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Land Consolidation Software Algorithm for Agricultural Reform in Turkey

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ABSTRACT

In this research, some algorithms have developed the name of in lighten and given rise level of land consolidation software's for TRGM (General Directorate of Agriculture Reform) applications. Some information has been given about the concept of land consolidation, extension, possibilities of automation. A program is developed for determining ownerships in land distribution by Delphi 5 programming language to test of applicability of developed algorithms. According to research results, algorithms have easiness in planning software. Obtained data calculated with developed program have been compared with TRGM Konya Department data. It has been seen same results. Thus, accuracy of programming algorithms has been tested.

Key words: Land consolidation, agricultural reform, algorithm, flow chart, software

INTRODUCTION

In many parts of Europe and elsewhere, land consolidation is currently essential for ensuring the economic viability of rural areas, facilitating environmental management or rationalizing urban growth (Crecente *et al*., 2002; Van der Brink, 1999; Sonnenberg, 1996; Van Lier, 2000). In its widest terms, this kind of process can involve multidisciplinary consideration of economic, environmental and social factors (Van den Noort, 1987; Janssen and Rietveld, 1985; Huylenbroek and Martens, 1992; Huylenbroek *et al*., 1996; Coelho *et al*., 1996, 2001; Gonzalez *et al*., 2004).

Multidisciplinary approaches and models provide useful support for the decision-making process in LC, but their reliability depends on a proper definition of the relevant criteria, which will vary from country to country due to differences in natural and social conditions and different objectives of land-use policy (Sklenicka, 2006).

Land consolidation projects are conducted to consolidate fragmented agricultural properties, scattered parcels of the distinct farms and thus to achieve improvements in the harvest and the living standards. It is carried out by means of projects neighbouring the rural area through a project management. Land consolidation may also include the improvement of the road and of the water management system, as well as of the landscape and the conditions of nature in project areas (Sonnenberg, 2002). It also includes the process of fragmented or scattered plots of farms. For this purpose, the land is divided into blocks by planning an optimal network for roads and channels and then the problem of reallocation is solved by answering to the question how much land from which block is given to a farm? In some of the land consolidation applicable country, the possible

applications of operations research techniques are investigated. Klempert (1974), Kropff (1977), Reimer (1983) and Lemmen and Sonnenberg (1986) studied how to use different algorithms of the mathematical programming methods in reallocation of farm lands (Avci, 1999). Different and complementary general-purpose software tools aid experts to solve particular aspects of only some tasks of the process. These tools use different data models and formats. Moreover, the high volume of consolidation information is spread among different institutions and there is a lack of coordination between the participants involved in the process: landowners, rural engineers, local and regional administrations and consultants. Specific-purpose tools have also been designed to assist the development of consolidation plans, including those in the Netherlands (Rosman and Sonnenberg, 1998), Hungary (Kovacs, 2001) and Morocco (Semlali, 2001), but they only cover partial aspects of the consolidation process (Touriño *et al*., 2003).

In many countries, land consolidation is performed in order to improve the rural areas, which comprise substantial parts of the available land and they are subject to a series of pressures including water shortage, land degradation, failing commodity prices and depopulation. Land consolidation includes the unification and re-registration of lands, which are divided for reason of heritage, sales or irrigation canals. The application of land consolidation commenced officially in the year 1961 in the Konya region, Turkey. Turkish land consolidation regulations are based on various acts concerning landscape renovation within land consolidation areas, which focuses among other things, on the planting of shrubs and trees, the creation of small parks-recreation areas in non-agricultural areas, the preservation of cultural heritages and environmental aspects within agricultural areas. Land consolidation projects are carried out by the General Directorate of Rural Services and General Directorate of Agricultural Reform (Banger and Sisman, 2001).

According to the conventional definition, redistributive land reform is a public policy that transfers property rights over large private landholdings to small farmers and landless farm workers (Griffin *et al*., 2002). The universally accepted definition, implicitly and explicitly, excludes non-private lands (i.e., public, state or communal lands). The underlying assumption in the dominant land reform literature is that lands that are officially classified as public/state properties, especially those used to open up resettlement areas, are lands that are generally not cultivated and inhabited and are without pre-existing private control. In such conditions, it is logical to conclude that land policies that concern these lands do not recast any land-based production and distribution relationships. The literature on land reform is strong on this point and rightly so. Yet, it becomes problematic when the use of the same lens is stretched as far as to examine public lands that are, in fact, under varying degrees of cultivation, imbued with private interests and marked by production and distribution relationships between the landed and the landless and land-poor, between the elite and non-elite, often not captured by official census. The failure to recognize the potentially and actually contested nature of much of public lands risks removing them from the reach of redistributive reform and so risks the continuation of many of the economic, social and political problems associated with an agrarian structure that is dominated by the landed classes as well (Borras, 2006).

