saqarTvelos teqnikuri universiteti

gia surgulaZe

daprogramebis vizualuri meTodebi da instrumentebi: interfeisebi da aplikaciebi

(Borland C++ Builder, SQL, QBE)

Tbilisi 2007

sarCevi

- Sesavali 3

I Tavi: monacemTa manipulirebis ena *SQL* 4

1.1. *SQL*-enis sintaksi da misi gamoyenebis vizualuri instrumenti 5

1.2. vizualuri komponentis klasi *TQuery* 11

1.3. *QBE* vizualuri instrumenti SQL moTxov-nebis asagebad 12

1.4. Excel cxrilis kavSiri *BC++B*-is formasTan 15

1.5. bazebisa da cxrilebis marTva 17

1.6. *SQL* Explorer 19

1.7. filtrebis dayeneba monacemTa bazis cxrilSi 6 21

1.8. angariSis formireba da beWdva *QReport* 25

II Tavi: aplikaciebisa da momxmarebelTa interfeisebis daprogrameba 29

2.1. xelfasis amocanis daproeqteba da ageba 29

2.2. jandacvis obieqtebis monitoringis kompiuteruli sistema 37

2.3. studentTa testirebis avtomatizebuli sistema 41

2.4. komerciuli obieqtis mravalganzomilebiani analizis paketis ageba *Decision Cube*-iT U 48

2.5. ganawilebuli sistemis resursebis marTvis procesis modeli 56

- sakontrolo kiTxvebi da savarjiSoebi 64
- literatura 65

Sesavali

marTvis sainformacio sistemebis daproeqteba da Semdgom daprogrameba Tanamedrove vizualuri kompiuteruli teqnologiebis saSualebiT metad mniSvnelovani da aqtualuria, rameTu sagrZnoblad umjobesdeba proeqtis realizaciis xarisxi da mcirdeba misi damuSavebis dro da xarjebi.

gansakuTrebiT sayuradReboa dRes programuli inJineriis *(Software Engineering)* iseTi instrumentis aTviseba, rogoricaa unificirebuli modelirebis ena *(UML - Unified Modeling Language*), vinaidan igi iTvleba kompiuteruli programuli paketebis Seqmnis meTodologiurFsafuZvlad.

esaa daprogramebis obieqt-orientirebul meTodze Seqmnili Tanamedrove informaciuli teqnologia, romelic aris modulebis specifikaciis, konstruirebis, vizualizebisa da dokumentirebis ena da aRniSvnaTa sistema. dRes am standarts iyenebs Microsoft, Oracle, Hewlet-Packard da sxva cnobili firmebi.

daprogramebis Tanamedrove instrumentebi integrirebuli paketebia, romlebic aerTianebs monacemTa aRwerisa *(DDL)* da manipulirebis *(DML)* enebs (monacemTa bazis saxiT), procedurebis damuSavebis xerxebs klasTa Teoriis gamoyenebiT da standartul biblioTekebs. amgvarad, maTSi realizebulia obieqt-orientirebuli daprogramebis meTodi da stili: inkafsulaciis, klasTa memkvidreobiTobis, polimorfizmisa da abstraqciis saxiT.

aqtualuri da farTod gamoyenebadia SQL-ena (Structured Query Language), romelic manipulirebis enis standartad iqca mTels msoflioSi. ar arsebobs daprogramebis ena an monacemTa bazebis marTvis sistema, romelSic igi ar gamoiyenebodes.

moTxovnebis formirebis procedurebis avtomatizebis TvalsazrisiT metad sayuradReboa *QBE*-ena *(Query By Exampl)*. am instrumentiT momxmarebeli advilad akompleqtebs *SQL*-enis struqturis mqone moTxovnebs, romlebsac Semdgom avtomaturad amuSavebs, magaliTad, Borland_**C++Builder** -ze agebuli kompiuteruli sistema.

el-wignSi ganixileba aseTi saxis kompiuteruli aplikaciebi sxvadsxva gamoyenebiTi sferoebidan. aq mniSvnelovani adgili uWiravs momxmarebelTa interfeisebis agebisa da maTi monacemTa bazebTan dakavSirebis amocanebis gadawyvetas.

I Tavi
monacemTa manipulirebis ena *SQL*

1.1. SQL-enis sintaqsi da misi gamoyenebis vizualuri instrumenti

daniSnuleba: *SQL* (*Structured Query Language* – struqturirebuli moTxovnebis ena) gamoiyeneba monacemTa bazebis cxrilebidan saWiro informaciis amosaRebad. amisaTvis iwereba moTxovna (Query) firma maikrosoftis mier damuSavebul SQL-enis standartis Sesabamisad.

SQL-enis sintaqsi ganvixiloT misi ZiriTadi amorCevis Select-operatoris magaliTze. konstruqcia aseTia:

SELECT <list of fields> FROM <Table>

[WHERE <clause>] [ORDER BY <list of fields>]

mag., operatoriT

*SELECT * FROM Students*

airCeva studentebis cxrilidan yvela (*) veli.

SELECT ST_NAME, TEL FROM Students WHERE CITY=”Tbilisi” AND AGE > 22 AND AGE < 30

amoirCeva im studentTa gvarebi da telefonebi, romlebic cxovroben TbilisSi da maTi asaki aris 22 – 30 farglebSi.

rogorc vxedavT *SQL* konstruqciaSi gamoiyeneba logikuri (*AND, OR, NOT*) operaciebi da damokidebulebiTi operaciebi: { =, !=, >, >=, <, <=, Like, between . . . and, in }.

mag., Select St_Name FROM Students

WHERE St_Name Like ‘%Svili’

amoarCevs yvela studentis gvars, romelic mTavrdeba sityviT - ‘Svili’.

mag., *Select Lect_Name, Status, Age FROM Lectors*

WHERE Age between 30 and 50

amoarCevs im leqtorTa gvarebs, Tanamdebobebs da asaks, romelTa asakic aris diapazonSi [30 . . 50].

simravlidan elementis amirCevis magaliTi:

Select Lect_Name, Status, Money FROM Lectors

*WHERE Status IN(‘**profesori**’,’**docenti**’)*

leqtorTa simravlidan amoarCevs mxolod profesorebs da docentebs da dabeWdavs maT gvarebs, Tanamdebobebs da xelfasebs. Tu saWiroa am siis dalageba xelfasebis klebadobiT (desc**), maSin gamoiyeneba** *ORDER BY:*

Select Lect_Name, Status, Money FROM Lectors

*WHERE Status IN(‘**profesori**’,’**docenti**’)*

ORDER BY Money DESC.

SELECT-**<u>is erToblivi operatorebi</u>:**

- *COUNT(*)* - **cxrilSi Canawerebis raodenobis daTvla.**

SELECT COUNT(*) FROM Students.

*SELECT COUNT(*) FROM Students WHERE City=”**baTumi**”.*

SELECT COUNT(DISTINCT City) FROM Students

bolo moTxovnaSi daiTvleba qalaqis saxelebis raodenoba maTi gameorebis gareSe (*DISTINCT* **-unikalurobis ofcia).**

- *MIN(<field>), MAX(<field>)* **– minimaluri da maqsimaluri mniSvnelobebis moZebna miTiTebuli velisaTvis.**

-*AVG(<field>)* – **saSualo mniSvnelobis povna velisaTvis.**

-*SUM(<field>)* - **jamis angariSi miTiTebuli velisaTvis.**

- **Canawerebis dajgufebisaTvis gamoiyeneba** *GROUP BY*:

magaliTad:

SELECT City , COUNT(*) FROM Students GROUP BY City

mogvcems qalaqis dasaxelebas da studentTa raodenobas TiToeuli qalaqidan.

SELECT-is Calagebuli moTxovnebi.

esaa SemTxveva, roca erTi SELECT operatoris Sedegebi gamoiyeneba meore SELECT–Si. Calagebis doneebi SeiZleba ramdenime iyos (7-ze meti) da mas aseTi sintaqsi gaaCnia:

```
SELECT <fields-R1> FROM <Table-1>
     WHERE  <field-R1> IN  (SELECT <field-R2> FROM <Table-2>)
```

am SemTxvevaSi R1 da R2 cxrilebs unda hqondeT erTnairi veli (field-R1= field-R2), romliTac xdeba SerCeva.

mag., "kaTedraze vipovoT informacia im leqtorTa Sesaxeb, romelTa gvarebic emTxveva studentTa gvarebs":

```
SELECT *  FROM Lectors
     WHERE  L_Name IN  (SELECT L_Name FROM Students)
```

E `vipovoT yvelaze axalgazrda leqtoris gvari,statusi da telefoni~ (IN-is magivrad SeiZleba ' = ~ gamoyeneba):

```
SELECT L_Name, Status, Tel  FROM Lectors
     WHERE  Age = (SELECT MIN(Age) FROM Lectors)
```

cxrilebis gaerTianeba.

xSirad saWiroa ori an meti cxrilis gadasinjva da monacemebis amoReba. aseT dros didi mniSvneloba aqvs cxrilebis gaerTianebas.

mag., `vipovoT leqtorebi, romlebic aswavlian 108935 da 608935 jgufebs~:

```
SELECT Lectors.*, Lec_Gr.Jg_ID  FROM Lectors, Lec_Gr
   WHERE  (Lectors.LEC_ID=Lec_Gr.LEC_ID)
      AND (Lec_Gr.Jg_ID='108935' OR Lec_Gr.Jg_ID='608935')
```

cxrilTa saxelebis fsevdonimebis SemotaniT moTxovnis Canaweri martivdeba. wina magaliTisaTvis:

```
SELECT L.*, LG.Jg_ID  FROM Lectors L, Lec_Gr LG
     WHERE  (L.LEC_ID=LG.LEC_ID)
        AND (LG.Jg_ID='108935' OR LG.Jg_ID='608935')
```

aq fsevdonimebia: L da LG, romlebic FROM-Si ganisazRvra. SeiZleba erT cxrils mieces ori gansxvavebuli fsevdonimi, maSin isini ganixileba rogorc sxvadasxva cxrilebi.

mag., `vipovoT asakiT Tanatol leqtorTa gvarebi~:

SELECT L1.Name, L2.Name, L1.Age FROM Lectors L1, Lectors L2
WHERE (L1.Age=L2.Age) AND (L1Name != L2.Name)
AND (L1Name < L2.Name)

me-3 striqoni gamoricxavs SemTxvevas, roca leqtori Tavisi Tavis Tanatolia, xolo bolo striqoni gamoricxavs semantikurad dublirebadi informaciis miRebas (Cvens SemTxvevaSi Tu gvaqvs erTi Canaweri `isakaZe = surgulaZe~, maSin aRar dafiqsirdeba `surgulaZe = isakaZe ~)..

cxrilTa gaerTianeba SeiZleba maSinac, Tuki maT ar aqvT saerTo velebi. amas BC++Builder-Si gare gaerTianebas uwodeben (outher join). aseTi sami tipisaa: marcxena, marjvena da sruli (LEFT OUTHER JOIN . . . ON, RIGHT OUTHER JOIN . . .ON, FULL OUTHER JOIN . . . ON).

mag., SELECT * FROM Lectors LEFT OUTHER JOIN Students
ON Lectors.Name = Students.Name

SedegSi mogvcems yvela leqtoris gvars, miuxedavad imisa, eqneba Tu ara mas kavSiri studentebTan.

interaqtiuli-SQL operaciebi Canawerebze.

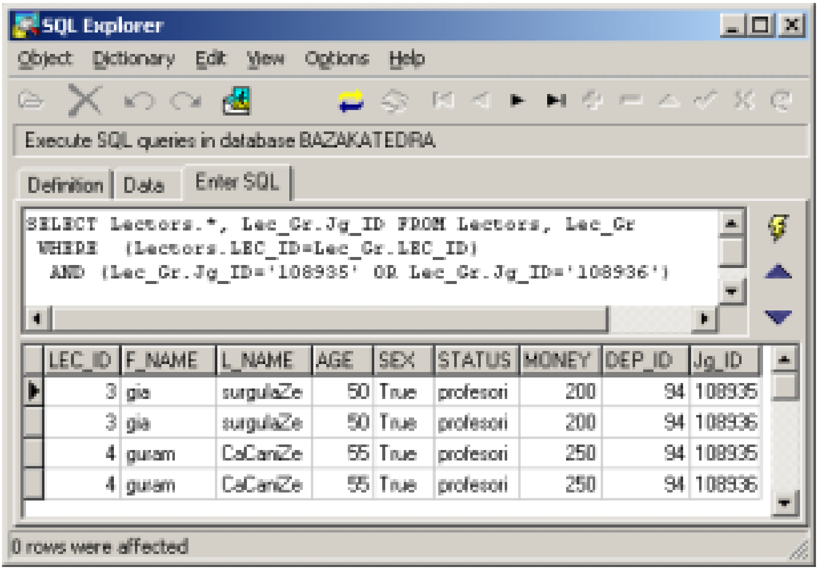
SQL Explorer instrumenti gamoiZaxeba BC++Builder–dan (Database | Explore), an Start | Borland C++ 5.0 | SQL Explorer.

1.1 naxazze naCvenebia SQL-moTxovnis Caweris da Sesrulebis Sedegis fragmenti SELECT-operatoriT.

