** aris dakavSirebuli CanawerTa jgufi. **monacemTa baza** aris dakavSirebuli fail Ta (cxrilebis) jgufi. programebis jgufs, romel Ta daniSnul ebaa monacemTa bazebis Seqmna da marTva, monacemTa bazebis marTvis sistemas uwodeben (**mbms**).

magal iTad, universitetis yovel students fail Si studenti eqneba erTi Canaweri. magram studentTa ricxvi SeiZl eba iyos 20 000 an meti. an Tbilisis mosaxl eobis aRweris monacemTa baza, romel Sic 1000000-ze meti adamiania aRricxuli da a.S. aseTi tipis sistemebSi dgeba probl emafail ebis efeqturad organizebisaTvis, anu informaciis struqturirebis xarj ze mexsierebis racional uri gamoyenebisa da saWiro monacemebis swrafi moZebnisaTvis.

C/C++-enebs ar gaaCnia special uri instrumenti (**mbms**), amitom TviT momxmarebel s uxdeba fail ebis Seqmnisa da maTTan muSaobis programebis dawera.

firma Borland-ma C++-enas daamata es saSual eba da amJamad Borland C++ Builder da Borland Delphi-s programul paketebSi Sesazl ebel ia monacemTa bazebTan Tanamedrove xerxebiT muSaoba. am sistemebSi gamoiyeneba rogorc l okalur bazebTan (dBase, Paradox), aseve ganawil ebul bazebTan (InterBase) kl ient-server arqiteqturIT muSaobis saSual ebani. es ukanasknel i iseTive rangis sistemaa, rogoricaa Oracle, SQL-Server, SyBase da sxv.

kl asikuri meTodebidan Cven ganvixil avT monacemTa fail ebis mimdevrobiTi da pirdapiri mimarTvis organizebis xerxebis.

4.1. mimdevrobiTi mimarTvis fail ebis ageba

mimdevrobiT fail ebSi Canawerebi moTavsebul ia erTmaneTis mimarT mowesrigebul ad garkveuli gasaRebiT. magal iTad, universitetis buxhal teriaSi esaa TanamSroml is nomeri (satabelo #), romelic unikal uria TiToeuli muSakisaTvis. kadrebis ganyofil ebas igive faili mowesrigebuli aqval fabetiT kaTedrebisa da laboratoriebis Sesabamisad da a.S.

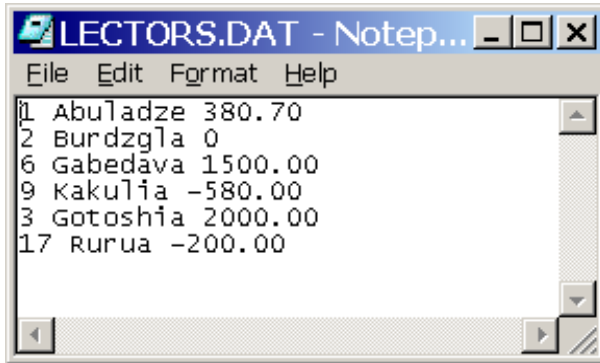
ganvixil oT sail ustracio programa, roml is daniSnul ebaa Seqmnas struqturirebuli faili leqtorTa finansurimdgomareobis Sesaxeb universitetis sal aroSi. am fail Si Canawerebis Setana da ganlageba unda iyos mimdevrobiTi, leqtoris nomris Sesabamisi Nom-atributis mixedviT.

```
/*Pr_41.c create the Sequential file */
#include <stdio.h>
#include <conio.h>
main()
{ int Nom; char Name[20]; float Money;
  FILE *p;
  clrscr();
  /* aq mieTiteba gza fail amde */
  if((p=fopen("c:\\tc\\d1\\data\\Lectors.dat", "w")) == NULL)
    printf("File not found \n");
  else
  { printf("Input Nomer, Name, Money\nor EOF wenn END\n? : ");
    scanf("%d%s%f", &Nom, Name, &Money);
    while(!feof(stdin))
    { fprintf(p, "%d %s %.2f\n", Nom, Name, Money);
      printf("? : ");
      scanf("%d%s%f", &Nom, Name, &Money);
    }
    fclose(p);
  }
}
```

Tavidan Data direktoriaSi SeiZl eba ar arsebobdes Lectors.dat fail i. igi avtomaturad Seiqmneba fopen() funqciit da mzad iqneba strigonebis Casawerad (" w " - ofcia). Tu arsebobs es fail i winaswar, maSin misi Zvel i Canawerebi waiSl eba.

programa moitxovs momxmarebl idan Nom, Name da Money atribetebis mniSvel obebis Setanas dial ogSi.

Sedegebi asaxul ia 2.16 naxazze.



nax.2.16

41-e programis Sedegebi Lectors.dat fail isaTvis aq gamotanil ia NotePad-is daxmarebit.

axl a davuSvaT, rom saWi roa aRniSnul i fail is programul ad wakiTxva. e.i. unda daiweros C-funqcia, romel ic gaxsnis da mimdevrobit waikiTxavs mis Canawerebs. es programa warmodegenil ia qvemoT.