In any land consolidation process, it is important to obtain and process raw data in a short time in addition to data storage and retrieval for storing them for other applications and further processes and to present the results in graphic, numeric and alphanumeric forms.

Therefore, computer itself is not sufficient but needs relevant software programs and the algorithms. Besides, the hardware and software needed, manpower is also very significant in land consolidation projects.

Although, there are some exceptions the software use in Turkey for land consolidation projects is insufficient. In this study, software algorithms are developed in line with the land consolidation projects carried out by the General Directorate of Agricultural Reform. For this purpose, a program we proposed for determining ownerships in land consolidation by using Delphi 5 programming facilities.

APPLICATIONS OF GENERAL DIRECTORATE OF AGRICULTURAL REFORM

The agricultural areas in Turkey have become insufficient due to high population growth rate and decreasing productivity. The increase of land productivity is related to improvement of land and water resources, technology level, agricultural structure and the quantity and quality of seed, fertilizer, pesticide and water use. The land consolidation helps to develop agricultural structure, which is one of the main factors in improvement of land and water resources. Fortunately, the opportunities offered by satellite images such as explained above can meet many of requirements described in land consolidation projects (Cay *et al*., 2002).

The purposes of land consolidation as given in the related law, Agricultural Reform Law for land consolidation in well-watered areas and application regulations are as follows:

- Connection of highly fragmented plots according to the principles of modern management
- Improvement of land and soil
- Reorganization and improvement of agricultural managements
- Building roads, drainage and water management systems
- Leveling and tree planting in mountainous areas
- Arrangement and reallocation of land and enlargement of managements
- Arrangement of settlements (electrification etc.), by joining scattered plots, improvement of all aspects of agricultural life in order to obtain highest productivity of land and labor and taking measures in technical, social, cultural and economic aspects to increase agricultural life (Banger, 1992)

According to the same law agricultural lands at the end of the consolidation are registered to its owner and the remaining land is left with the treasury registration. The registered land can not be divided into smaller parts than the normal size. The law has defined the smallest agricultural holding size as distribution norm (Gur and Demirel, 2002). Table 1 shows laws of land arrangement in Turkey, and many laws and regulations may be added in Table 1.

Table 1: Laws of land arrangement in Turkey

Law			
Date	No.	Targets	Distributed land and its type in application (Dekar:Dk)
1929	Budget	Land distribution	6787234 Dk. Arable field
02.06.1929	1505	Land distribution	327081 Dk. Vineyards and orchards
16.04.1934	2510	Land distribution	2999825 Dk. Agricultural land
1945	4753	Land distribution	22013060 Dk. Agricultural land
16.06.1970	1306	To settle	27147120 Dk. Pasture land
26.05.1905	1757	Land reform (land improve and distribution)	
22.11.1984	3083	Agricultural reform (agricultural improve and land distribution): 50000 Dk. Agricultural land	

MATERIALS AND METHODS

In this study, Delphi 5 programming approach is used as a software for determining ownerships in land distribution according to grade system of Technical Instruction in General Directorate of Agricultural Reform applications. Source codes of software are given in Appendix 1 (Iscan, 2003). This study was conducted in 2003.