Enter SQL- fanjaraSi SeiZleba gamoyenebul iqnas cxrilebTan muSaobis operatorebi: INSERT (Casma), UPDATE (Sesworeba) da DELETE (waSla).

mag., striqonis Camateba leqtorebis cxrilSi:

INSERT INTO Lectors (L_ID, L_NAME, STATUS, MONEY)
VALUES (‘9405’, ‘dolize’, ‘profesori’, ‘100’)



nax. 1.1

- ***`Seicvalos studentTa asaki +1 –iT.”***

UPDATE Students SET AGE=AGE+1

- ***`waiSalos cxrilidan studenti `nino gagua”:***

DELETE FROM Students WHERE F_NAME=’nino’

AND L_NAME=’gagua’

cxrilTan muSaobis operaciebi:

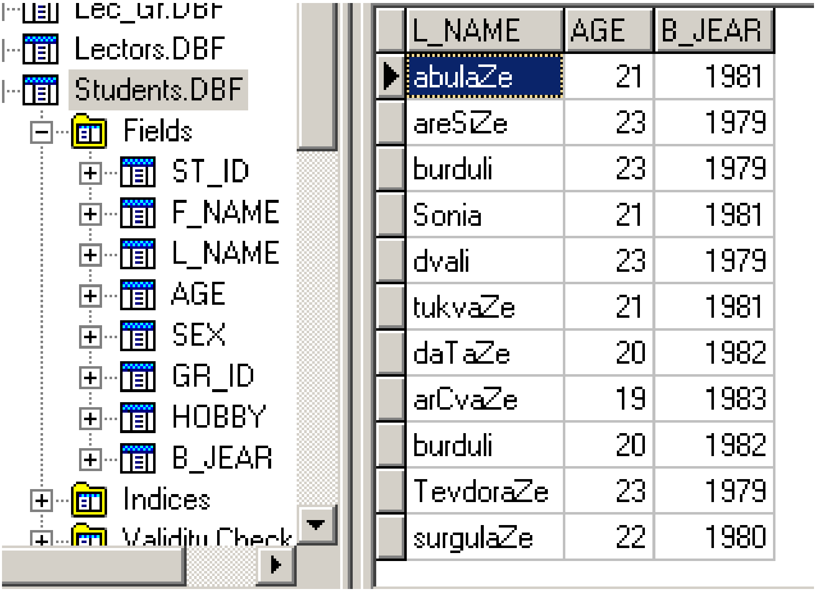
ganixileba *SQL Explorer* ***instrumentiT cxrilebios Seqmna (****CREATE****), maTi waSla (****DROP****), struqturis modifikacia (****ALTER TABLE****) axali atributis Camateba (****ADD****), Zvelis waSla (****DROP****) da a.S. magaliTad, cxrilSi*** *Students* ***CavamatoT axali veli `dabadebis weli~ (****B_JEAR****), ganvsazRvroT maTi mniSvnelobebi da wavSaloT `asaki~ (****AGE****). es procedurebi ase Caiwereba.***

1. ALTER TABLE Students ADD B_JEAR INTEGER ***da*** *Ctrl+E*

2. UPDATE Students SET B_JEAR=2002 - AGE

miviRebT 1.2 naxazze mocemul Sedegs:

3. ALTER TABLE Students DROP AGE ***da*** *Ctrl+E (****waSla****).*



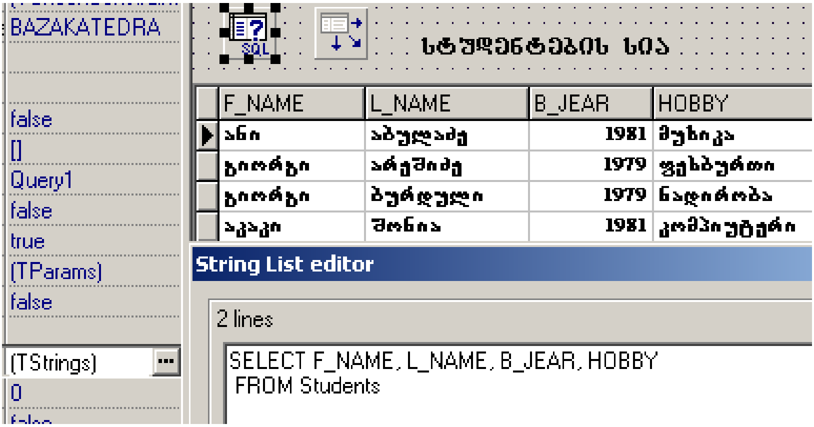
L_NAME	AGE	B_JEAR
abulaZe	21	1981
areSiZe	23	1979
burduli	23	1979
Sonia	21	1981
dvali	23	1979
tukvaZe	21	1981
daTaZe	20	1982
arCvaZe	19	1983
burduli	20	1982
TevdoraZe	23	1979
surgulaZe	22	1980

nax.1.2

1.2. vizualuri komponentis klasi (TQuery)

<u>daniSnuleba</u>: TQuery gamoiyeneba moTxovnebis asagebad SQL-enis standartis Sesabamisad. Query komponenta moTavsebulia Data Access panelze da igi analogiuria Table komponentisa. gansakuTrebiT mniSvnelovania Query-is gamoyeneba klient-serverul konfiguraciebSi ganawilebuli bazebis dros.

1.3 naxazze naCvenebia forma Query–komponentiT DBGrid-Si gamotanili amonarCeviT Students-cxrilidan.



nax.1.3

aq mTavaria Object Inspector-is SQL TStrings TvisebaSi ganisazRvros amorCevis predikati (logikuri piroba). es ki aris swored SQL-enaze awyobili moTxovna. cxrilSi Sedegebis gamosatanad miTiTebuli SELECT-operatoriT,aucilebelia Object Inspector-is Active TvisebaSi true –s Casma.

TStrings-Si moTxovnis operatiuli cvlilebiT miiReba axali Sedegebi. moTxovna SeiZleba sakmaod rTuli iyos, aerTianebdes ramdenime cxrils. aseT SemTxvevaSi sasargebloa QBE-vizualuri instrumenti.

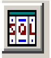
1.3. QBE - vizualuri instrumenti SQL moTxovnebis asagebad

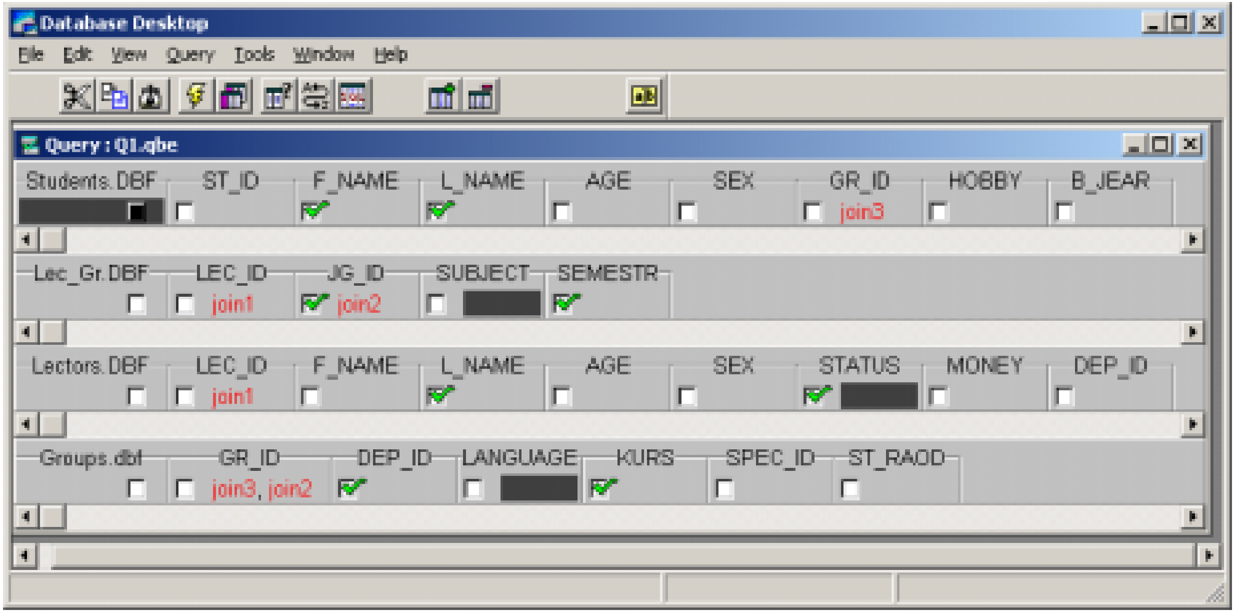
<u>**daniSnuleba**</u>: QBE (Query By Example) **saSualebas iZleva vizualurad swrafad avagoT rTuli** SQL–**tipis moTxovnebi, gavaerTianoT cxrilebi, amovirCioT velebi da miviRoT Sedegebi, moTxovnis** SQL-**sqema gadavitanoT** BC++Builder-**is formaze** TStrings-**Si da avsaxoT Sedegebi** DBGrid-**cxrilebSi.**

QBE **instrumenti gamoiZaxeba** Data Desktop-**dan:**

File | New | QBE Query

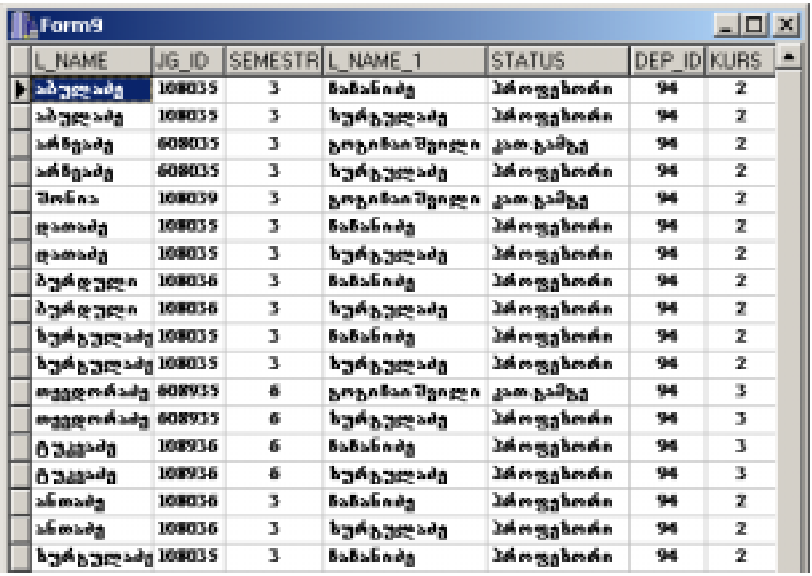
amovarCioT BAZAKATEDRA **aliasi da oTxive cxrili: leqtorebi,studentebi,jgufebi da leqciebi (leqtori-jgufi). ekranze gamoCndeba 1.4 naxazze warmodgenili suraTi. qvemoT, cxrilSi mocemulia zogierTi piqtogramis daniSnuleba.**

	Run Query	მოთხოვნის შესრულება
	Join Tables	ცხრილების დაკავშირება გასაღებური ველებით
	Query Properties	მოთხოვნის თვისებები (მახასიათებლები)
	Sort Answer Table	საშედეგო ცხრილის მოწესრიგება (სორტირება)
	**Show SQL**	SQL-მოთხოვნის სტრუქტურის ნახვა



nax. 1.4. QQBE- instrumentis interfeisi

SQL-**struqturis teqsti** *copy*-**iT SevinaxoT da gadavitanoT formaze** *SQL TStrings* **TvisebaSi. Sedegi miRebulia (nax.1.5).**



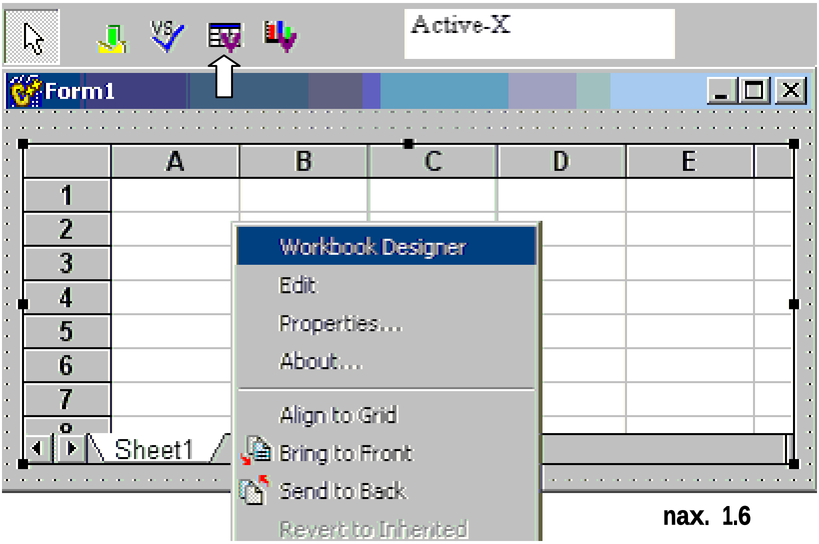
nax. 1.5. *QBE* - **s Sesrulebis Sedegi**

SELECT DISTINCT D.F_NAME, D.L_NAME, D1.JG_ID, D1.SEMESTR, D2.L_NAME, D2.STATUS, d3.DEP_ID, d3.KURS
FROM "C:\KAFEDRA\Students.DBF" D, "C:\KAFEDRA\Lec_Gr.DBF" D1, "C:\KAFEDRA\Lectors.DBF" D2, "C:\KAFEDRA\Groups.dbf" d3
WHERE (D2.LEC_ID = D1.LEC_ID) AND (d3.GR_ID = D.GR_ID) AND (d3.GR_ID = D1.JG_ID)
ORDER BY D.F_NAME, D.L_NAME, D1.JG_ID, D1.SEMESTR, D2.L_NAME, D2.STATUS, d3.DEP_ID, d3.KURS

1.4. Excel cxrilis kavSiri BC++ BUILDER-is formasTan (F1Book)

daniSnuleba: F1Book komponents (Active-X panelidan) SeuZlia Borland-is formaze MS-Excel tipis cxrilis Seqmna, masSi monacemebis Setana, koreqtireba, gadmotana namdvil-Excel failidan da a.S. SesaZlebelia aqve cxrilis Sesabamisi diagramebis agebac.

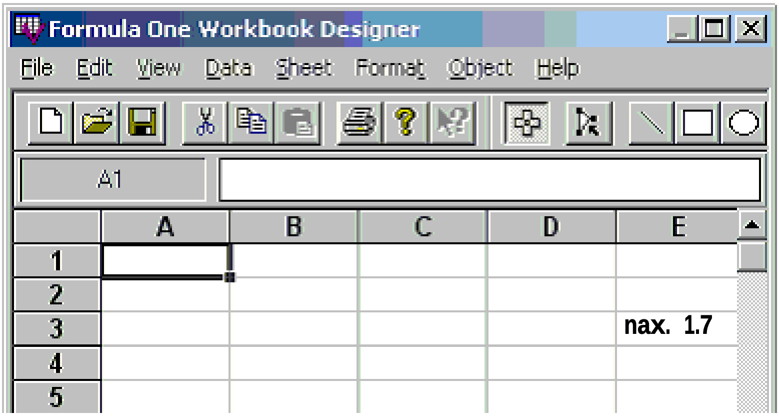
Active-X panelidan formaze gadavitanoT F1Book komponenti da SevarCioT cxrilis saWiro zoma. 1.6 naxazze naCvenebia Sedegi, Excel-tipis formiT (A,B,C,…svetebiTa da 1,2,3,..striqonebiT). es cxrili rom aqtiuri gaxdes monacemebis Sesatanad, saWiroa Tagus marjvena Rilakis 1-el dawkapuneba da Workbook Designer striqonis arCeva. Sedegad gamova axali, aqtiuri Excel-cxrili (nax.1.7), romelSic SesaZlebelia cnobili manipulaciebis Catareba.