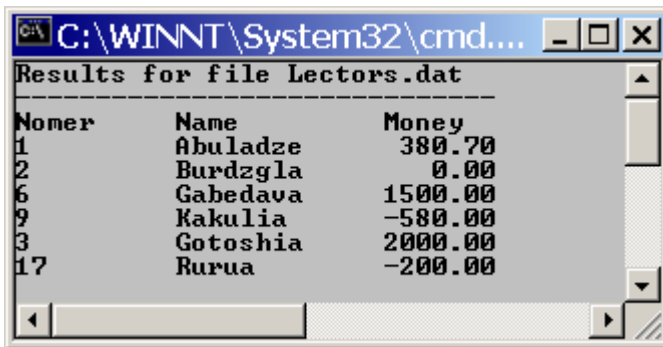
```
/*Pr_42.c Sequential fscanf() */
#include <stdio.h>
#include <conio.h>
main()
{
    int Nom;
    char Name[20];
    float Money;
    FILE *p;
    clrscr();
```

```

if((p=fopen("c:\\tc\\d1\\data\\Lectors.dat", "r")) == NULL)
printf("Gibt's kein File\n");
else
{
printf("Results for file Lectors.dat \n");
printf("%-10s%-13s\n", "Nomer", "Name", "Money");
fscanf(p, "%d%s%f", &Nom, Name, &Money);
while(!feof(p))
{
printf("%-10d%-13s7.2f\n", Nom, Name, Money);
fscanf(p, "%d%s%f", &Nom, Name, &Money);
}
fclose(p);
}
getch();
}

```

ამ პროგრამაში ფაილი Lectors.dat-ის სხვა ვაკის სტატუსით ("r"). შემდეგ fscanf() ფუნქციით ფიზიკურად პირველი ჩანაწერის სამივე ატრიბუტის მნიშვნელობა დისკიდან გადმოიწვება (ვაკის სხვა) ოპერატიული მესიერების ცვლადების მიხედვით: &Nom, Name, &Money. ეკრანზე ასახული იქნება ეს შედეგები.



nax.2.17

ფაილი SeiZl-ეხსენება შეიცავს ჩანაწერებს და მათში მოცემულია ამოცანების აღწერა და იქნება ასევე დროს საჭირო სპეციალური

programis damuSaveba, romelic saZebni kriteriumiT (Cvens SemTxvevaSi menius punktis nomeri) amoirCevs failidan l eqtorTa Sesabamis mTI ian strigonebs da gamoitans ekranze. 43-e programis teqsti dial oguri proceduriT (menuTi) mocemul ia qvemoT.

```

/*Pr_43.c Information output */
#include <stdio.h>
#include <conio.h>
main()
{ int N, Nom;
  float Money;
  char Name[20];
  FILE *p;
  clrscr();
  if((p=fopen("c:\\tc\\d1\\data\\Lectors.dat", "r"))== NULL)
    printf("Kein File ist geoffnet !\n");
  else
    { /*----- menu ----- */
      printf( "1 - mit Zero (0) Money\n"
        "2 - mit Kredit (-) Money\n"
        "3 - mit Debit (+) Money\n"
        "4 - End Seances\n"
        "Input N: "); /* airCieT punkti */
      scanf("%d", &N);
      while(N != 4)
        { fscanf(p, "%d%s%f", &Nom, Name, &Money);
          switch(N)
            {
              case 1: /* l eqtorebi 0-ovani TanxiT */
                printf("\nNom mit Zero Money: \n");
                while(!feof(p)) /* yvel a Canaweris gadasinj va */
                  { if(Money==0) /* Tu 0-a, maSin daibeWdeba */
                      printf("%-10d%-13s%7.2f\n", Nom, Name, Money);
                    fscanf(p, "%d%s%f", &Nom, Name, &Money);
                  } break;
            }
        }
    }
}

```

```

case 2: /* Tu l eqtors uaryofITi bal ansi aqvs */
    printf("\nNom mit Kredit Money: \n");
    while(!feof(p))
    {
        if(Money < 0)
            printf("%-10d%-13s%7.2f\n", Nom,Name,Money);

        fscanf(p, "%d%s%f", &Nom, Name, &Money);
    }
    break;
case 3: /* Tu l eqtors dadebiTi bal ansi aqvs */
    printf("\nNom mit Debit Money: \n");
    while(!feof(p))
    {
        if(Money > 0)
            printf("%-10d%-13s%7.2f\n", Nom,Name,Money);

        fscanf(p, "%d%s%f", &Nom, Name, &Money);
    }
    break;
}
rewind(p); /* fail is pirvel Canawerze gadasvl a */
printf("\n? ");
scanf("%d", &N);
}
printf("End Seances\n");
fclose(p);
}
}

```

Sedegebi asaxul ia 2.18 naxazze.

menuSi SemoTavazebul ia sami SemTxveva da erTi dasasrul i. Tu l eqtors Tavis angariSze ara aqvs Tanxa, maSin mas Seesabameba O-ovani bal ansi, e.i. menius 1-el i punqti. aseTia erTi Canaweri: burZgl a. uaryofITi bal ansis angariSiT me-2 punqtia da Canawerebic Sesabamisia amorCeul i: kakul ia da rurua.


```

C:\WINNT\System32\c...
1 - mit Zero (0) Money
2 - mit Kredit (-) Money
3 - mit Debit (+) Money
4 - End Seances
Input N: 2

Nom mit Kredit Money:
9      Kakulia      -580.00
17     Rurua        -200.00

? 3

Nom mit Debit Money:
1      Abuladze     380.70
6      Gabedava     1500.00
3      Gotoshia     2000.00

? 1

Nom mit Zero Money:
2      Burdzgla     0.00

? -

```

nax.2.18

aseT sistemisaTvis (programebi 41, 42 da 43) ukeTesia aigos mTavari menius programa, romel Sic gaerTiandeba samive ganxil ul i funqcia: fail is Seqmna da monacemTa Setana, fail is wakiTxva da monacemTa Canawerebis naxva (mTI ianad), da bol os, Canawerebis daj gufeba garkveul i wesiT da Sedegebis gamotana ekranze.D

mimdevrobiTi organizaciis gamoyenebisas Canawerebi fizikurad ganl agebul ia maTi manqanaSi Setanis mimdevrobiT. amitomac aq l eqtoris nomris mniSvnel oba ar asrul ebs mowesrigebis funqcias. aseTi sakiTxi wydeba momdevno paragrafSi.