Appendix

Source Codes of Software

```
unit arazi;
interface
uses
  Windows, Messages, SysUtils, Classes, Graphics,
Control, Form, Dialogs,
  StdCtrls,ExCtrls,Printers;
type
  Tform1 = class(TForm)
    RadioGroup1: TradioGroup;
    RadioGroup2: TradioGroup;
    RadioGroup3: TRadioGroup;
    RadioGroup4: TradioGroup;
    RadioGroup5: TRadioGroup;
    RadioGroup6: TRadioGroup;
    RadioGroup7: TRadioGroup;
Sayiayarla(gelen:String;basamak:Integer):String;
    Button1: TButton;
    Edit1: Tedit;
    Label1: Tlabel;
    Edit2: Tedit;
    Edit3: Tedit;
    Edit4: Tedit;
    Edit5: Tedit;
    Edit6: Tedit;
    Edit7: TEdit;
    Edit8: Tedit;
    Edit9: Tedit;
    Edit10: Tedit;
    Edit11: Tedit;
    Edit12: Tedit;
    Edit13: Tedit;
    Edit14: Tedit;
    Edit15: Tedit;
    Label2: Tlabel;
    Label3: Tlabel;
    Label4: Tlabel;
    Label5: Tlabel;
    Label6: Tlabel;
    Label7: Tlabel;
    Label8: Tlabel;
    Label9: Tlabel;
    procedure Button3Click(Sender: TObject);
    procedure Button4Click(Sender: TObject);
    procedure Button5Click(Sender: TObject);
    procedure Button6Click(Sender: TObject);
  private
  public
    {Public declarations}
  end;
var
  Form1: Tform1;
implementation
{$R *.DFM}
function
Var
  i:Integer;
  nokta:Integer;
  giden:String;
  gecici:String;
  gecici1:String;
  elde:Word;
  dongu:Word;
Begin
    Giden:='';
    For I:=1 to length(gelen) do
    Begin
      If gelen[i]=',' then
      Begin
        nokta:=I;
      End;
    End;
  If nokta+basamak<length(gelen) then
  Begin
    If strtoint(gelen[nokta+basamak+1])>=5 then
      elde:=1 else elde:=0;
      dongu:=Nokta+basamak;
    For I:=dongu downto 1 do
    Begin
        If gelen[i]<>',' then
```

Appendix: Continued

```
      Label10: Tlabel;
      Label11: Tlabel;
      Label12: Tlabel;
      Label13: Tlabel;
      Button2: Tbutton;
      Edit16: Tedit;
      Edit17: Tedit;
      Label14: Tlabel;
      Label15: Tlabel;
      MEMO1: Tmemo;
      OpenDialog1: TopenDialog;
      Button3: Tbutton;
      Button4: Tbutton;
      SaveDialog1: TsaveDialog;
      Button5: Tbutton;
      Label16: Tlabel;
      PrintDialog1: TprintDialoge
      Button6: Tbutton;
      Edit18: Tedit;
      Label17: Tlabel;
      procedure Button1Click(Sender: Tobject);
      procedure Button2Click(Sender: Tobject);
edit12.text:=floattostr((strtofloat(edit2.text)/a)+(strt
ofloat(edit4.text)/b) + (strtofloat(edit6.text)/c)+
(strtofloat(edit8.text)/d));
edit13.text:=floattostr((((strtofloat(edit10.text)/strto
float(edit11.text))* (strtofloat(edit3.text)+
strtofloat(edit5.text)+ strtofloat(edit7.text)+
strtofloat(edit9.text)))/a));
edit14.text:=floattostr(strtofloat(edit12.text)+strtofl
oat(edit13.text));
edit15.text:=floattostr(((strtofloat(edit14.text)/strtofl
oat(edit10.text))* m));
   case RadioGroup1.ItemIndex of
      0: toplam_puan:= toplam_puan+1;
      1: toplam_puan:= toplam_puan+3;
      2: toplam_puan:= toplam_puan+5;
      3: toplam_puan:= toplam_puan+7;
      4: toplam_puan:= toplam_puan+8;
      5: toplam_puan:= toplam_puan+9;
      6: toplam_puan:= toplam_puan+10;
      7: toplam_puan:= toplam_puan+0;
   end;  begin
      case RadioGroup2.ItemIndex of
      0: toplam_puan:= toplam_puan+10;
      1: toplam_puan:= toplam_puan+8;
      2: toplam_puan:= toplam_puan+4;
      3: toplam_puan:= toplam_puan+2;
      4: toplam_puan:= toplam_puan+1;
                  Begin
                     gecici:=Gelen[i];
                     gecici:=inttostr(strtoint(gecici)+elde);
                     If strtoint(gecici)>9 then
                     Begin
                        giden[i]:='0';elde:=1;
                     End else
                     begin
                        giden[i]:=gecici[1];elde:=0;
                     end;
                  end else giden[i]:=',';
               end;
               if elde=1 then giden:='1'+giden;
               result:=giden;
            end else result:=Gelen;
      end;
      procedure TForm1.Button1Click(Sender: TObject);
      var
      toplam_puan: double;
         const
         a=0.707; b=0.816; c=1; d=1.414; m=5;
      begin
edit18.text:= floattostr((toplam_puan)+ strtofloat (
edit1.text)+ strtofloat(edit15.text));
edit18.text:= sayiayarla(edit18.text,3);
      end;
procedure TForm1.Button2Click(Sender: TObject);
begin
memo1.lines.add(' '+ edit17.text+ '       ' +edit16.text
+'          '+ edit18.text);
end;
procedure TForm1.Button3Click(Sender: TObject);
begin
if not opendialog1.Execute then exit;
memo1.Lines.LoadFromFile(opendialog1.FileName);
end;
procedure TForm1.Button4Click(Sender: TObject);
begin
if not savedialog1.execute then exit;
memo1.Lines.SaveToFile(savedialog1.filename);
end;
      procedure TForm1.Button5Click(Sender: TObject);

halt;
end;
procedure TForm1.Button6Click(Sender: TObject);
var
dosya: textfile;
satirno: integer;
```