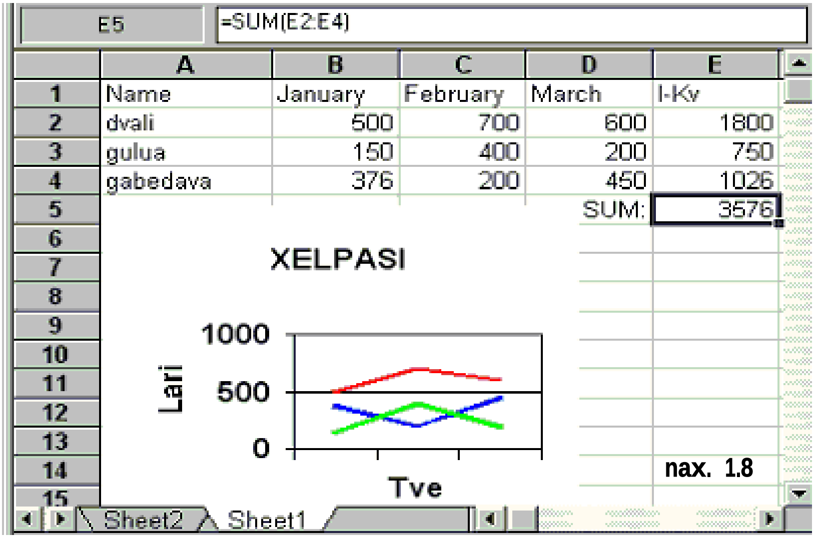
nax. 1.6

magaliTad, axali Sheet gverdebis Seqmna (Sheet | Insert Sheet), fontis arCeva (Format | Fonts), kopireba (Copy | Paste) sxva cxrilebidan (an piriqiT), formulebis Setana da a.S.

1.8 naxazze naCvenebia saSedego cxrili Sesabamisi diagramiT.



nax. 1.7



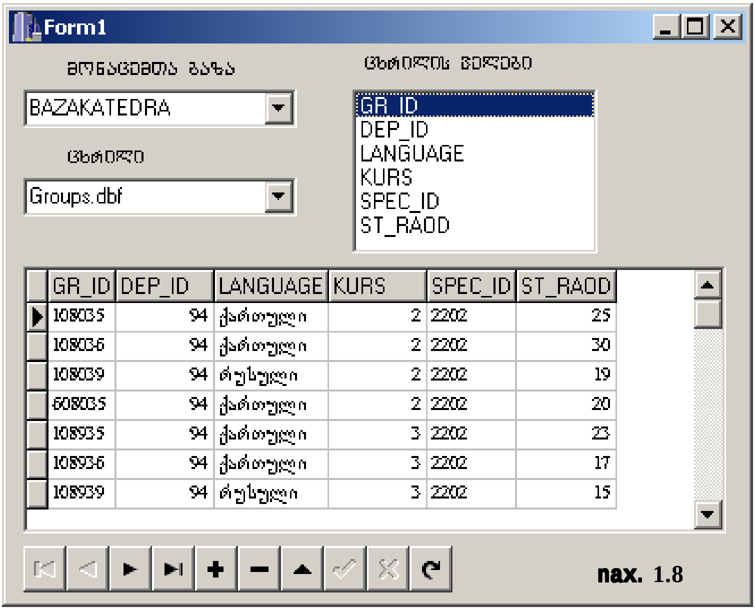
nax. 1.8

1.5. bazebisa da cxrilebis marTva (Session-komponenta)

<u>**daniSnuleba**</u>: Session **komponenta (**Data Access **panelidan) marTavs monacemTa bazebisa da cxrilebis SerCevisa da gamoyenebiTi sistemis formaze maTi gamotanis procesebs. sistema avtomaturad axorcielebs** Session-**obieqtis generirebas yovel danarTSi, amitom momxmarebels misi Seqmna ar uxdeba.**

TDataModeule **komponentis gacnobis dros (cxrilebs Soris kavSiris agebis vizualuri komponenti) Cven SevxvdiT** Default Session, **romlis daqvemdebarebaSic monacemTa bazis aliasebia (mag.,** BAZAKATEDRA**). realur SemTxvevaSi SeiZleba arsebobdes ramdenime monacemTa baza (aliasebi), TiToeulSi ramdenime cxrili (**Tables**) da a.S.**

ganvixiloT sailustracio magaliTi, roca formaze erT DBGrid **cxrilSi mimdevrobiT unda gavaanalizoT sxvadasxva monacemTa bazis sxvadasxva cxrili (nax.1.8). naCveneb formaze Session komponenti ar Cans, igi uxilavia, magram misi moqmedebis Sedegi Cans 2 Combo- da 1 listBox - ebSi, romlebSic gamoitaneba monacemTa bazebis, arCeul bazaSi Semavali cxrilebis da arCeuli cxrilis velebis CamonaTvali. am monacemTa gamosatanad gamoiyeneba** Session **komponentis funqciebi** GetTableNames **(cxrilebis siis gamotana) da** GetFieldNames **(arCeuli cxrilis velebis siis gamotana).**



nax. 1.8

qvemoT moyvanilia Sesabamisi programebis fragmentebi.

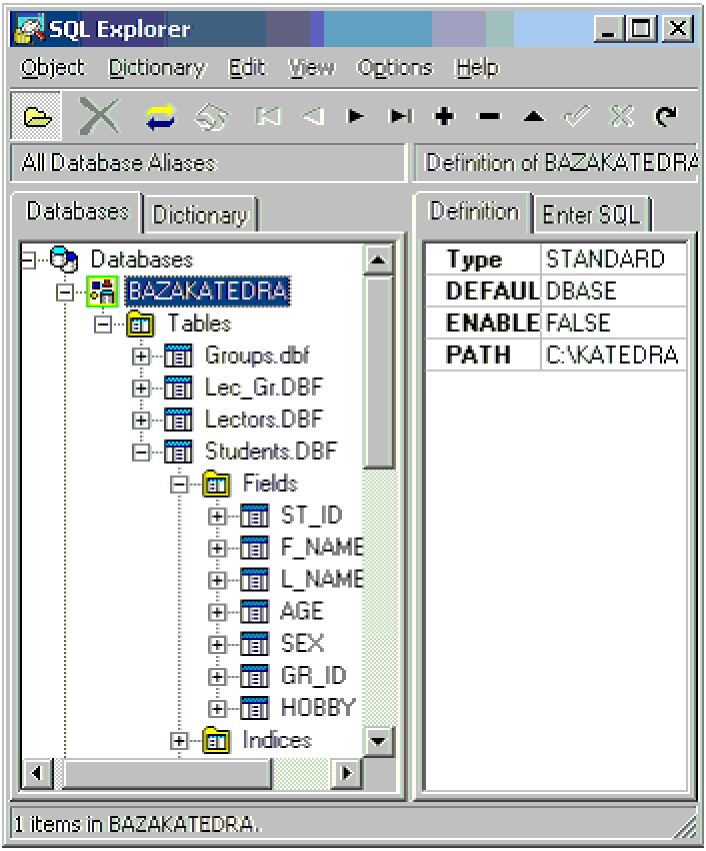
```
void __fastcall TForm1::cbAliasChange(TObject *Sender)
{ //arCeul monacemTa bazaSi Semavali cxrilebis
  //gamotana cbTable (ComboBox) komponentSi
Session->GetTableNames(cbAlias->Text,"",
                    true, false, cbTable->Items);
cbTable->ItemIndex = 0;
if (cbTable->Text == "")
  {  ShowMessage("Table not selected");
  return;  }
 Table1->Active = false;
 Table1->DatabaseName = cbAlias->Text;
 Table1->TableName = cbTable->Text;
 Table1->Active = true;
   if(Table1->Active)
//arCeul cxrilSi Semavali velebis
//gamotana cbField (ComboBox) komponentSi
  Table1->GetFieldNames(cbField->Items);
}
```

1.6. SQL Explorer

<u>daniSnuleba</u>: ***monacemTa bazis fsevdonimis** (Alias) **Seqmna, cxrilebis, velebis, indeqsebis, gasaReburi velebis da sxva elementebis realizacia.***

*SQL Explorer-**Si Sesvla xorcieldeba meniudan:***

Start -> Programms -> BorlandC++Builder -> SQL Explorer* an TviT** *Borland C++Builder* ***fanjridan, mTavari menius punqtidan: ***BorlandC++Builder ->Database -> Explore.***



nax.1.9 ***SQL-Explorer* - is fanjara**

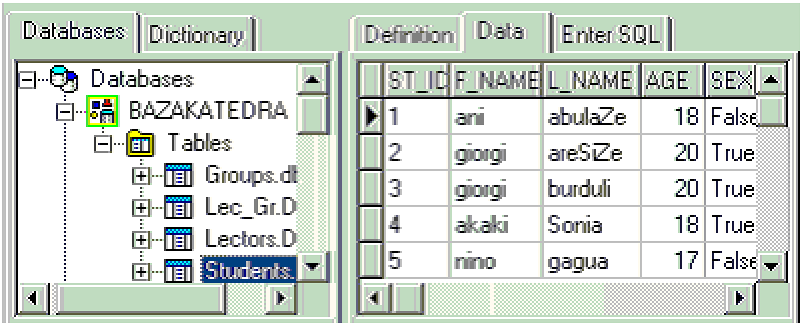
monacemTa bazis fsevdonimis (Alias) Seqmna xdeba mTavari meniudan: *Object -> New*. davarqvaT mas BAZAKATEDRA. Sedegi mocemulia 1.9 naxazze.

aRniSnuli aliasis saxeli gamoiyeneba SemdgomSi Borland C++Builder sistemis mier monacemTa cxrilebis dasakavSireblad aplikaciebis formebze. erT aliasSi Tavs iyris cxrilTa sakmao simravle.

naxazze naCvenebia agreTve SQL Explorer-is gamoyenebis magaliTi axali cxrilebis, maTi velebisa da maxasiaTeblebis, pirveladi da meoreuli gasaRebebisa da indeqsebis Sesaqmnelad da a.S.

fanjris marcxena mxares iqmneba ierarqiuli xis struqtura, marjvenaSi ki – cxrilis struqtura velebiTurT. am naxazze naCvenebia monacemTa bazis aliasis dakavSireba C:\KATEDRA\ katalogis failebTan. es katalogi Seicavs yvela komponents, romlebic saWiroa gamoyenebiTi sistemis funqcionirebisaTvis.

davdgeT Students-failze da marjvena fanjaraSi gadavrToT Data-Rilaki. gamoCndeba samuSao cxrili (nax.1.10).



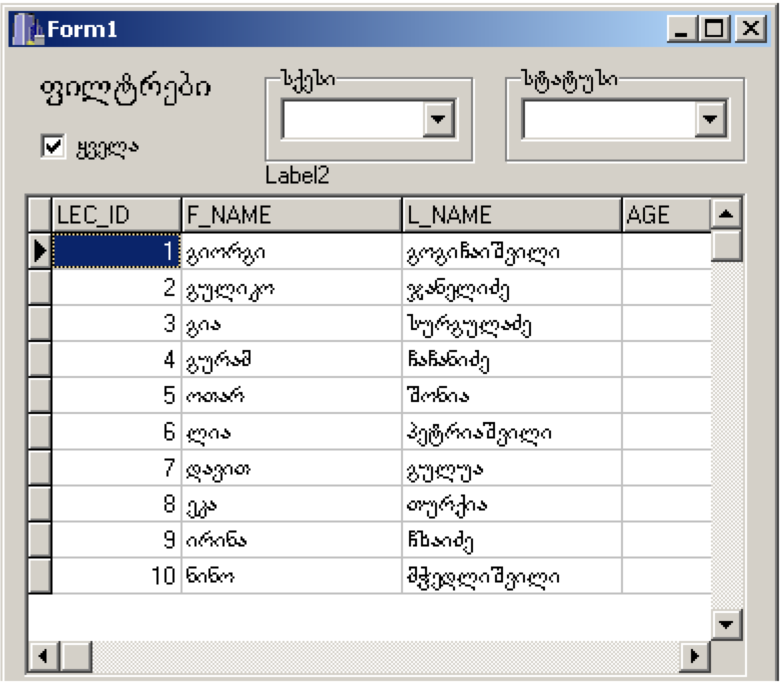
nax. 1.10

1.7. filtrebis dayeneba monacemTa bazis cxrilSi

<u>daniSnuleba:</u> filtri saSualebas gvaZlevs monacemTa bazidan amovirCioT Canawerebis mxolod is simravle, romelic daakmayofilebs Cvens mier SerCeul kriteriums.

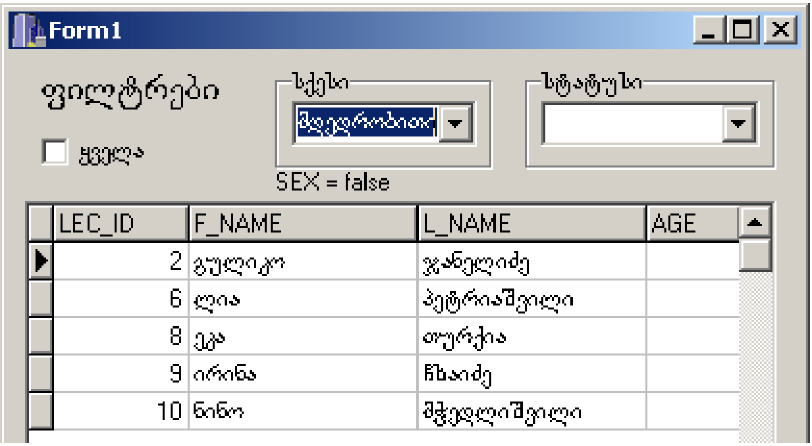
magaliTad, roca gvWirdeba informacia mxolod kaTedris profesorebis an mdedrobiTi sqesis TanamSromlebis Sesaxeb da ara yvelaze. filtris dasayeneblad iyeneben Table komponentis Tvisebebs Filtered da Filter. roca Filtered = true, es niSnavs, rom filtri CairTo da Sesruldeba Filter - Si aRwerili logikuri gamosaxuleba. filtri SeiZleba iyos kombinirebuli anu 1-ze metkriteriumiani, risTvisac logikur gamosaxulebaSi and da or gasaReburi sityvebi gamoiyeneba.

ganvixiloT martivi amocana. gvaqvs kaTedris TanamSromelTa cxrili, romelic Seicavs velebs TanamSromlis sqesisa da kaTedraze statusis Sesaxeb. Sesabamisi filtrebis gamoyenebis interfeisi naCvenebia 1.11 naxazze, sadac vxedavT SemTxvevas, roca yvela Canaweri gamotanilia.



nax.1.11. monacemTa cxrili filtris gareSe

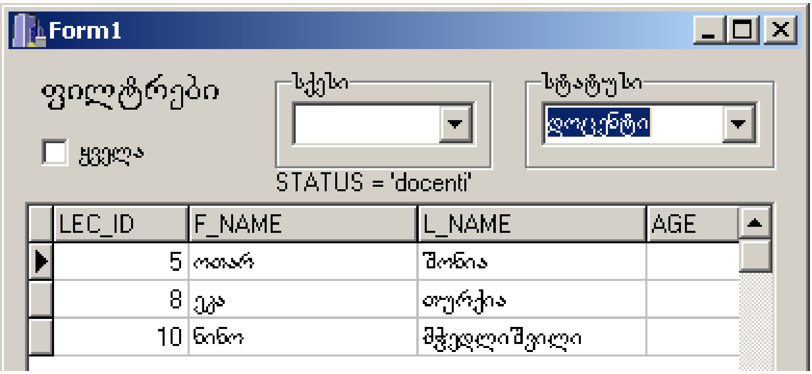
Tu gvainteresebs kaTedraze mxolod mdedrobiTi sqesis TanamSromelTa Canawerebi, sqess virCevT Sesabamisi ComboBox - idan da DataGrid - Sic gamova informacia mxolod mandilosnebze (nax.



nax.1.12. monacemTa cxrili filtri `mdedrobiTi sqesi”

1.12).