M4.2. pirdapiri mimarTvis fail ebis daproeqteba da ageba

monacemTa Canawerebis swrafad mosaZebnad da dasamuSavebl ad gamoiyeneba pirdapiri mimarTvis fail ebi. aseT fail ebSi Canawerebi erTnairi sigrZisaa da SesaZl ebel ia maTi adgil mdebareobis swrafi gaTvl a, romel ic Canaweris gasaRebis funqciaa.

aseT meTods didi mniSvnel oba aqvs drois real ur rejimSi momuSave kompiuterul sistemebSi, rogoricaa magal iTad, bil eTebis daj avSnis sistema, sabanko angariSebis kontrol is sistema, did sawarmoebsa da savaWro centrebSi produqciis aRricxvisa da marTvis sistema da a.S.

pirdapiri mimarTvis fail ebSi SesaZl ebel ia axal i Canawerebis Camateba mowesrigebis kriteriუმebis gaTval iswinebiT, yovel gvazedmeti procedurebis gareSe, rasac adgil i hqonda mimdevrobiT fail ebSi.

mimdevrobiT fail ebSi Canawerebis wasakiTxad da Casawerad gamoiyeneba, rogorc aRiniSna, fscanf() da fprintf() funqciebi. pirdapiri mimarTvisaSi ki am mizniT gamoiyeneba fread() da fwrite() funqciebi. maT aqvT Semdegi sintaksi:

```
fwrite(struct STRUCT Object, sizeof(struct STRUCT), n, *fp),
```

```
fread (struct STRUCT Object, sizeof(struct STRUCT), n, *fp).
```

konkretul i magal iTi SeiZl eba davazustoT momdevno programebSi, roml ebic eZRvneba `l eqtorTa finansuri danazogebis~ pirdapiri mimarTvis LectCred.dat-fail is Seqmnas LectorData struqturiT.

```
/*Pr_44.c create file with Directe Access */
```

```
#include <stdio.h>
```

```
#include <conio.h>
```

```
struct LectorData {
```

```
    int Nom;
```

```
    char lastName[15];
```

```
    char firstName[10];
```

```
    float Money; };
```

```
main()
```

```

{
int i;
struct LectorData blankLector = {0,"",",",0.0};
FILE *p;
clrscr();
if((p=fopen("C:\\TC\\D1\\DATA\\LectCred.dat", "w"))==NULL)
printf("Kein File geoffnet !");
else
{
for(i=1; i<100; i++)
fwrite(&blankLector, sizeof(struct LectorData), 1, p);

fclose(p);
}
}

```

amj erad C:\TC\D1\DATA katal ogSi Seiqmna stuqturirebul i cariel i fail i (monacemebis gareSe). struqtura ganzRvrul ia struct LectorData operatoriT, xol o fail is Canaweris (striqonis) anu obieqtis saxel ia blankLector. es ukanasknel i sawyisi nul ovani mniSvnel obebit Seivseba. ciki Si gaTval iswinebul ia 100-mde Canaweris arseboba.

fwrite() da fread() funqciebi gamoiyeneba Sesabamisd monacemebis Casawerad operatiul i mexsierebidan vinCesterze da piriqit, magnituri diskodan operatiul Si. maTi mesame argumenti (n=1) aris masivis el ementebis raodenoba, romel ic Caweril (diskze) an wakiTxul (diskidan) unda iqnes am operaciis Sesrul ebisas.

momdevno, 45-e programa axorciel ebs wina programiT Seqmnil i pirdapiri mimarTvis LectCred.dat-fail Si monacemebis Setanas. procesi dial oguria da momxmarebel i pasuxobs manqanis moTxovnebs. jer Seitaneba l eqtoris nomeri (Nom), romel ic unikal uri unda iyos (ar SeiZl eba arsebobdes ori l eqtoris erTidaigive angariSis nomeri). Semdeg Seitaneba gvარი, saxel i da bol os Tanxis odenoba ("- " iT aRiniSneba krediti).

/*Pr_45.c write in file with directe access */

```

#include <stdio.h>
#include <conio.h>
struct LectorData {
    int Nom;
    char LastName[15];
    char FirstName[10];
    float Money;
};
main()
{ FILE *p;
  struct LectorData Lector;
  clrscr();
  if((p=fopen("C:\\TC\\D1\\DATA\\LectCred.dat", "r+"))==NULL)
    printf("Kein File geoffnet !");
  else
  {
    printf("Input Nom :”
           “1 bis 100, 0 if end \n”);
    scanf(“%d”, &Lector.Nom);
    while(Lector.Nom != 0)
    { printf(“Input LastName, FirstName, Money\n?”);
      scanf(“%s%s%f”, &Lector.LastName, &Lector.FirstName,
            &Lector.Money);
      fseek(p, (Lector.Nom-1)*sizeof(struct LectorData), SEEK_SET);
      fwrite(&Lector, sizeof(struct LectorData), 1, p);
      printf(“Input Nom : “);
      scanf(“%d”, &Lector.Nom);
    }
    fclose(p);
  }
}

```

am programaSi gamoyenebul ia fseek() funqcia, roml is daniSnul ebaa kursoris poziciis dayeneba fail is CanawerebSi, ris Semdegac xorciel deba Cawera. kursoris pozicionirebisaTvis aq gamoyenebul ia formul a:

(Lector.Nom-1)*sizeof(struct LectorData),
 romel ic gvaZl evs wanacvl ebis mniSvnel obas fail is
 dasawyisidan (amaze miuTiTebS simbol uri konstanta SEEK_SET).
 Tu mis nacvl ad aris SEEK_END, maSin pozicionireba xdeba
 fail is bol odan, xol o Tu SEEK_CUR, maSin kursoris
 poziciidan.

avamuSavoT programa da dial ogSi SevitanoT ramdenime
 striqoni. damTavrebis SemTxvevaSi nomrisTvis SevitanoT O.

programa Seinaxavs monacemebs diskze, daxuravs fail s da
 daasrul ebs muSaobas.

axl a ganvixil oT 46-e programis teqsti, romel ic waikiTxavs
 Cvens mier Seqmnil Canawerebs pirdapiri mimarTvis fail idan
 da gamoitans ekranze.