Appendix: Continued

```
      5: toplam_puan:= toplam_puan+0;
   end;  if not printdialog1.Execute then exit;
      case RadioGroup3.ItemIndex of
      0: toplam_puan:= toplam_puan+7;
      1: toplam_puan:= toplam_puan+10;
      2: toplam_puan:= toplam_puan+5;
      3: toplam_puan:= toplam_puan+2;
      4: toplam_puan:= toplam_puan+0;
   writeln(dosya, memo1.lines[satirno]);
   case RadioGroup4.ItemIndex of
      0: toplam_puan:= toplam_puan+5;
      1: toplam_puan:= toplam_puan+10;
      2: toplam_puan:= toplam_puan+8;
      3: toplam_puan:= toplam_puan+0;
   case RadioGroup5.ItemIndex of
      0: toplam_puan:= toplam_puan+0;
      1: toplam_puan:= toplam_puan+5;
      2: toplam_puan:= toplam_puan+15;
      3: toplam_puan:= toplam_puan+30;
   end;
      case RadioGroup6.ItemIndex of
      0: toplam_puan:= toplam_puan+5;
      1: toplam_puan:= toplam_puan+5;
      2: toplam_puan:= toplam_puan+10;
      3: toplam_puan:= toplam_puan+0;
   end;
      case RadioGroup7.ItemIndex of
      0: toplam_puan:= toplam_puan+5;
      1: toplam_puan:= toplam_puan+0;
   begin

   assignprn(dosya);
   rewrite(dosya);
   printer.Canvas.Font.Name:='arial';
   printer.Canvas.font.Size:=14;
   for satirno:= 0 to memo1.lines.count do
   begin
      writeln(dosya,memo1.lines[satirno]);
   end;
   system.closefile(dosya);
   end;
   end.
   end;
```

Calculate of participation share of common facilities: All parcels have to benefit from canal and road network. Therefore, the project area is planned with sufficient canal and road systems. These calculated areas are taken from the land pieces that are not registered and if this is not possible then the area is reduced proportionally from the areas of the landowners.

According to another law, a participation share of 10% for common facilities, like roads and canals, most be deducted from the lands that belong to real and artificial people of public and private law. Any cost for such a consolidation and extra roads (registration external lands) will be used for this purpose. If deduction amount exceeds 10%, extra amount is provided from the treasury lands primarily. The following equation is used to compute participation share of common facilities, OTKPO, as:

$$OTKPO = \frac{h - r - a}{h}$$

where, h is the total area of cadastre parcels; r is the total area of blocks and a is registration external lands. According to OTKPO, Cadastre parcels are necessary to read and gather from the available database. Total block areas are necessary to calculate from block corner coordinate (Fig. 1).