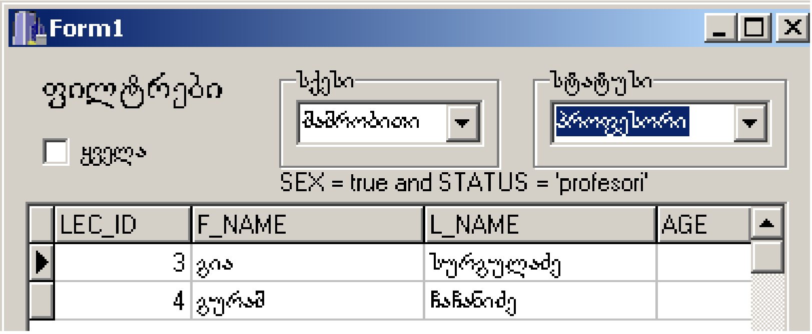
Tu mxolod kaTedris docentebze informaciis miReba gvsurs, `docents” virCevT statusis ComboBox-



nax.1.13. monacemTa cxrili filtriT “docenti”

Si (nax.1.13).

1.14 naxazze mocemulia kombinirebuli filtris nimuSi: `kaTedris yvela mamrobiTi sqesis profesori”.



nax.1.14. monacemTa cxrili kombinirebuli filtriT “mamrobiTi sqesi” da “profesori”

kombinirebuli filtris misaRebad saWiroa programuli kodis Seqmna. aseTi kodis fragmentebi mocemulia qvemoT.

```
//--- statusi cnobilia, virCevT sqesis mixedviT -----
void __fastcall TForm1::sqesiChange(TObject *Sender)
{ all->Checked = false;
  if(status->ItemIndex != -1)    // Tu statusi ukve cnobilia, maSin
    Label2->Caption =  "STATUS = '" + status->Items->
       Strings[status->ItemIndex]+"' and ";  // filtris striqoni
 else
     Label2->Caption = "";    // statusi carielia
switch(sqesi->ItemIndex)    // sqesis amorCevis blokSi Sesvla
  {
 case 0:  Label2->Caption = Label2->Caption + "SEX = false";
   Table1->Filter = Label2->Caption; break;
  case 1:    Label2->Caption = Label2->Caption + "SEX =
true";
    Table1->Filter = Label2->Caption;
  }
}
```

//--- sqesi cnobilia, virCevT statusis mixedviT -----

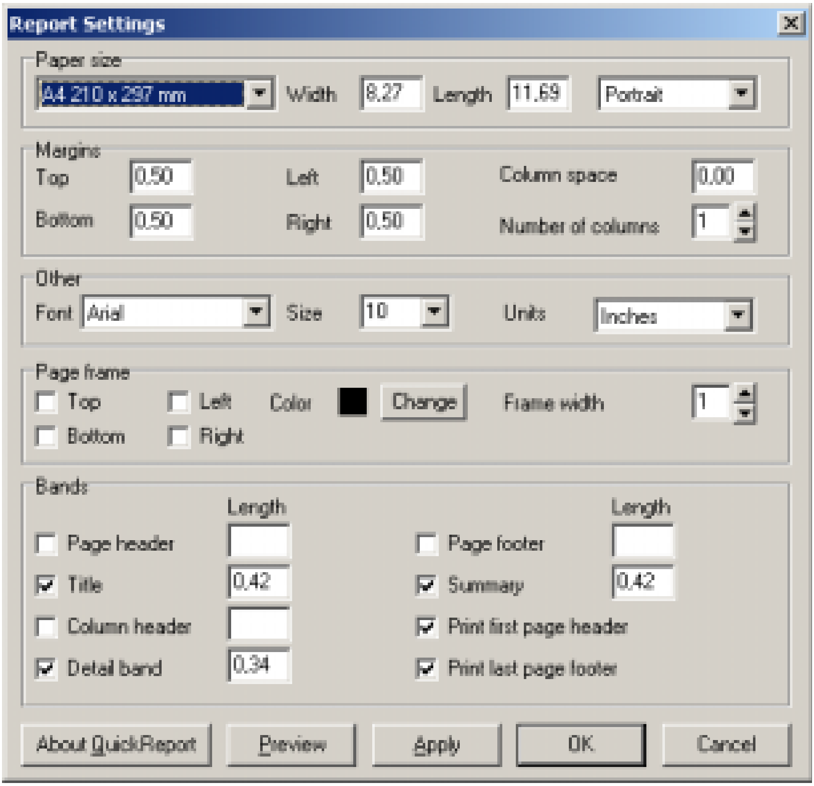
```
void __fastcall TForm1::statusChange(TObject *Sender)
{
all->Checked = false;
if(sqesi->ItemIndex != -1)
  if(sqesi->ItemIndex == 0)
      Label2->Caption = "SEX = false and ";
    else
      Label2->Caption = "SEX = true and ";
 else
   Label2->Caption = "";

Label2->Caption = Label2->Caption + "STATUS = '" +
status->Items->Strings[status->ItemIndex]+"'";
Table1->Filter = Label2->Caption;
}
```

1.8. angariSebis formireba da beWdva (QReport)

__daniSnuleba:__ gamoiyeneba Sesrulebuli samuSaos gasaformeblad da dasabeWdad C++ Builder-Si.

angariSebis Seqmnis komponentebi moTavsebulia QReport panelze. ganvixiloT ZiriTadi komponentebis gamoyenebis wesebi.

angariSisTvis rekomendebulia calke formis Seqmna da saWiroebis mixedviT misi gamoZaxeba. pirveli gansaxilveli komponenti iqneba QReport, romelzec Tagus orjer dawkapunebiT (an marjvena Rilaki - Report Settings) gamodis Page Setup - is tipis dialogi (nax.1.15), sadac SeiZleba mivuTiToT furclis formati, orientacia, velebi, ferebi da sxva imgvari parametrebi, romelTa aRqmac saofise programebSi mcire xans namuSevari momxmareblisTvisac



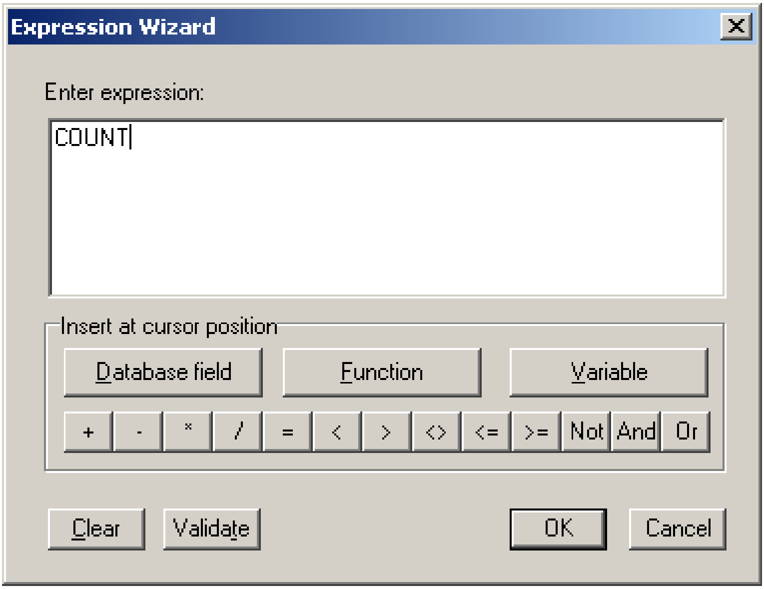
nax.1.15 angariSis parametrebis dayeneba

Zneliar iqneba. QReport komponentis Tviseba DataSet komponents monacemTa bazis sasurvel cxrilTan daakavSirebs.

danarCeni komponentebi QReport-ze Tavsdeba. maTgan yvelaze mniSvnelovania QRBand, romlis Tviseba BandType saSualebas gvaZlevs komponenti sxvadasxva daniSnulebiT gamoviyenoT. magaliTad, Tu BandType = rbTitle, komponentze angariSis `qudis” formirebaa SesaZlebeli. rbPageHeader (an rbPageFooter) kolontitulebis Seqmnas niSnavs, rbDetail - monacemTa bazis cxrilis gamotanas,

rbSummary - reziumes da ase Semdeg. radgan es monacemebi angariSSi erTianadaa saWiro,QQRBand komponents angariSze ramdenimes aTavseben da Semdeg TiToeulisTvis saWiro tipebs ayeneben.

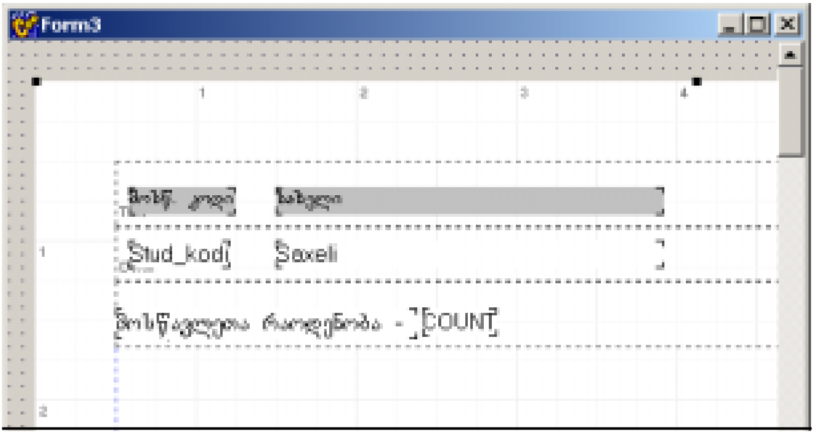
komponenti QRLabel angariSze statikur teqsts asaxavs, QRDBText - monacemTa bazis miTiTebuli velis mniSvnelobas, xolo QRExpr gamoiyeneba jamebis, saSualoebis da msgavsi saWiro informaciis formirebisTvis. am bolo komponents gaaCnia Tviseba Expression, romelsac gamohyavs dialogi aRwerili funqciebis Sesasruleblad (nax.1.16).



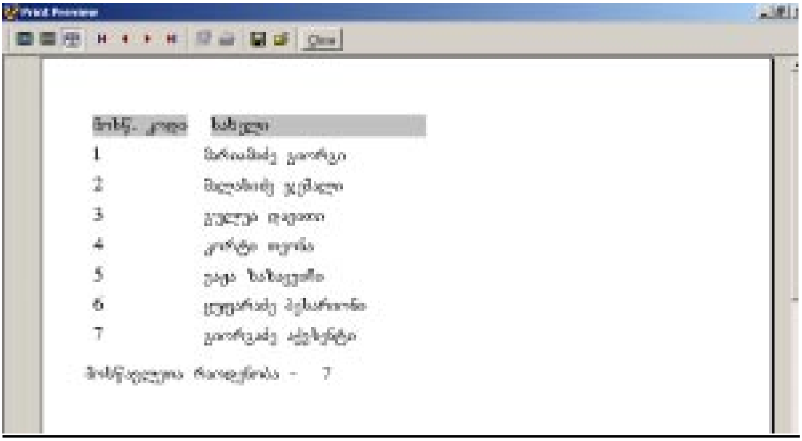
nax.1.16. Expression Tvisebis dialogi

QReport - ze marjvena Rilaki - Print Preview gamoitans angariSis sabeWd formas standartuli Rilakebis sakmaod didi nakrebiT. igives programulad gakeTeba SesaZlebelia QReport - is meTod Preview() - is gamoyenebiT.

1.17 naxazze mocemulia sailustracio angariSis saproeqto gamosaxuleba, xolo 1.18 naxazi gviCvenebs angariSs “moqmedebaSi” - mis sabeWd formas.



nax.1.17. angariSi daproeqtebis etapze



nax.1.18. angariSi Sesrulebis etapze

II Tavi
aplikaciebisa da momxmarebelTa interfeisebis ageba

2.1. xelfasis amocanis daproeqteba da ageba

sabuxhaltro aRricxvis sistemaSi erT-erTi mniSvnelovani da rTuli sakiTxia xelfasebis gaangariSebis amocana. did da saSualo firmebSi, sadac TanamSromlebis raodenoba 100-ze metia, aucilebelia kompiuteruli sistemis danergva, mZlavri maTematikuri da programuli uzrunvelyofiT.

amocanis sirTule ganisazRvreba imiT, rom nazardi jamis meTodi – es iseTi instrumentia, romlis gamoyenebiTac yovelTviurad TanamSromlebs eqnebaT gansxvavebuli xelfasebi. saSemosavlo dasabegri Tanxa damokidebulia ramdenime faqtorze da igi cvalebadia. amitomac ZiriTad daricxul xelfass akldeba es dasabegri Tanxa da sxva (sapensio, samkurnalo da a.S.) fiqsirebuli an procentuli (mag., xelfasis 1 %) Tanxebi.

axla ganvixiloT xelfasis gaangariSebis maTematikuri modeli, romelic nazardi jamis meTodiTaa cnobili. 2.1 cxrilSi mocemulia amocanis ZiriTadi maCveneblebi.

amocanis maTematikuri modelis asagebad gamoviyenebT cxrilSi motanil aRniSvnebs. TvalsaCinoebisaTvis SemovitanoT naxazi 2.1, romelzec asaxuli iqneba dasmuli amocanis logika.