/*Pr_46.c fread from file with directe access */

```
#include <stdio.h>
```

```
#include <conio.h>
```

```
struct LectorData {
```

```
    int Nom;
```

```
    char LastName[15];
```

```
    char FirstName[10];
```

```
    float Money;
```

```
};
```

```
main()
```

```
{
```

```
    FILE *p;
```

```
    struct LectorData Lector;
```

```
    clrscr();
```

```
    if((p=fopen("C:\\TC\\D1\\DATA\\LectCred.dat", "r+"))==NULL)
```

```
        printf("Kein File geoffnet !");
```

```
    else
```

```
    {
```

```
        printf("%-6s%-16s%-11s%-10s\n", "Nomer", "LastName",  

            "FirstName", "Money");
```

```

while(!feof(p))
{
    fread(&Lector, sizeof(struct LectorData), 1, p);
    if(Lector.Nom != 0)
        printf(“-6d%-16s%-11s%-10.2fn”,
            Lector.Nom, Lector.LastName,
            Lector.FirstName, Lector.Money);
    }
}
fclose(p);
getch();
}

```

programis muSaobis Sedegebi mocemul ia 2.19 naxazze.
 striqonebis Setanisas dial ogSi araa saval debul o

Nomer	LastName	FirstName	Money
1	Narishkin	Gulik	1700.00
2	Shone	Otto	2000.00
4	Pazazia	Zuza	0.00
5	Abashidze	Aslan	10005.00
9	Kapanadze	Kaplan	-2500.00
15	Dzukuia	Dzuku	0.00

nax.2.19

I eqtoris nomris mimdevrobis dacva. rogorc vxedavT, Canawerebi dal agebul ia am nomrebis zrdadobiT.

imisaTvis, rom SeiZl ebodes axal i Canawerebis damateba, arsebul is koreqtireba an waSl a, saWi roa special uri procedurebis damuSaveba da axal i programis dawera. 47-e programa asrul ebs aRniSnul funqciebs.

/*Pr_47.c updating file with directe access */

```

#include <stdio.h>
#include <conio.h>
struct LectorData {
    int Nom;
    char LastName[15];
    char FirstName[10];
    float Money;
};
int enterChoice(void);
void textFile(FILE *);
void updateRecord(FILE *);
void newRecord(FILE *);
void deleteRecord(FILE *);

main()
{
    FILE *p;
    int choice;
    clrscr();
    if((p=fopen("C:\\TC\\D1\\DATA\\LectCred.dat", "r+"))==NULL)
        printf("Kein File geoffnet !");
    else
    {
        while ((choice = enterChoice()) != 5)
        {
            switch(choice)
            {
                case 1:
                    textFile(p);
                    break;
                case 2:
                    updateRecord(p);
                    break;
                case 3:

```

```

        newRecord(p);
        break;
    case 4:
        deleteRecord(p);
        break;
    }
}
}
fclose(p);
}

```

```

void textFile(FILE *readPtr)
{
    FILE *writePtr;
    struct LectorData Lector;
    int C_N=0;
    clrscr();
    if((writePtr=fopen("C:\\TC\\D1\\DATA\\Angarishi.txt", "w"))
                                           ==NULL)
        printf("Kein File geoffnet !");
    else
    {rewind(readPtr);
      fprintf(writePtr, "%-6s%-16s%-11s%-10s\n",
                  "Nomer", "LastName", "FirstName", "Money");
      while(!feof(readPtr))
      {fread(&Lector, sizeof(struct LectorData), 1, readPtr);
        if(Lector.Nom != 0 && Lector.Nom != C_N)
            fprintf(writePtr, «%-6d%-16s%-11s%10.2f\n», Lector.Nom,
                        Lector.LastName, Lector.FirstName, Lector.Money);
        }
      C_N=Lector.Nom;
    }
    fclose(writePtr);
}
void updateRecord(FILE *p)

```



```

{
int N;
float transaction;
struct LectorData Lector;
clrscr();
printf("Input N to update (1 bis 100) : ");
scanf("%d", &N);
fseek(p, (N-1)*sizeof(struct LectorData), SEEK_SET);
fread(&Lector,sizeof(struct LectorData), 1, p);
if(Lector.Nom==0)
    printf("Angarishis# - %d hat keine Information.\n", N);
else
    {
    printf("%-6d%-16s%-11s%10.2f\n",
        Lector.Nom, Lector.LastName,
        Lector.FirstName, Lector.Money);
    printf("Enter chrge (+) oder payment (-) : ");
    scanf("%f", &transaction);
    Lector.Money += transaction;
    printf("%-6d%-16s%-11s%10.2f\n",
        Lector.Nom, Lector.LastName,
        Lector.FirstName, Lector.Money);
    fseek(p, (N-1)*sizeof(struct LectorData), SEEK_SET);
    fwrite(&Lector,sizeof(struct LectorData), 1, p);
    }
}

```

```

void deleteRecord(FILE *p)
{
    struct LectorData Lector, blankLector={0,"", "", 0};
    int accN;
    clrscr();
    printf("Input accN to delete (1 bis 100) : ");
    scanf("%d", &accN);
    fseek(p, (accN-1)*sizeof(struct LectorData), SEEK_SET);