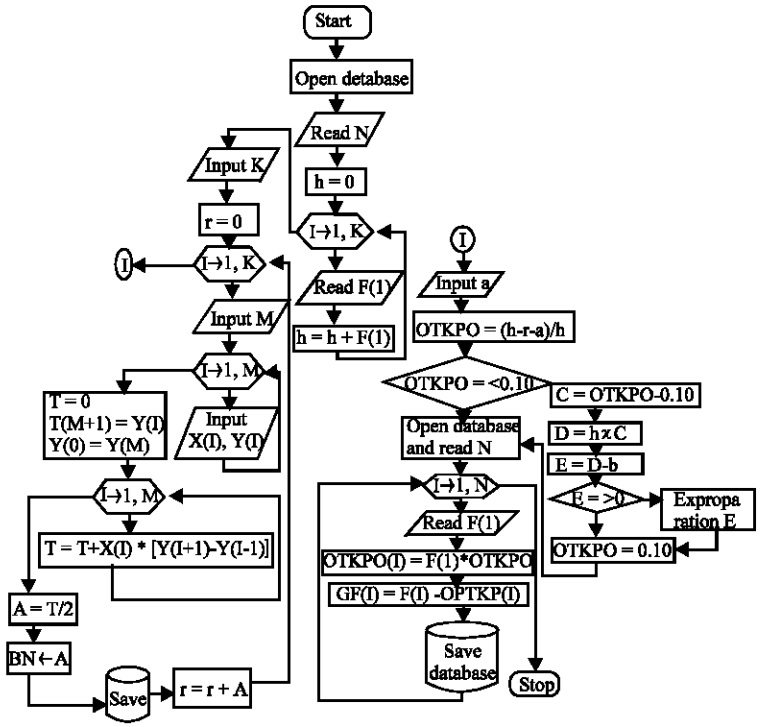

Fig. 1: Flow chart prepared to calculate the sharing ratio of common area

Flow chart prepared to calculate sharing ratio of common area. The following list of terms is used in the Algorithm 1.

I = Loop
K = Block No.
M = No. of block corner
X, Y = Block corner coordinates
T = Block area
F = Area of cadastre parcel
N = No. of cadastre parcel
OTKP = Share of common facilities
GF = Land area given back to owner
b = Treasury lands
C = Deduction ratio of more than 10%
D = Deduction area according to ration of more than 10%
E = Remaining land after given back treasury lands

Algorithm 1: Calculate of participation share of common facilities:

1 Start
2 Read h and r
3 Input

4 Calculate $_{OTKPO} = \frac{h - r - a}{h}$
5 If OTKPO =< 0.10 then go to 6. Else go to 12
6 Open database and Read N
7 I → 1, N
8 Read F(I)
9 Calculate OTKP(I)=F(I)×OTKPO
10 Calculate GF(I) = F(I) – OTKP(I)
11 Save database and go to 16
12 Calculate C = OTKPO – 0.10
13 Calculate D = h×C
14 Calculate E =D – b
15 If E => 0 then OTKPO = 0.10 after expropriation E and go to 6. Else OTKPO = 0.10 and go to 6
16 End

Classification study: Irrigated and arid farmlands are distributed by using the size of farmlands, norms of the allocation, the area that remains to the owner and coefficients of transformation. The land is ranked between the intervals I-VIII. Four degrees are evaluated between each other with coefficients of transformation as given in Table 2. The degrees between V-VIII lie are not subject to evaluating.

Technical instruction arranges land consolidation independently from land reform. For ranking process all parcels in the project areas are marked as related to market value and soil indices. Market value index is related to the soil productivity, the variety of production, the features of soil, location, the irrigation condition, the distances to the holdings center, the village and the market, size and shape of the parcel and transportation condition.

The land and market value indices are marked as 100 point. The Unit Value of the Parcel (UVP) is computed as the mean values of these indexes. For the parcels that have more than one land index and market value index the UVP is more than one. The weighted mean value of these indices is equal to the Weighted Mean Value of the Parcels (WMNP). The highest WMNP is accepted as first rank and accordingly the other parcels in application area are ranked. In the case of approximately the same WMNPs the mean value called as Rank Mean Point (RMP). The rating of RMPs among themselves provides the equivalency of degrees as (Demir *et al.*, 2002).

$$UVP = (\text{Soil index} + \text{Market value index})/2$$

The following terms are used in the Algorithm 2.

Table 2: Coefficients of transformation

Degree of soil	Coefficients of transformation lands of degree of III to the other degrees
I	0.707
II	0.816
III	1.000
IV	1.414

GF	=	Land area given back to owner
I, J, K and L	=	Loop
N	=	No. of cadastre parcels
S	=	No. of holdings
TPDS	=	Total No. of parcel value for a holding
TE	=	Soil Index
MVI	=	Market value index
UVP	=	Unit value of the parcel
C	=	Arrange variable
A	=	Parcel degree variable
Degree	=	Parcel degree
M	=	Variable for transformation table
T	=	Transformation table index
BDF	=	First degree area of a parcel
TBDF	=	Total area of first degree area of a holding