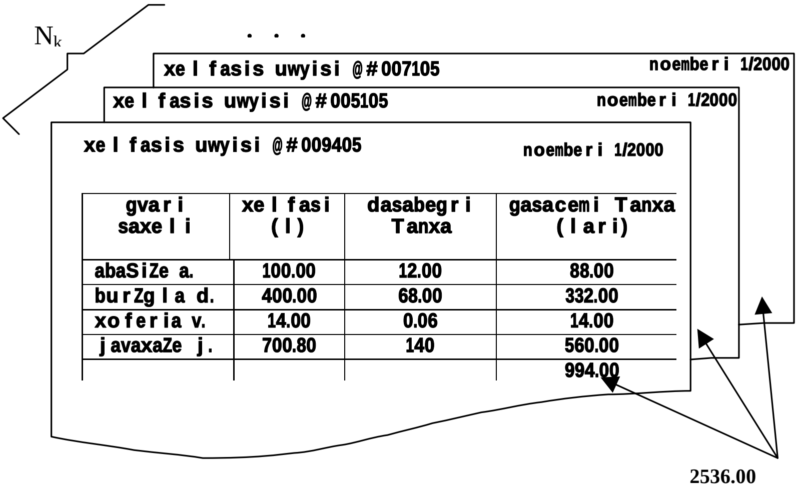
aq warmodgenilia firmis k-ganyofilebis N_k cali xelfasis uwyisis cxrili (forma), romelic gamoiyeneba buRalteriaSi. cxrilSi Seitaneba firmis TanamSromelTa monacemebi. isini dalagebulia ganyofilebebis (saamqroebis) mixedviT da mowesrigebulia gvarebis anbaniT. xelfasis zoma, rogorc sawyisi monacemi, Seitaneba cxrilSi yvelasTvis.

axla aRvweroT xelfasis saSemosavlo dabegvris algoriTmi da ganvsazRvroT TiToeuli TanamSromlisTvis individualurad xelze gasacemi Tanxis moculoba. davadginoT agreTve jamuri Tanxebis angariSis formulebi.

cxr.2.1

Identif	მაჩვენებლის დასახელება
i	თანამშრომლის იდენტიფიკატორი (სატაბელო №)
name	გვარი, სახელი
St	სტატუსი (თანამდებობა)
X_i	i-ური თანამშრომლის ხელფასის ზომა (ლარი)
d	დაუბეგრავი მინიმუმის ზომა (ლარი)
Dj	ერთობლივი დასაბეგრი თანხის j-ური დიაპაზონი (ლარებში)
P_i	დასაბეგრი პროცენტი j-ური დიაპაზონისათვის (%)
Ti	დარიცხული თანხის მნიშვნელობა i-ური თანამშრომლისათვის (ლარებში)
T_{Di}	დასაბეგრი თანხის მნიშვნელობა i-ური თანამშრომლისათვის (ლარებში)
S_{io}	წინა თვეების საშემოსავლო დაბეგრილი თანხის ჯამური მნიშვნელობა i-ური თანამშრომლისათვის (ლარებში)
S_{io}	მიმდინარე თვის საშემოსავლო დასაბეგრი თანხის მნიშვნელობა i-ური თანამშრომლისათვის (ლარებში)
Y_i	ხელზე გასაცემი თანხა i-ური თანამ-შრომლისათვის (ლარებში)
S_T	დარიცხული თანხის ჯამური მნიშვნელობა ყველა თანამშრომლისათვის (ლარებში)
S_D	დარიცხული თანხის ჯამური მნიშვნელობა ყველა თანამშრომლისათვის (ლარებში)
S_o	დაბეგრილი თანხის ჯამური მნიშვნელობა ყველა თანამშრომლისათვის მოცემულ თვეში
D_T	ხელზე გასაცემი თანხის ჯამური მნიშვნელობა ყველა

pirobiTad miviRoT, rom xelfass akldeba mxolod saSemosavlo dabegvris Tanxa. samedicino, dazRvevis, sapensio da sxva saxis daqviTvebi (alimenti, ganvadebis gadasaricxi Tanxebi, sinaTlis) amjerad ar dagvWirdeba. mTeli sirTule xelfasebis angariSebisa Cadebulia xelfasis nazardi jamiT saSemosavlo dabegvris meqanizmSi.

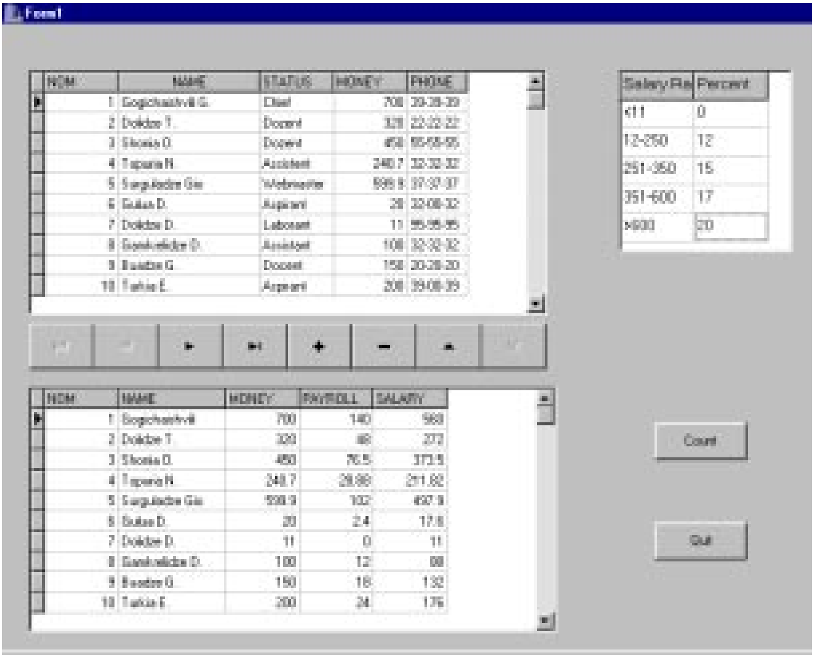


nax.2.1. xelfasis uwyisis fragmentis gamartivebuli samganzomilebiani modeli

aRvweroT sityvierad es meqanizmi, Semdeg ki CamovayaliboT misi maTematikuri modeli. nazardi jamis wesiT saSemosavlo gadasaxadis gamoTvlebisas gaiTvaliswineba TanamSromlis mier kalendaruli wlis ganmavlobaSi miRebuli Semosavlis mTliani raodenoba. mis mier mimdinare wlis 1 ianvridan mocemul momentamde miRebul TanxaTa jami.

ganvixiloT `xelfasis uwyisis~ formirebis amocana da avagoT **Borland C++ Builder**-is saSualebiT kompiuteruli sistema. 2.2 naxazze naCvenebia fanjara, romelzec agebulia sami cxrili. pirveli `TanamSromeli~, romlis velebia **NOM, NAME, STATUS, MONEY** da **PHONE.** aRniSnuli cxrili (Table) aigeba monacemTa bazebis instrumentis (Database Desktop) gamoyenebiT.

SeirCeva cxrilis saxeli (Person); meore _ `xelfasis uwyisi~ (Salary). TiToeul cxrilSi (bazebSi) ganisazRvreba velebis parametrebi. aseve dadgindeba kavSiri Person da Salary bazebs Soris. Person sawyis monacemTa Setanis cxrilia, xolo Salary saboloo Sedegebis gamotanis cxrili (uwyisi). mesame cxrili _ `skala~ saSemosavlo dabegvris procentebs gviCvenebs.

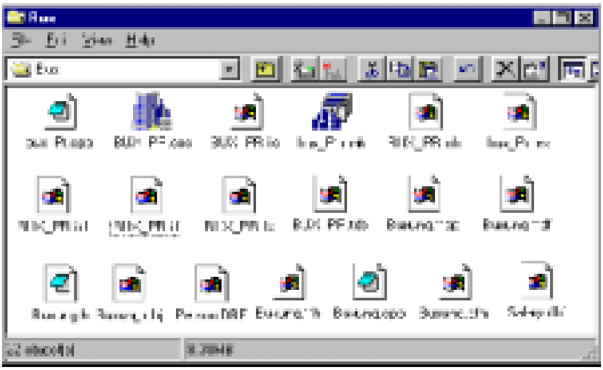


nax.2.2.

naxazze daproeqtebulia ori Rilaki: `Count~ da `Quit~. Person cxrilSi ganaxlebis Semdeg, Count Rilakis meSveobiT Sedegis Salary cxrilSi gamoitaneba axali Sedegebi. muSaobis damTavreba xdeba Quit RilakiT. orive Rilakis Casma xdeba obieqt-orientirebuli principis gamoyenebiT (Button-obieqti arsebobs rogorc klasi). misi gadmotaniT formaze, Semdeg maTi meTodebisa (Methods) da Tvisebebis (Properties) SerCeviT Object Inspector-Si vRebulobT formis Rilakebs.

2.3 naxazze naCvenebia fanjara Bux, romelSic moTavsebulia Cvens mier damuSavebuli `xelfasis~ angariSis amocanis yvela saWiro programa. vizualuri daproeqtebis procesis paralelurad Borland C++ Builder sistemam Seqmna es programebi. papkidan SeiZleba waiSalos is failebi, romelTa gafarToebis (tipis) aRniSvna iwyeba: ilp, ~, tds da obj. es sagrZnoblad Seamcirebs gamoyenebiTi programis paketis moculobas.

dasasruls, mocemulia ZiriTadi funqciuri da saTavo failebis listingis: Bux_PR.cpp, Bux_PR.mak, Bux.h, Bux.cpp RilakebiT Button1 Click () da Button2 Click ().



nax.2.3

//xel fasis angariSis programa Borland C++ Builder paketis bazaze

```
//------------------- BUX_PR.cpp   main-file ----------------------
#include  <vcl\vcl.h>
#pragma  hdrstop
//--------------------------------------------------------------------------
USEFORM("Buxung.cpp", Form1);
USERES("bux_Pr.res");
//--------------------------------------------------------------------------
WINAPI WinMain(HINSTANCE, HINSTANCE, LPSTR, int)
{
        try
        {
                Application->Initialize();
                Application->CreateForm(__classid(TForm1), &Form1);
                Application->Run();
        }
        catch  (Exception  &exception)
        {
                Application->ShowException(&exception);
        }
        return 0;
}
```

```
//-------------------  Buxung.h --------------------------
#ifndef BuxungH
#define BuxungH
//-----------------------------------------------------------
#include <vcl\Classes.hpp>
#include <vcl\Controls.hpp>
#include <vcl\StdCtrls.hpp>
#include <vcl\Forms.hpp>
#include <vcl\DBGrids.hpp>
#include "Grids.hpp"
#include <vcl\DB.hpp>
#include <vcl\DBTables.hpp>
#include <vcl\DBCtrls.hpp>
#include <vcl\ExtCtrls.hpp>
//-----------------------------------------------------------
class TForm1 : public TForm
{
_published:// IDE-managed Components
  TDBGrid *DBGrid1;
 TDBGrid *DBGrid2;
 TDataSource *DataSource1;
 TDataSource *DataSource2;
 TTable *Table1;
 TTable *Table2;
 TDBNavigator *DBNavigator1;
 TButton *Button1;
 TButton *Button2;
        TSmallintField *Table2NOM;
        TStringField *Table2NAME;
        TFloatField *Table2MONEY;
       TFloatField *Table2PAYROLL;
TFloatField *Table2 SALARY;
       TSmallintField *Table1NOM;
        TStringField *Table1STATUS;
        TFloatField *Table1MONEY;
        TFloatField *Table1PHONE;
       TStringGride*String Grid1;
```

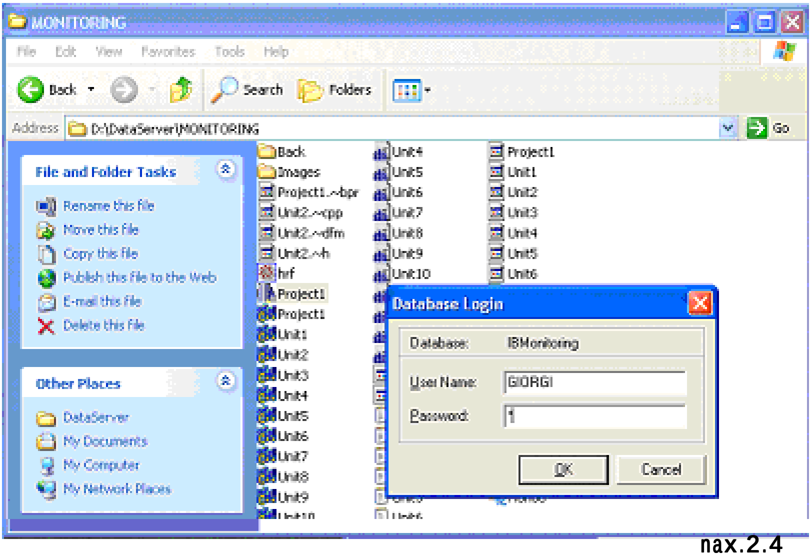
```
        void_fastcall  Button1Click(TObject*Sender);
        void_fastcall  Button2Click(TObject*Sender);
        void_fastcall  FormCreate(TObject*Sender);

private:   //User declarations
public:                                    User declarations
          _fastcall TForm1(TComponent*Owner)
};
//-------------------------------------------------------
extern TForm1*Form1;
//----------------------------------------------------
#extern TForm1*Form
//--------      Buxung.cpp      ------------------------------------
#include  <vcl\vcl.h>
#pragma  hdrstop
#include  "Buxung.h"
//----------------------------------------------------------------------
#pragma  link  "Grids"
#pragma resource "*.dfm"
TForm1 *Form1;
//----------------------------------------------------------------------
__fastcall TForm1::TForm1(TComponent* Owner)
        : TForm(Owner)  {}
//  Ri l aki - Count
void __fastcall  TForm1::Button1Click(TObject  *Sender)
{
Table1->First();
Table2->EmptyTable();
while(!Table1->Eof)
 {
  Table2->Append();
  float p, pr;
   Table2->FieldValues["NOM"]=  Table1->FieldValues["NOM"];
   Table2->FieldValues["NAME"]=  Table1->Fie l dVa l ues["NAME"];
    Table2->FieldValues["MONEY"]= Table1->FieldValues["MONEY"];
  p=Table2->FieldValues["MONEY"];
```

```
    if( p <= 11) pr=0;
     else if(p <= 250) pr=0.12;
       else if (p <=350) pr=0.15;
         else if(p <= 600) pr=0.17;
          else pr=0.20;
  Table2->FieldValues["PAYROLL"]= p*pr;
    Table2->FieldValues["SALARY"]=
                          Table2->FieldValues["MONEY"]-   Table2-
>FieldValues["PAYROLL"];
    Table1->Next();  Table2->Post();
   }
  }
  //-----------------------------------------------------------------------
  // Ri l aki - Quit
  void __fastcall TForm1::Button2Click
  (TObject *Sender)
  {
   Table1->Close();   Table2->Close();
   Application->Terminate();
  }
  //----------------------------------------------------------------
  void __fastcall TForm1::FormCreate(TObject *Sender)
  {
  Table1->Open();    Table2->Open();
  StringGrid1->Cells[0][0]="Salary Range";
  String Grid1->Cells[1][0]="Percent"
  String Grid1->Cells[0][1]="<11"
  String Grid1->Cells[0][2]="12-250"
  String Grid1->Cells[0][3]="251-360"
  String Grid1->Cells[0][5]=">600"
  String Grid1->Cells[1][1]="0"
  String Grid1->Cells[1][2]="12"
  String Grid1->Cells[1][3]="15"
  String Grid1->Cells[1][4]="17"
  String Grid1->Cells[1][5]="20"
  }
  //---------------------------------------------------------------
```

2.2. jandacvis obieqtebis monitoringis kompiuteruli sistema

monitoringis kompiuteruli sistemis funqcionireba xorcieldeba *Windows*-2000 operaciuli sistemis platformaze, *Borland_C++Builder* vizualuri, obieqt-orientirebuli daprogramebis integrirebuli paketisa da ganawilebuli monacemTa bazebis marTis sistemis InterBase-s safuZvelze.