```

```

fread(&Lector,sizeof(struct LectorData), 1, p);
if(Lector.Nom==0)
    printf("Angarishis-# %d existiert nicht.\n", accN);
else
    {
        fseek(p, (accN-1)*sizeof(struct LectorData), SEEK_SET);
        fwrite(&blankLector,sizeof(struct LectorData), 1, p);
    }
}

void newRecord(FILE *p)
{
    struct LectorData Lector;
    int accN;
    clrscr();
    printf("Input new accN (1 bis 100) : ");
    scanf("%d", &accN);

    fseek(p, (accN-1)*sizeof(struct LectorData), SEEK_SET);
    fread(&Lector,sizeof(struct LectorData), 1, p);

    if(Lector.Nom==accN)
        printf("Angarishis-# %d hat schon information.\n", accN);
    else
        {
            printf("Input Lastname, Firstname, Money\n? ");
            scanf("%s%s%f", &Lector.LastName, &Lector.FirstName,
                &Lector.Money);
            Lector.Nom=accN;

            fseek(p, (Lector.Nom-1)*sizeof(struct LectorData), SEEK_SET);
            fwrite(&Lector,sizeof(struct LectorData), 1, p);
        }
}
int enterChoice(void)

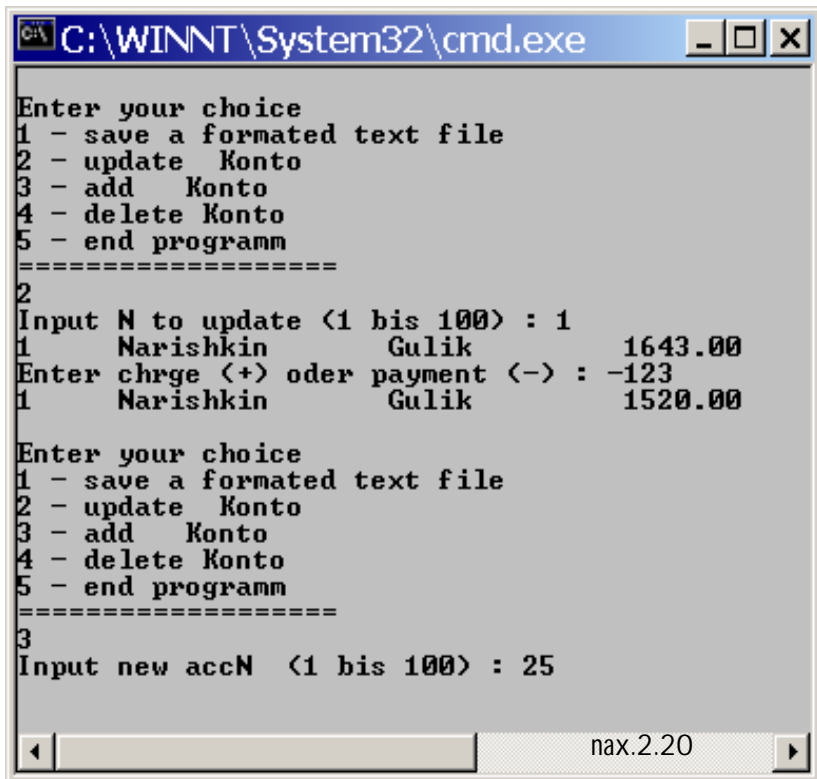
```

```

{
int menuChoice;
printf("\nEnter your choice\n"
      "1 - save a formatted text file\n"
      "2 - update Konto\n"
      "3 - add Konto\n"
      "4 - delete Konto\n"
      "5 - end programm\n");
scanf(, "%d", &menuChoice);
return menuChoice;
}

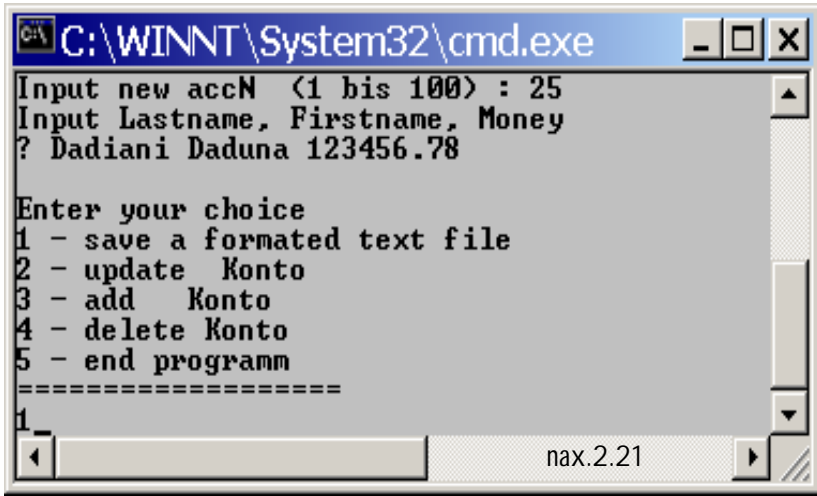
```

programis muSaobis Sedegebi naCvenebia 2.20 naxazze.
 25-e nomris Setanis Semdeg (max. 2.21) SevitanT axal



Canawers: dadiani, daduna, 123456.78. bol os mivuTiTebT 1-s, rac niSnavs tegsturi fail is Seqmnas da masSi Cveni monacemebis Caweras.

4.22 naxazze naCvenebia am tegsturi fail is saSedego



Canawerebi MS Windows-is NotePad-idan.



5. xel fasis angariSiS programa

xel fasebis angariSiS amocana did da saSual o firmebSi, sadac TanamSromel Ta raodenoba 100-ze metia, aucil ebl ad moiTxovs kompiuterul i sistemis danergvas. am amocanis sirTul e ganisazRvreba `nazardi jamis- meTodis gamoyenebiT yovel Tviurad cal keul i TanamSroml is saSemosavl o dasabegri Tanxis dasadgenad. es Tanxa damokidebul ia ramdenime faqtorze da yovel Tviurad icvl eba.

al goriTmi aseTia: ZiriTad daricxul xel fass akl deba es dasabegri Tanxa da sxva (sapensio, sankurnal o da a.S.) fiqsirebul i an procentul i (mag., xel fasis 1 %) Tanxebi.

nazardi jamis wesiT saSemosavl o gadasaxadis gamoTvl isas gaiTval iswineba TanamSroml is mier kal endarul i wl is gamnavl obaSi miRebul i Semosavl is mTliani raodenoba. mis mier mimdinare wl is 1 ianvridan mocemul momentamde miRebul TanxaTa jami. arsebobs dadgenil i sagadasaxado ganakveTebi, roml ebic xel fasis zomasa da jamur daricxul TanxebiT ganisazRvreba. aseTi Skal a mocemul ia qvemoT cxril Si.