Algorithm 2: Calculation of first degree area for each holding in general directorate of agricultural reform applications:

1 Start
2 Open database
3 Read N
4 I→1, N
5 Read TE(I) and MVI(I)
6 Calculate UVP (I) = TE(I) × MvI(I)/2
7 Save database
8 I→1, N-1
9 J→I+1, N
10 If UVP (I) >=UVP (J) then go to 9
Else UVP(J)→C,UVP(I)→UVP(J), C→UVP(I) and go to 9
11 Save UVP
12 A = 1
13 I→1, N
14 Degree(I) = A
15 If UVP (I)=UVP(I+1) then go to 16
Else Degree (I+1) = Degree (I) + 1 and calculate A=A+1 and go to 18
Degree (I+1) = A
16 UVP (A) = UVP (I)
17 UVP (A) = UVP (I+1)
18 Save
19 K→1, A
20 L→1, A
21 Calculate M = UVP (K) / UVP (L), T(K,L)←M and T(L,K)←M
22 Save

23 Read S and N
24 J → 1, S
25 TBDF = 0
26 I → 1, N
27 Read T , GF(I) and Degree (J,I)
28 A ← Degree (J,I)
29 Calculate UVP (J,I) = GF(I)×T(A,1)
30 Calculate TBDF = TBDF+BDF(J,I) and go to 27
31 TBDF(J) = TBDF
32 Save database
33 Stop

Reallocation study: Infrastructure and superstructure application projects are planned preliminarily by private or governmental institutions and must agree with land consolidation projects. After the completion of irrigation, drainage, road, grading and ownership etudes, blocks are formed on Standard Topographic Cadastral Maps by irrigation, drainage and road plans. In forming the blocks, length and direction of irrigation, grading state, rate of plot width and length must be taken into consideration.

In land consolidation, land planning and implementing is conducted by land reallocation step. New settlement parcels are obtained according to landowner desire within blocks of the public facilities. Landowner contributions provide easiness in the reallocation. According to General Directorate of Agricultural Reform, reallocation study is implemented by reduced unit value of the parcel. First degree area is calculated separately for each block then according to landowner desire settlement blocks are held. The remaining area is registered in the name of treasury lands and hence parceling is completed. New parcels will be formed within the settlement blocks with the necessary iteration on map or in computer. Algorithm 3 executes all calculations for reallocation. The following terms are used in this Algorithm.

BN = Block No.
BBDF = First degree area of block
T(K,1) = Transformation table
D = No. of parcel index in block
KF = Area of same degree group
BDF = First degree area
TBDF = First degree area of a holding
GBBDF = Remaining first degree area in block after reallocation
HZN = Remaining first degree area in the name of state
THZN = Total of first degree area in name of state
M = Landowner wishes

Algorithm 3: Calculate of first degree area of the blocks and reallocation:

1 Start
2 Input BN
3 BBDF = 0

4 Input D
5 I→1, D
6 Input T(K,1)
7 Input KF(I)
8 Calculate BDF(I) = KF × T(K,1)
9 Calculate BBDF = BBDF + BDF(I)
10 BBDF→ BN
11 Save
12 If new BN is inputted then go to 2
13 Open database
14 Input S
15 J→1, S
16 Read TPDS(J)
17 I = 1
18 Input M(I)
19 Read BN
20 Read BBDF
21 If BBDF = 0then I = I+1and go to 18
22 If TBDF(J)> = BBDF then BBDF→ BN else go to 26
23 Save
24 Cal. TBDF(J) = TBDF(J)–BBDF
25 If TBDF(J) = 0 then go to 5 else I = I + 1 and go to 18
26 Cal. GBBDF = BBDF – TBDF(J)
27 GBBDF→ BBDF
28 BBDF→ BN, TBDF (J) →BN
29 Save and go to 5
30 THZN = 0
31 Input BN
32 Read BBDF
33 Calculate THZN=THZN + BBDF
34 BBDF→ HZN, HZN→ BN
35 Save
36 Is input different BN then go to 31
37 Stop

Sample program: Here, some algorithms are developed for determination of ownerships in land distribution for General Directorate of Agricultural Reform applications. For this purpose, a program is developed for ownerships determination in land distribution by using Delphi 5 programming.

In this approach point of group priority is determined in Technical Instruction for Expropriation, Consolidation and Reallocation, where if is marked as 100 points (Table 3).