2.4 naxazze mocemulia programis gamoZaxebis Semdeg momxmareblis saxelisa da parolis Setanis dialogi.

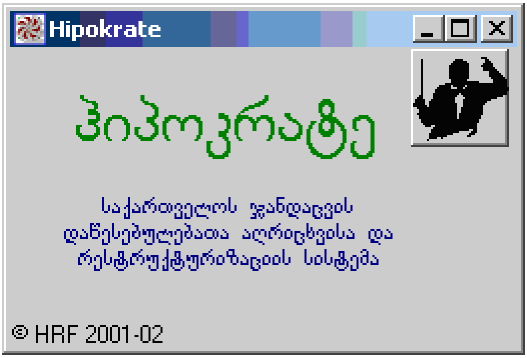


nax.2.4

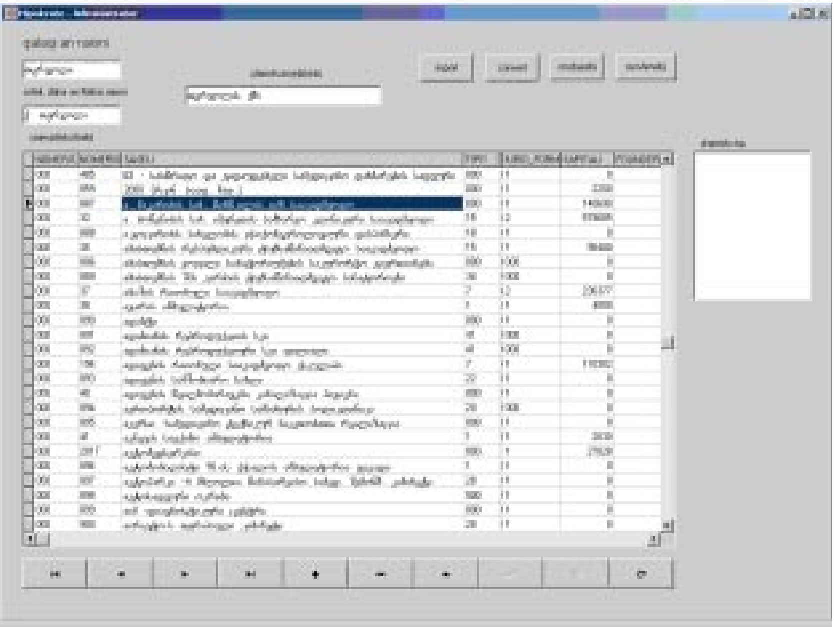
maTi sworad Setanis SemTxvevaSi programa iwyebs muSaobas da gamodis 2.5 naxazi. mTavar meniuSi pirveli amocanis arCevis Semdeg gamoitaneba 2.6 kadri, romelic gansazRvravs Semdeg etaps, anu vimuSaoT administratoris reJimSi (Tu am fanjaraze maosiT davawkapunebT).

nax.2.5

nax.2.6

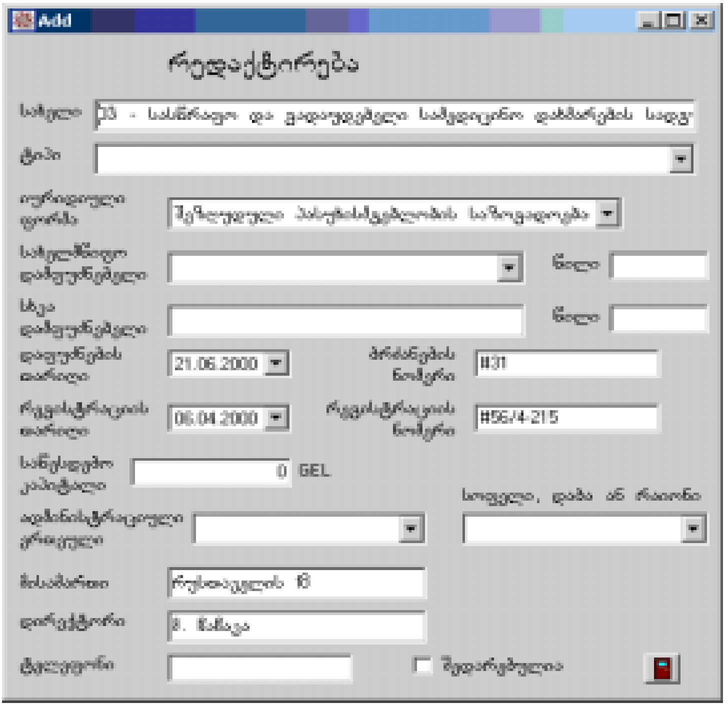


Tu Cveulebrivi momxmareblis reJimSi (velodebiT ramdenime wamiT dawkapunebis gareSe). am SemTxvevaSi gamodis 2.7 fanjara.



nax.2.7

monitoringis kompiuteruli sistemis funqcionirebis dros mTavari meniudan Tu avirCevT punqts `obiqtTa redaqtireba~, maSin ekranze gamoitaneba fanjara (nax.28), romelSic mocemulia jandacvis sistemis arCeuli saprovatizacio obieqti.



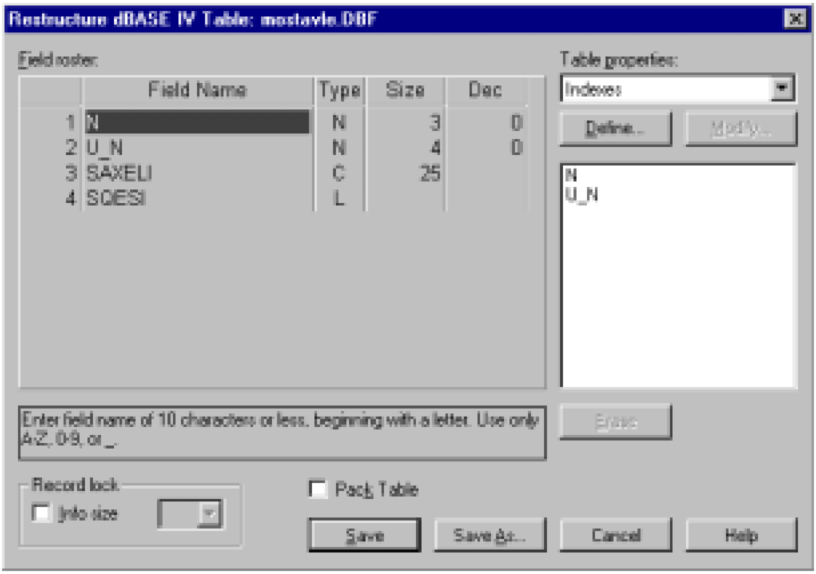
nax.2.8

aq SesaZlebelia TiToeuli maCveneblis koreqtireba, romelic realizebulia EditBox, ComboBox-komponentebiT da LookUp-kavSiriT, rac gamoiyeneba cxrilebs Soris xilvadi velebis Sesaqmnelad. Cven aq ganvixileT avtorTa mier damuSavebuli sistemis mxolod ramdenime fragmenti.

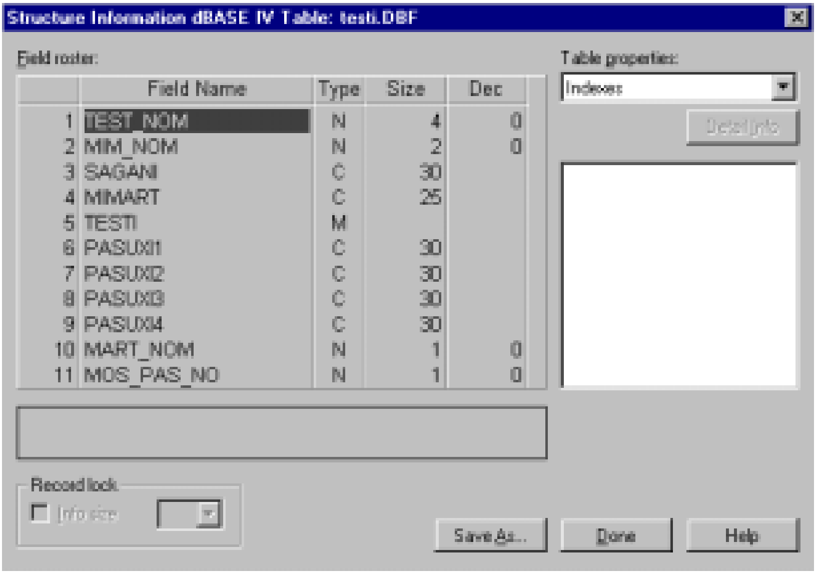
2.3. studentTa testirebis avtomatizebuli sistema

abiturientTa proforientaciis, bakalavtriatis studentTa sabazo swavlebidan magistraturis samecniero mimarTulebis SesarCevad, an studentTa da msmenelTa testirebisaTvis ama Tu im akademiur disciplinasa da modulSi, SesaZlebelia qvemoaRwerili kompiuteruli sistemis gamoyeneba.

ganvixiloT, magaliTad, programuli enebisa da sistemebis Seswavlisa da Sefasebis procesebis sistemis ageba. pirvel rigSi, aucilebelia SevqmnaT is cxrilebi, romlebSic Seinaxeba sruli monacemebi Cveni sistemis Sesaxeb. amisaTvis unda avamuSavoT programa ***DataBase Desktop, Borland C++ Builder*** *- is programuli paketidan, aRvweroT cxrilebis struqturebi* ***(Dbase, Paradox*** *an romelime sxva cnobili formatSi) da SevitanoT monacemebi. saWiroa minimum 2 cxrili: moswavleebis da testebis. maTi struqturebis SesaZlo forma mocemulia 2.9 da 2.10 naxazebze.*



nax.2.9. moswavleebis cxrilis struqtura

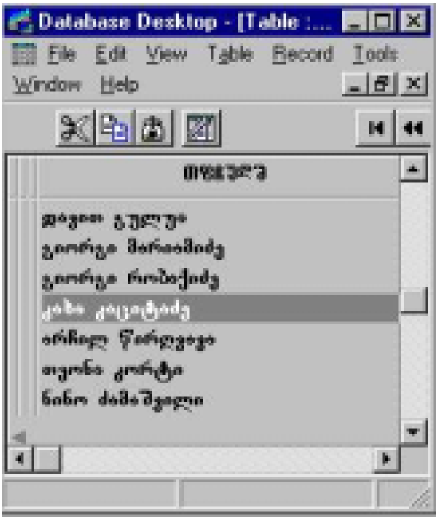


nax.2.10. testebis cxrilis struqtura

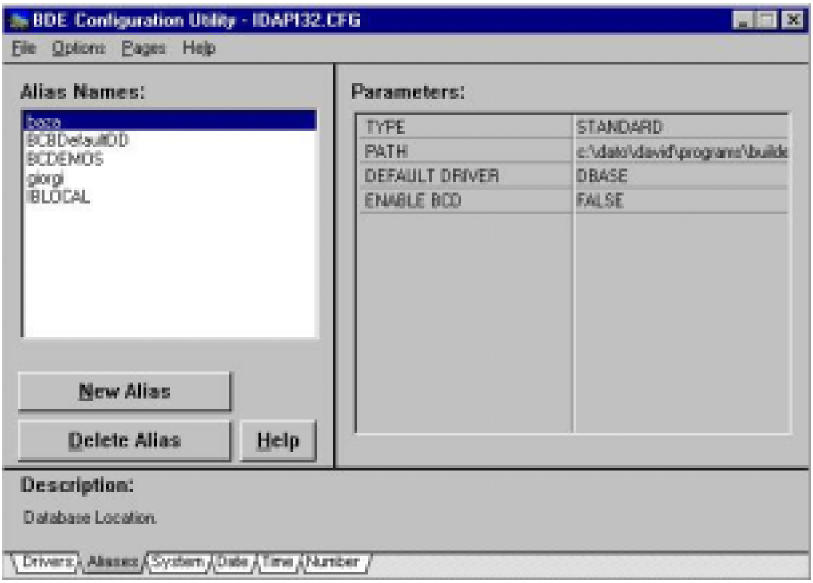
imave Rilakze daWeriT struqturebi Seinaxeba da mere ***File - Open*** brZanebiT SesaZlebelia gaixsnas cxrilis forma da masSi monacemebs SevitanT. 2.11 naxazze ixileT moswavleTa cxrilis magaliTi.

fsevdonimis ***(Alias)*** *Sesaqmnelad gamoiyeneba sxva programa* ***Borland C++ Builder –*** *is paketidan, romelsac 1.0 versiaSi ewodeba* ***BDE configuration*** *da momdevno versiebSi* ***BDE Administrator. BDE Configuration –*** *Si gadavdivarT ganyofilebaSi* ***Aliases,*** *sadac unda daaWiroT Rilaks* ***New Alias*** *da mivuTiToT bazis saxeli da tipi (Cvens SemTxvevaSi* ***Standart). fsevdonimis Seqmnis Semdeg dasayenebelia misi parametrebi, pirvel rigSi gza monacemTa bazisken (magaliTad, c:\Database).***

fsevdonimebTan muSaobis dialogis nimuSi 2.12 naxazzea mocemuli.