წინაობრივი დანახვები შეზღვევები (ლარი)		საპროცენტო განაკვეთი
<<	9	0 %
10	200	12 %
201	350	15 %
351	600	17 %
601	>>	20 %

ZiriTadi samuSao adgil is mixedviT miRebul i xel fasidan daubegravi minimumis mniSvnel oba aris 9 l ari. es daubegravi minimumi ar gaiTval iswineba SemTavsebel TanamSroml ebze (igi mxol od ZiriTad samuSao adgil ze eqvitebaT).

dasabegri Tanxis gamosaTvl el ad mTliani Semosavali s unda gamovakl oT: daubegravi minimumi da kmayofaze myof pirTa raodenobaze gamravl ebul i daubegravi minimumis raodenoba. magal iTad, TanamSroml is xel fasia 100 l ari, maSin mistvis

daricxul i Tanxa Tveebis mixedviT iqneba:

აგობი №	1	2	3	...	11	12
აპენი	100	200	300	...	1100	1200

dasabegri Tanxebi j-uri TvisTvis gaiTvl eba:

$$T_{Di} = j*100 - j*9 = j*91, \text{ sadac } j=1,2,3,\dots, 12.$$

Cveni magal iTisTvis ianvarSi, martSi da dekemberSi saSemosavl o gadasaxadi S_{ij} Sesabamisad T_{Di} dasabegri Tanxebisa iqneba:

$$T_{D1} = 100 - 9 = 91,$$

$$S_{i1} = 91 * 0.12 = 10,92 \text{ l ari,}$$

Tu Tanxa Sedarebit didia, igi unda daiSal os ganakveTebis

Skal is mixedviT (mag., **200, 350, 600**).

$$T_{D3} = 3*100 - 3*9 = 273, \text{ rac daiSl eba: } \mathbf{200 + 73}, \text{ maSin}$$

$$S_{i3} = 200*0.12 + 73 * 0.15 = 24 + 12.41 = 36.41 \text{ l ari.}$$

$$T_{D11} = 11*100 - 11*9 = 1001, \quad 1001 = 200 + 350 + 451,$$

$$S_{i11} = 200*0.12 + 350*0.15 + 451*0.17 = \\ = 24 + 52,5 + 76.67 = 153.17 \text{ l ari.}$$

$$T_{D12} = 12*100 - 12*9 = 1092, \quad 1092 = 200 + 350 + 542,$$

$$S_{i12} = 200*0.12 + 350*0.15 + 542*0.17 = \\ = 24 + 52,5 + 92.14 = 168,64 \text{ l ari.}$$

xel ze asaRebi Tanxa dekembris TveSi iqneba:

$$100 - (168.64 - 153.17) = 84.53 \text{ l ari} \quad \text{da a.S.}$$

qveმოT mocemul ia C-programa am amocanis gadasawyvetad.

```
/* Pr_48.c Programms and Forms for two structures with C*/
```

```
#include <stdio.h>
```

```
#include <conio.h>
```

```
#include <ctype.h>
```

```
#include <string.h>
```

```
#define MAXMAN 20
```

```
#define W1 window(1,1,53,13)
```

```
#define W2 window(1,14,63,25)
```

```

#define W3 window(54,1 ,80,13)
#define W4 window(64,14,80,25)
#define B0 textbackground(0)
#define T0 textcolor(0)
#define B1 textbackground(1)
#define T1 textcolor(15)
#define B2 textbackground(2)
#define T2 textcolor(2)
#define B3 textbackground(3)
#define T3 textcolor(3)
#define B4 textbackground(4)
#define T4 textcolor(4)
#define C clrscr()
struct Person{
    int PN;
    char Name[15];
    char Status[10];
    float Money;
    char Phone[8]; };
struct Salary{
    int SN;
    float Money;
    float DasTanxa;
    float DasTanxaOld;
    float Payroll;
    float Salary; };
char *file1, *file2;
int Rec1=0, Rec2=0, Rec3=0, Twe;
main()
{ int i, M=8, win=0;
  B1; T1; W1; C; cprintf(" PERSONAL ");
  B2; W2; C; cprintf(" SALARY ");
  B3; W3; C; cprintf(" SCHEME ");
  B0; W4; C; cprintf(, MAINMENU ,);
  W1; B1;

```

```

gotoxy(2,2); cprintf("-----\n");
gotoxy(2,3); cprintf("! No ! Name ! Status ! Money !Phone\n");
gotoxy(2,4); cprintf("-----\n");
for(i=1; i<M; i++)
{ gotoxy(2,4+i);
  cprintf("! ! ! ! ! \n");
}

```

W2; B2 ;

```

gotoxy(2,2); cprintf("-----\n");
gotoxy(2,3); cprintf("! No ! Money ! SumMoney! PayMoney!
Old_Pay ! Payroll! Salary \n");
gotoxy(2,4); cprintf("-----\n");
for(i=1; i<M; i++)
{ gotoxy(2,4+i);
  cprintf("! ! ! ! ! ! ! \n");
}

```

W3; B3;

```

gotoxy(2, 2); cprintf("-----\n");
gotoxy(2, 3); cprintf("! N ! Scale !Payroll!\n");
gotoxy(2, 4); cprintf("!-----!\n");
gotoxy(2, 5); cprintf("! 1 ! <<- 9 ! 0 % !\n");
gotoxy(2, 6); cprintf("! 2 ! 10-200 ! 12 % !\n");
gotoxy(2, 7); cprintf("! 3 ! 201-350 ! 15 % !\n");
gotoxy(2, 8); cprintf("! 4 ! 351-600 ! 17 % !\n");
gotoxy(2, 9); cprintf("! 5 ! 601- >> ! 20 % !\n");
gotoxy(2,10); cprintf("-----\n");
/* ----- Menu ----- */