The following terms are used in the Algorithm 4.

FN = Form No.
Name_surname = Name and surname of farmer

Table 3: Point of group priority

Criterias of determining ownership	Point
Land	5
Education	10
Agricultural education	10
Age	10
Marital status	10
Duration of settlement	30

IK, IIK, IIIK, IVK = Arid land of first, second, third and fourth degree
IS, IIS, IIIS, IVS = Irrigated land of first, second, third and fourth degree
KN = Accepted arid land norm by Council of Ministers
SN = Accepted irrigated land norm by Council of Ministers
a, b, c, d = Transformation coefficient
l = Irrigated land of farmer
e = Transformed value from arid land to third degree land
f = Transformed value from arid land to irrigated land
g = Third degree arid land value of f
h = Transformed value from total land of farmer to third degree land
I = Land point of farmer
k = Education point
n = Agricultural education point
o = Age point
p = Point of marital status and child No.
r = Duration of settlement point
s = House point
t = Means of production point
M = Singular holding point
Total point = Total point of farmer

Algorithm 4: Point of determining ownership:

1 Start
2 Input FN
3 Input Name_surname
4 Input IK, IIK, IIIK, IVK
5 Input IS, IIS, IIIS, IVS
6 Input KN ve SN
7 a = 0.707, b = 0.816, c = 1, d = 1.414 , Total_point = 0
8 Calculate l = IS + IIS + IIIS + IVS
9 Calculate e =
10 Calculate f = (KN/SN) * l
11 Calculate g = f / a

12 Calculate h = e + g
13 Calculate I = (h/kN) * 5
14 Total_point= Total_point + I
15 If farmer is reader and writer then, k= 1
Primary school then, k= 3
Middle school then , k= 5
High school then, k= 7
University is 2 year then, k= 8
University is 3 year then, k= 9
University is 4 year and more than, k=10
16 Total_point= Total_point + k
17 If agricultural education is more than 6 month(include 6 month) then , n= 10
6-3 month (include 3 month) then , n= 8
1 month (include 1 month) then, n= 4
1 month -2 week (include 2 week) then, n = 2
Less 2 week then, n = 1
No then, n = 0
18 Total_point= Total_point + n
19 If age=<25 then, 0 = 7
45 age then, 0 = 10
46-55 age then, 0 = 5
56-65 age then , 0 = 2
Age >65 then, 0 = 0
20 Total point = Total point + 0
21 If farmer is married and childless then, p = 5
Married and having children then, p = 10
Widow or widower and having children then, p = 8
Widow or widower and childless then, p = 0
22 Total_point= Total_point + p
23 If duration of settlement is 1 year then, r = 0
1-3 year then, r = 5
4-10 yer then, r = 15
More than 11 year, r = 30
24 Total point = Total_point + r
25 If there is house then, s = 5
There is holding building then, s = 5
There is house and holding building then, s = 10
No then, s = 0
26 Total point = Total_point + s
27 If there is means of production then, t = 5
No then, t = 0
28 Total point = Total point + t