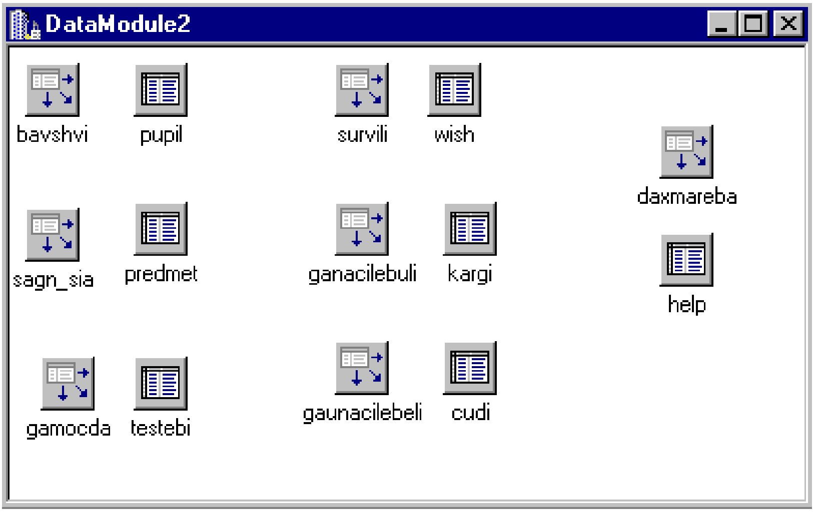
nax.2.11. moswavleTa cxrilis nimuSi



nax.2.12. *BDE Configuration* - programa monacemTa bazis fsevdonimebis Sesaqmnelad

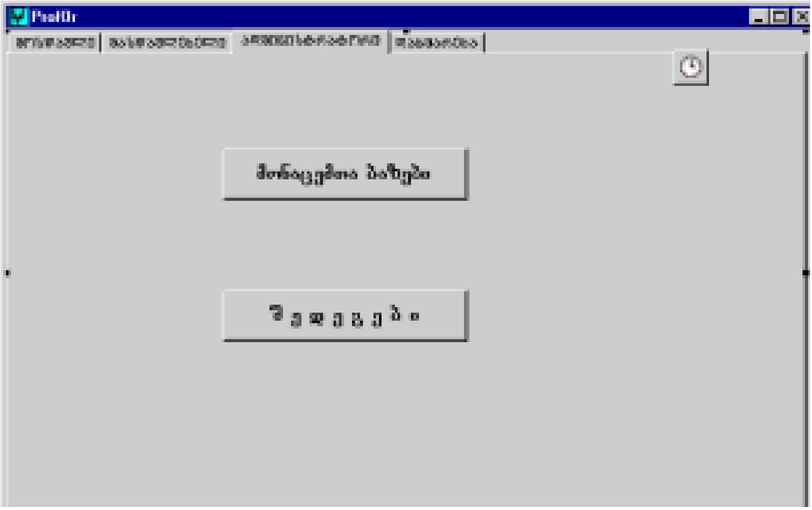
aRweril mosamzadebel samuSaoTa Semdeg SeiZleba daviwyoT uSualod sistemis ageba daprogramebis sistema Borland C++ Builder – is meSveobiT. saWiro iqneba ramdenime formis Seqmna sxvadasxva amocanebis Sesasruleblad. axali formis Seqmna SesaZlebelia File – New Form brZanebiT.

calke formis tipia e.w. “monacemTa moduli” (Data Module), romelzec proeqtSi monacemTa bazasTan samuSao komponentebi aisaxeba, kerZod DataSource da Table. Table komponentis TvisebaSi DatabaseName iwereba ukve Seqmnili fsevdonimis saxeli, xolo TvisebaSi TableName – cxrilis saxeli. Tviseba Active = true saSualebas mogvcems monacemebi gamovitanoT ukve proeqtis formaze, sanam programas Sesrulebaze gavuSvebT. ixileT naxazi 2.13.

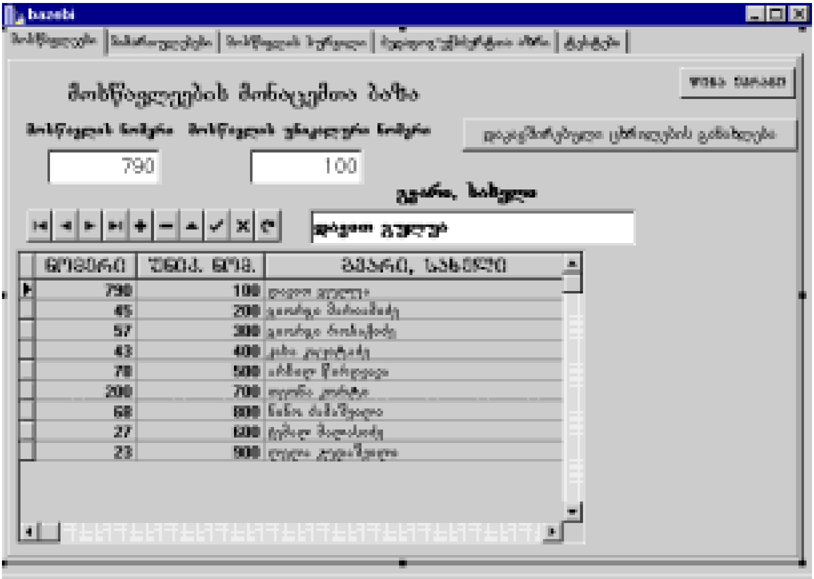


nax.2.13. `monacemTa moduli” *(Data Module)*

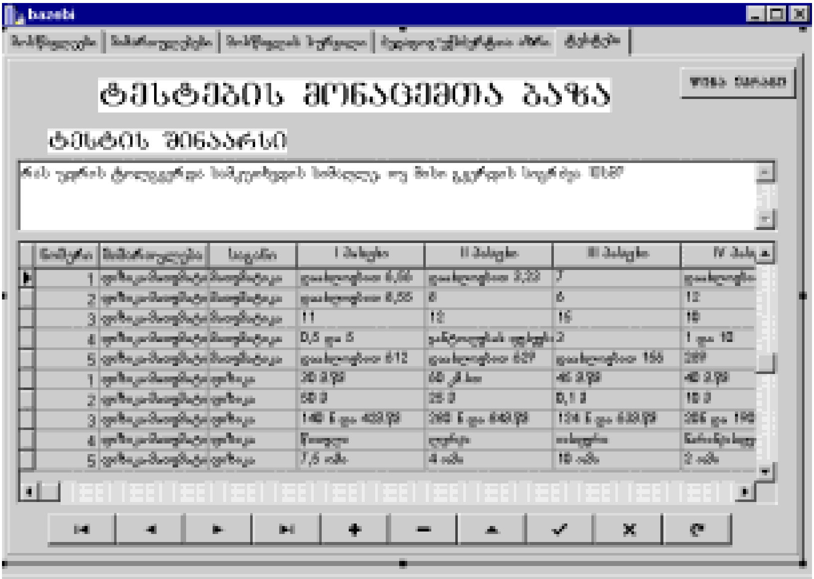
amis Semdeg vqmniT axal formebs monacemTa bazebisTvis, testebTan samuSaod, Sedegebis misaRebad da sxva. maTi nimuSebi mocemulia 2.14-:-2.18 naxazebze.



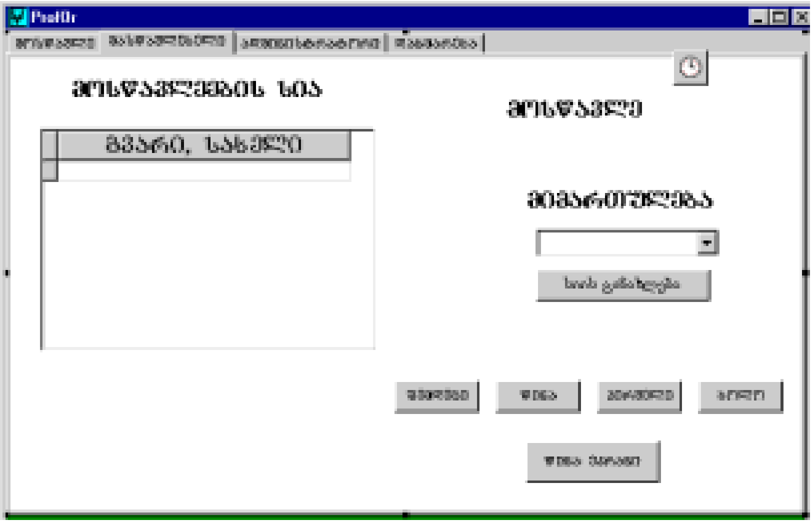
nax.2.14. sistemis administratoris fanjara



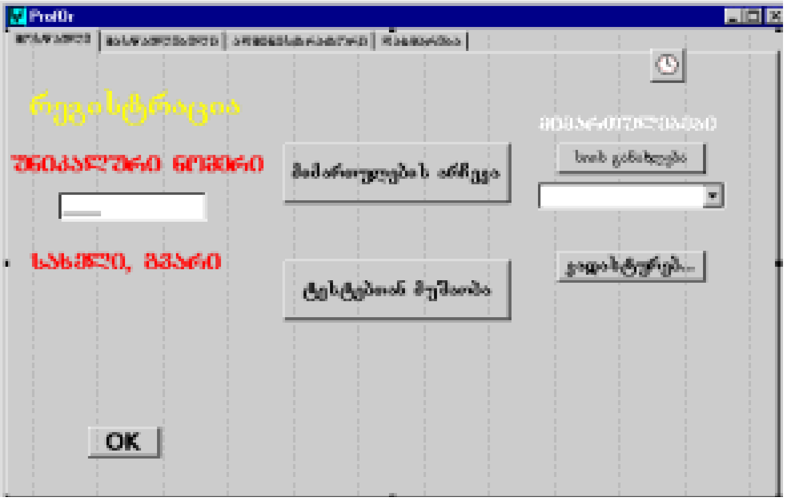
nax.2.15 moswavleebis cxrili



nax.2.16. testebis cxrili



nax.2.17. maswavleblis samuSao fanjara



nax.2.18. moswavlis samuSao fanjara

2.4. komerciuli obieqtebis mravalganzomilebiani analizis paketis ageba Decision Cube-iT

komerciuli obieqtebis sameurneo saqmianobis analizisa da strategiul-operatiuli gadawyvetilebis misaRebad mizanSewonilia mravalfaqtoruli analizis meTodebis programuli realizacia da maTi efeqturi gamoyeneba eqspertuli sistemebis saxiT.

monacemTa bazebidan miRebuli informaciis mravalfaqtoruli analizisaTvis *C++Builder-*is specialuri Decision_Cube komponentebis saSualebiT SesaZlebelia avagoT sistemis programuli paketi.

dasamuSavebeli informaciis wyaro sakvlevi obieqtis mudmivad ganaxlebadi monacemTa bazaa, romelSic Tavmoyrilia saproblemo sferos Sesabamisi faqtorebi, faqtorTaSorisi kavSirebi da mizez-Sedegobrivi damokidebulebiT asaxuli produqciuli wesebi, romlebic eqspertuli sistemis codnis bazis fundaments warmoadgens.

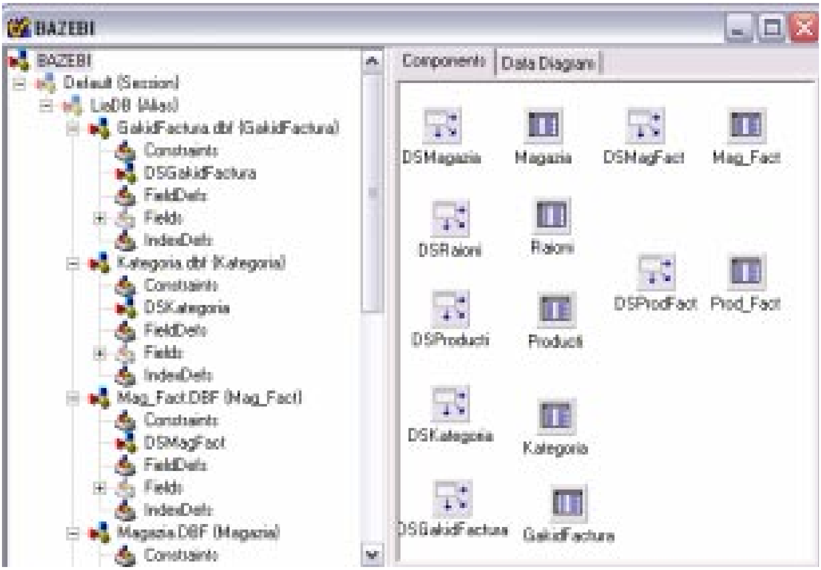
monacemTa da codnis bazebis efeqturad gamosayeneblad, maTSi informaciisa da gamoyvanis wesebis dinamikurad ganaxlebisaTvis mizanSewonilia momxmarebelTa Sesabamisi interfeisebis damuSaveba.

amocanaTa aseTi kompleqsis gadasawyvetad, adamian-manqanuri sistemis mokle vadebSi asagebad da Semdgom operatiulad gasafarToveblad Cven viyenebT obieqt-orientirebul daprogramebis integrirebuli paketebis instrumentebs, rogorebicaa *Borland C++Builder, Delphi, InterBase* **da** *SQL Server.*

momxmareblebs, maTi rolebis Sesabamisad lokalur klient-manqanebze SeuZliaT sakuTari interfeisebidan monacemTa bazebis (InterBase) Sevseba-koreqtireba, xolo server-manqanidan (SQL_Server-baziT) garkveuli informaciis miReba

gadawyvetilebis misaRebad. monacemTa struqturebis Tavsebadoba bazebs Soris xorcieldeba specialuri transformaciis programebiT.

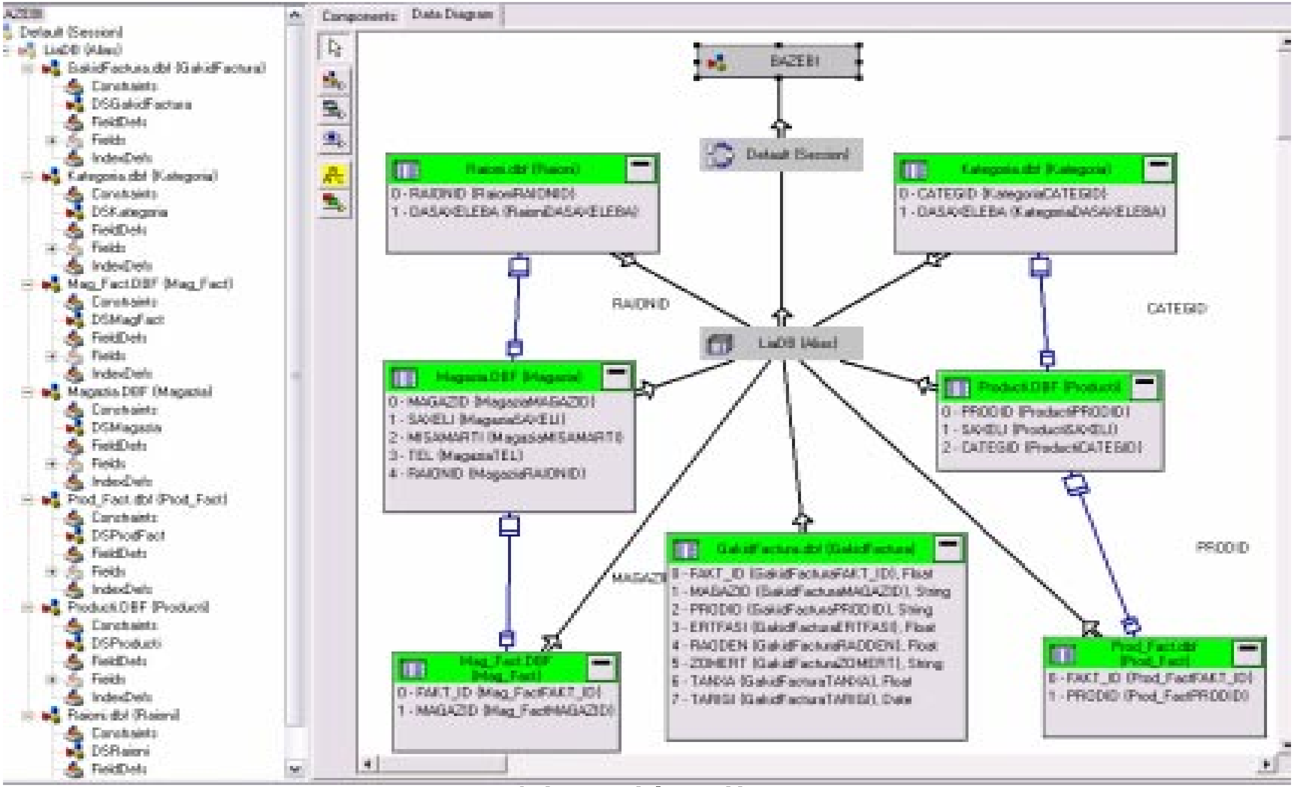
2.19-a,b naxazebze naCvenebia Cveni obieqtis monacemTa bazis struqtura, agebuli InterBase garemoSi vizualuri, obieqt-orientirebuli *TDataModule*-instrumentis gamoyenebiT.