```

while(win != 4)

```

{ W4; B0;
  { int a, min=1, max=4;
    char *c[4]={ " Input ",
                 " Correct ",
                 " Count ",
                 " End " };

```



```

for(i=0; i<4; i++)
{ gotoxy(7,5+i); cprintf("%s", c[i]); }
gotoxy(7,5);
B4; T2;
i=0;
cprintf("%s", c[i]);
while((a=getch()) != 13)
{ if(a==0)
    a = getch();
switch(a)
{
case 72:
    B0; T1; gotoxy(7,5+i); cprintf("%s", c[i]);
    i--;
    if(i<min-1)
        i++;
    B4; T2; gotoxy(7,5+i); cprintf("%s", c[i]);
    break;
case 80:
    B0; T1; gotoxy(7,5+i); cprintf("%s", c[i]);
    i++;
    if(i>max-1)
        i--;
    B4; T2; gotoxy(7,5+i); cprintf("%s", c[i]);
    break;
default: break;
}
}
win=i+1;
/* —— go to Window ——*/
switch(win)
{
case 1:
    Win_1(); Rec1=0;
    break;

```

```

    case 2:
        Win_2(); Rec2=0; break;
    case 3:
        Win_3(); Rec3=0; break;
    case 4:
        win=4; exit();
    default:
        break;
}
} /* while (win != 4) */
}
getch();
}

Win_1() /* ---- Input -----*/
{FILE *f1;
    struct Person Man[MAXMAN];
    int i, j, Add=1;
    char c;
    W1; B1; T1;
    f1=fopen("Person", "r");
    /* strigonebis raodenoba */
    while((c=getc(f1)) != EOF)
    { if(c=='\n')
        Rec1++; }
    f1=fopen("Person", "a");
/* Setanis damTavrebis miniSneba */
    gotoxy(1,13); printf("If End ==>> '0' ");
    i=0;
    while(Add==1)
    { gotoxy( 4, 5+i); scanf("%d",&Man[i].PN);
        if(Man[i].PN != 0)
        { fprintf(f1,"%2d",Man[i].PN);
            gotoxy( 9, 5+i); scanf("%s",Man[i].Name);
                fprintf(f1,"%-15s",Man[i].Name);

```

```

gotoxy(25, 5+i); scanf("%s",Man[i].Status);
                fprintf(f1,"%-10s",Man[i].Status);
gotoxy(36, 5+i); scanf("%f",&Man[i].Money);
                fprintf(f1,"%6.2f",Man[i].Money);
gotoxy(45, 5+i); scanf("%s",Man[i].Phone);
                fprintf(f1,"%10s\n",Man[i].Phone);

    Rec1++;
    }
else
    {
        gotoxy(4,5+i); printf(" ");
        Add=0;
    }
    i++;
}
fclose(f1);
/* ekranis gasufTaveba */
gotoxy(1,13); printf("          ");
for(i=1; i<8; i++)
    {
        gotoxy(2,4+i);
        cprintf("! !          ! ! ! \n");
    }
} /* End Win_1() */

Win_2() /* ----- Correct ----- */
{ FILE *f1;
  struct Person Man[MAXMAN];
  int i, j;  char c;
  W1; B1; T1;
  f1=fopen("Person","r");
  /* striqonebis raodenoba */
  while((c=getc(f1)) != EOF)
    { if(c=='\n') Rec2++; }
  rewind(f1);

```

```

for(i=0; i < Rec2; i++)
    { gotoxy( 4, 5+i); fscanf(f1,"%d", &Man[i].PN);
      printf("%2d", Man[i].PN);
      gotoxy( 9, 5+i); fscanf(f1,"%s", Man[i].Name);
      printf("%-15s", Man[i].Name);
      gotoxy(25, 5+i); fscanf(f1,"%s", Man[i].Status);
      printf("%-10s", Man[i].Status);
      gotoxy(37, 5+i); fscanf(f1,"%f", &Man[i].Money);
      printf("%6.2f", Man[i].Money);
      gotoxy(45, 5+i); fscanf(f1,"%s", Man[i].Phone);
      printf("%s", Man[i].Phone);    }
fclose(f1);  } /* End Win_2() */

Win_3() /* ----- Count ----- */
{ FILE *f1, *f2;
  struct Person Man[MAXMAN];
  struct Salary Pay[MAXMAN];
  int i, j;
  float p, p0, pp, pp_old;
  float Darizxuli[MAXMAN], DasTanxa[MAXMAN],
        DasTanxaOld[MAXMAN];

  char c;
  W2; B2; T1;
  gotoxy(46,1); printf("Month = ");
  gotoxy(46,1); printf("Month = ");
  do /* Twis Controli [1-12] */
    { gotoxy(46,1); printf("Month = ");
      gotoxy(46,1); printf("Month = ");
      scanf("%d", &Twe);
    } while(Twe < 1 || Twe > 12)
    ;
  f1=fopen("Person","r");
  /* striqonebis raodenoba */
  while((c=getc(f1)) != EOF)
    { if(c=='\n') Rec3++; }