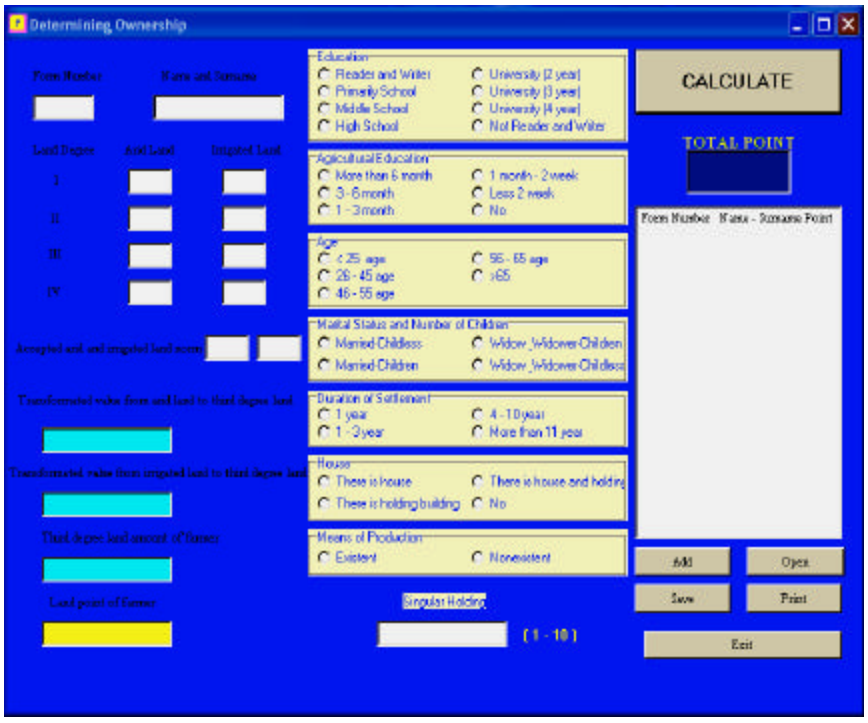

Fig. 2: Screen view of developed program

29 Input M
30 Calculate Total_point= Total_point + M
31 Save
32 If new input is yes then go to 2 else stop

Figure 2 shows the screen view of the proposed program. Form number, name and surname of farmer, land size, dried and watery land norms by Council of Ministers are entered into white box in the left top of the screen corner. Subsequently, the buttons are pressed in center of screen. House box is entered with a value between 1 and 10 and calculate button is pressed, which calculates the total third degree land and its amount of watery and dried land of farmer in green box then program ends the necessary operations. It calculates to land point of farmer in yellow box, which calculates the total point of farmer in dark blue. When add button is pressed program lists form number, name and surname of farmer and total point. It is possible to save and/or print the results.

RESULTS AND DISCUSSION

Land distribution data of Yaglibayat Village is taken from General Directorate of Agricultural Reform Konya Department, which is shown in Fig. 3.

The proposed algorithms have easiness in planning through software, which execute data given by General Directorate of Agricultural Reform Konya Department and it yields similar results, which proves the accuracy of programming algorithms.

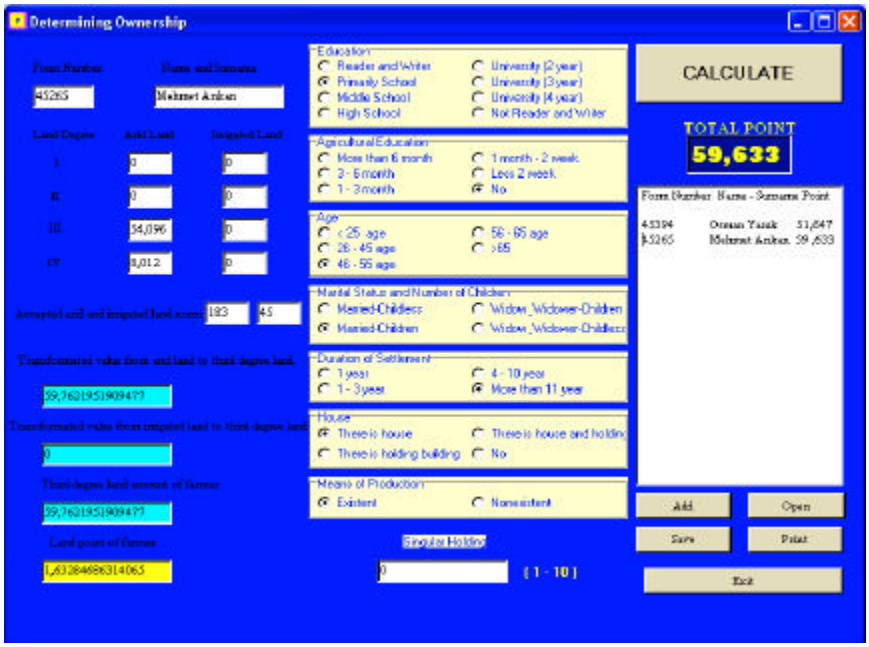

Fig. 3: Inputting of data

CONCLUSIONS

Algorithm preparation is the most important step in the process of software development. Software developers make use of the algorithms for land consolidation, which can be coded in any computer language and hence bring many innovations to the applications of land consolidation.

Some algorithms of land consolidation software have been developed for General Directorate of Agricultural Reform applications. In addition, sample program is also developed for determining ownerships in land distribution by using Delphi 5 programming.

The program is developed differently from algorithms of land consolidation, because, algorithms of land consolidation are developed inside the existing database system.

Land consolidation software programs reduce the possible damages of land consolidation projects, costs and manpower to minimum and maximize the productivity.

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