```

```

rewind(f1); /* go top in f1 */
f2=fopen("Salary","w");
for(i=0; i< Rec3; i++)
    { gotoxy( 4, 5+i); fscanf(f1,"%d", &Man[i].PN);
      Pay[i].SN=Man[i].PN;
      printf("%2d", Pay[i].SN);
      fprintf(f2,"%2d",Pay[i].SN);
      fscanf(f1,"%s", Man[i].Name);
      fscanf(f1,"%s", Man[i].Status);
      gotoxy( 9, 5+i); fscanf(f1,"%f", &Man[i].Money);
      printf("%6.2f", Man[i].Money);
      Pay[i].Money=Man[i].Money;
      Darixxuli[i]=Man[i].Money * Twe;
      DasTanxa[i]=(Man[i].Money-9)*Twe;
      DasTanxaOld[i]=(Man[i].Money-9)*(Twe-1);
      p = DasTanxa[i];
      p0= DasTanxaOld[i];
      gotoxy(17, 5+i); printf("%6.2f", Darixxuli[i]);
      gotoxy(27, 5+i); printf("%6.2f", DasTanxa[i]);
      /* wina Tvis begara */
      if(Twe==1) pp_old=0;
      else
          if(p0<=200) pp_old=p0*0.12;
          else if(p0<=350) pp_old=24+(p0-200)*0.15;
          else if(p0<=600) pp_old=46.5+(p0-350)*0.17;
          else pp_old=89+(p0-600)*0.2;
      gotoxy(37, 5+i); printf("%6.2f", pp_old);
      /* axal i Tvis begara */
      if(p<=200) pp=p*0.12;
      else if(p<=350) pp=24+(p-200)*0.15;
      else if(p<=600) pp=46.5+(p-350)*0.17;
      else pp=89+(p-600)*0.2;
      Pay[i].Payroll = pp-pp_old;
      gotoxy(46, 5+i); printf("%6.2f", pp);
      fprintf(f2,"%6.2f", Pay[i].Money);

```

```

        fscanf(f1,"%s", Man[i].Phone);
        Pay[i].Salary=Pay[i].Money - Pay[i].Payroll;
        fprintf(f2,"%6.2f", Pay[i].Payroll);
gotoxy(57, 5+i); printf("%6.2f", Pay[i].Salary);
        fprintf(f2,"%6.2f\n", Pay[i].Salary);
    }
fclose(f1);
fclose(f2);
}

```

programis muSaobis Sedegebi naCvenebia 2.23 naxazze.

6. monacemTa fail is (nakadis) printerze beWdvis programa

xSirad saWiroa fail is monacemebis gadagzavna printerze, anu gamobeWdva. amisaTvis aucil ebel ia Semdegi saxis programis gamoyeneba:

```

/*Pr_49.c File to Printer */
#include <stdio.h>
main()
{
    FILE *file-P
    file-P=fopen("PRN", "w");
    clrscr();
    if( !file-P)
    {
        printf("\n Can't access Printer \n");
        return;
    }
    /* printing */
    fprintf(file-P, "Giorgio ! testing-Text \n");
    fclose(file-P);
    printf("Ok ! \n");
    getch();
}

```

Select C:\WINNT\System32\cmd.exe

PERSONAL										SCHEME		
No	Name	Status	Money	Phone	N	Scale	Payroll					
1	Abuladze	Aspirant	100.00	44-44-44	1	<<- 9	0 %					
2	Balavadze	Assistant	240.00	21-12-11	2	10-200	12 %					
3	Giorgadze	Leiter	500.00	32-32-32	3	201-350	15 %					
4	Doldze_D	Laborant	11.00	11-11-11	4	351-600	17 %					
5	Dolidze_I	Dozent	360.00	22-22-22	5	601->>	20 %					
6	Topuria	Assistant	250.00	39-39-39								
7	Shonia	Dozent	700.00	52-52-52								

SALARY										MAINMENU		
No	Money	SumMoney	PayMoney	Old_Pay	Payroll	Salary						
1	100.00	100.00	91.00	0.00	10.92	89.08						
2	240.00	240.00	231.00	0.00	28.65	211.35						
3	500.00	500.00	491.00	0.00	70.47	429.53						
4	11.00	11.00	2.00	0.00	0.24	10.76						
5	360.00	360.00	351.00	0.00	46.67	313.33						
6	250.00	250.00	241.00	0.00	30.15	219.85						

Month = 1

Correct Count End

max.4.23

7. kiTxvebi da savarjiSoebi

1. dial ogSi SeitaneT N-namdvil i ricxvi. gamobeWdeT maTi mniSvnel obebi, min da max ricxvebi, j ami da saSual o.

2. SeadgineT programa ori veqtoris el ementTa j amisa da namravl isaTvis: $\text{sum}[n]=a[n]+b[n]$, $m[n]=a[n]*b[n]$.

3. mocemul ia namdvil ricxvTa matrica Mat[5][5]. daal ageT striqonebSi ricxvebi zrdadobiT, xol o striqonebi pirvel i svetis el ementebis kl ebadobiT.

4. gamoTval eT programul ad krameris wesiT gantol ebaTa sistemis ucnobebi:

$$\begin{cases} 10x - 13y - 9z = 24 \\ 15x + 7y - 2z = 3 \\ 2x - 11y + 17z = 19 \end{cases}$$

5. namdvil ricxvTa matricaSi Mat[5][5] daiangariSeT diagonal ze moTavsebul i ricxvebis namravl Ta sxvaoba.

6. mocemul ia matrica {"vato", "mito", "dito", "kato", "daTo"}. moawesrigeT al fabetis mixedviT.

7. aageT programa cxril isTvis studenti 5-ZiriTadi maCvenebl iT da SeitaneT 10-striqoni. bol os SeinaxeT mimdevrobiT fail Si.

8. aageT cxril i produqti-sawyobi 5 maCvenebl iTa da 10 produqtiT. Sedegebi SeinaxeT pirdapiri mimarTvis fail Si.

9. aageT programa xel fasis uwyisi 7-TanamSroml isTvis sxvadasxva xel fasebiT da gaiTval eT saSemosavl o begarisa da xel ze asaRebi Tanxebis mniSvnel obebi, fail Si SenaxviT.

10. aageT programa ori sxvadasxva feris fanjriT: studentebi da l eqtorebi. SeitaneT striqonebi orive cxril Si da Sedegebi SeinaxeT fail ebSi.

11. aageT programa cxril isaTvis rentabel uri-saqonel i 10-produqtisaTvis, sxvadasxva TviTRirebul ebiTa da fasebiT. gaiTval eT mogeba, rentabel oba. mocul obebis mixedviT gaiTval eT j amuri Tanxebisa da d.R.g.-s mniSvnel obebi, fail Si SenaxviT.

12. ra gansxvavebaa mimdevrobiT da pirdapiri mimarTvis fail ebs Soris ?