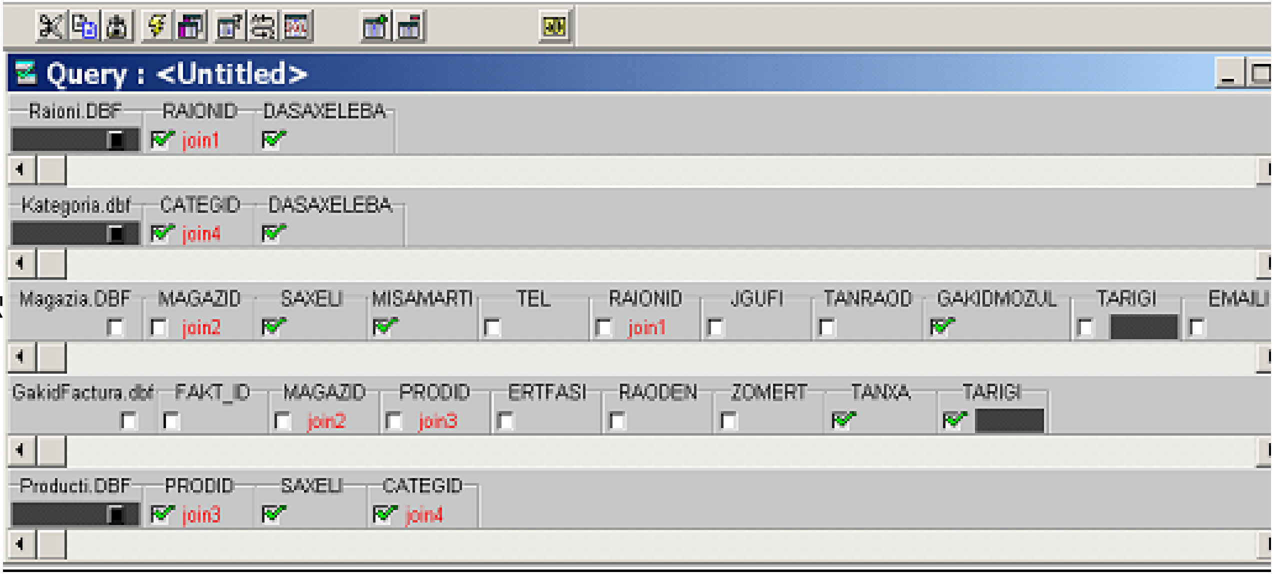
nax.2.19-a. mb-is komponentebi

bazis cxrilebidan momxmareblis moTxovnebis safuZvelze monacemebis amosaRebad saWiroa *SQL*-instruqciis dawera. rogorc, aRvniSneT amisaTvis efeqturia QBE-instrumentis gamoyeneba. 2.20 naxazze ilustrirebulia es magaliTi. ShowSQL-vizualuri komponentis daxmarebiT SesaZlebelia Cveni moTxovnis formatiT warmodgena (nax.2.21).

SQL-teqsti copy-iT SevinaxoT da gadavitanoT Borland C++ Builder formaze, Object Inspector-is SQL TStrings TvisebaSi. Sedegi asaxulia 2.22 cxrilSi.



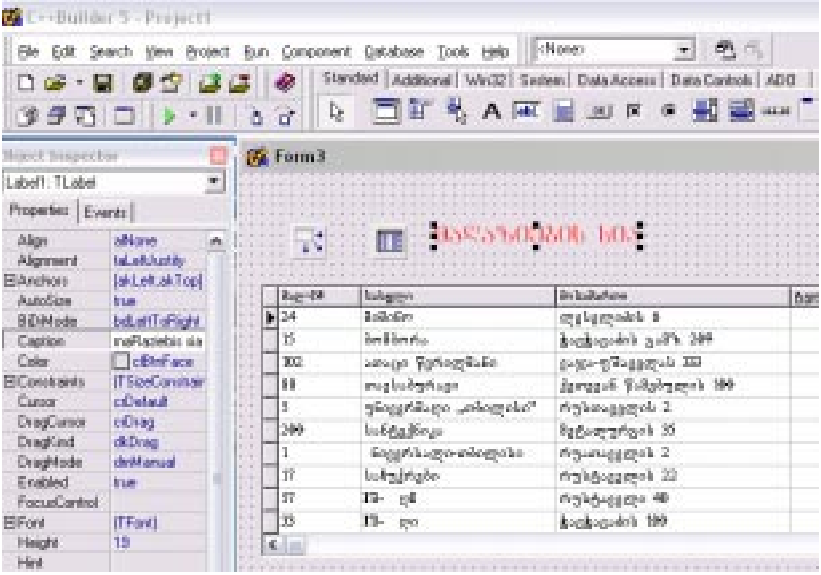
nax.2.19-a. mb-is cxr i l Ta diagrama


Query : <Untitled>
Raioni.DBF
RAIONID
DASAXELEBA
join1
Kategoria.dbf
CATEGID
DASAXELEBA
join4
Magazia.DBF
MAGAZID
SAXELI
MISAMARTI
TEL
RAIONID
JGUFI
TANRAOD
GAKIDMOZUL
TARIGI
EMAILI
join2
join1
GakidFactura.dbf
FAKT_ID
MAGAZID
PRODID
ERTFASI
RAODEN
ZOMERT
TANXA
TARIGI
join2
join3
Producti.DBF
PRODID
SAXELI
CATEGID
join3
join4
nax.2.20

SQL

```
SELECT DISTINCT   D.RAIONID, D.DASAXELEBA, d1.CATEGID, d1.DASAXELEBA,
D2.SAXELI, D2.MISAMARTI, D2.GAKIDMOZUL, d3.TANXA, d3.TARIGI, D4.PRODID,
D4.SAXELI, D4.CATEGID
FROM ":LiaDB:Raioni.DBF" D, ":LiaDB:Kategoria.dbf" d1, ":LiaDB:Magazia.DBF" D2,
":LiaDB:GakidFactura.dbf" d3, ":LiaDB:Producti.DBF" D4
WHERE
(D2.RAIONID = D.RAIONID)
 AND (d3.MAGAZID = D2.MAGAZID)
 AND (D4.PRODID = d3.PRODID)
 AND (D4.CATEGID = d1.CATEGID)
ORDER BY D.RAIONID, D.DASAXELEBA, d1.CATEGID, d1.DASAXELEBA,
D2.SAXELI, D2.MISAMARTI, D2.GAKIDMOZUL, d3.TANXA, d3.TARIGI, D4.PRODID,
D4.SAXELI, D4.CATEGID
```

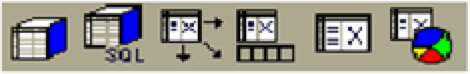
nax.2.20

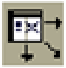
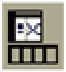
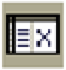


nax.2.21

kubis yoveli ganzomileba warmovadgineT monacemTa bazis cxrilTa velebis saxiT (maRaziebi, produqtebi, klientebi, kategoriebi da sxv.). didi savaWro qselis operatiuli marTvisa da efeqturi muSaobisTvis (romlis filialebi sxvadasxva raionebSia ganTavsebuli) realizebuli gvaqvs am obieqtebze saqonelbrunvis gegmebis Sesrulebis operatiuli analizis amocana, romelic saSualebas iZleva mTliani informacia warmovadginoT sxvadasxva WrilSi.

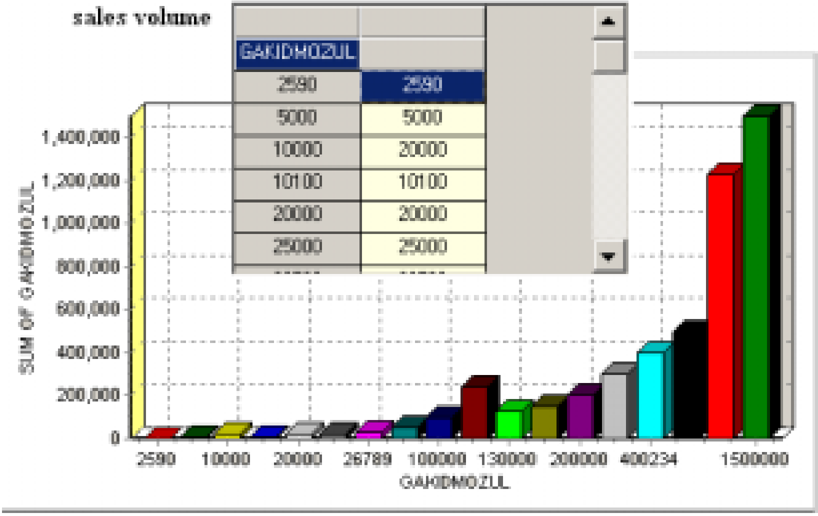
programuli paketi *BorlandC++Builder–***is** *Decision Cube***–is komponentebis gamoyeneba, uzrunvelyofs ara mxolod mravalfaqtoruli analizis Catarebas, aramed vizualuri grafikuli masalis warmodgenasac. 2.22 naxazze warmodgenilia** Decision Cube **vizualuri komponentebis palitra:**



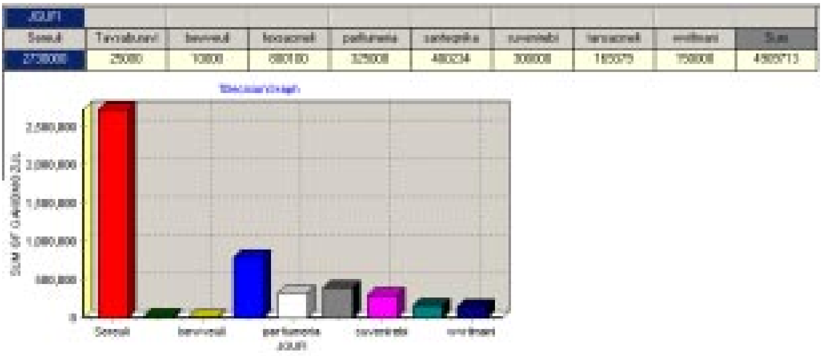
	DecisionCube	უზრუნველყოფს დაკავშირებული ცხრილების მონაცემებთან მუშაობას. იღებს მრავალგანზომილებიან მონაცემებს
	DecisionQuery	არის სპეციალიზებული SQL-მოთხოვნა,რომელიც ამზადებს დაკავშირებული ცხრილების მონაცემებს გადაწყვეტილებათა კუბისთვის
	DecisionSource	აკავშირებს მართვის გადაწყვეტილებას კონფიგურირებულ მონაცემებსა და გადაწყვეტილებათა კუბს შორის
	DecisionPivot	მომხმარებელს აძლევს ნებას აკონტროლოს გადაწყვეტილების წყაროს მდგომარეობა
	DecisionGrid	წარმოადგენს დაკავშირებულ ცხრილებს, მონაცემებს GRID-ცხრილის სახით
	DecisionGraph	გამოაქვს ეკრანზე დაკავშირებული ცხრილების მონაცემთა გრაფი

nax.2.22

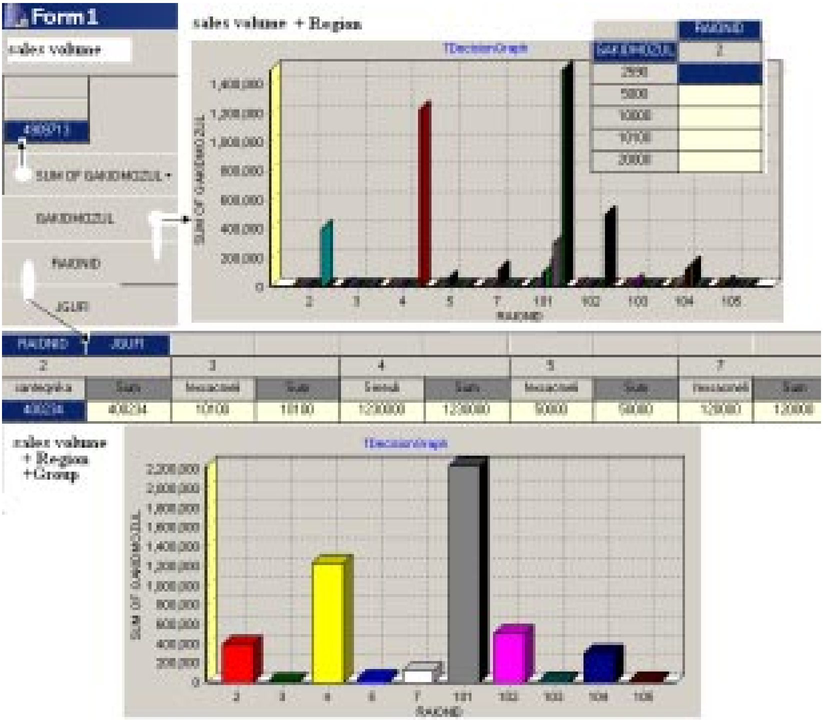
kubis instrumentis gamoyenebiT miRebuli interfeisis ramdenime sailustracio magaliTi motanilia 2.23-2.25 naxazebze.



nax.2.23



nax.2.24


Form1
sales volume
sales volume + Region
sales volume
+ Region
+Group

nax.2.25

2.5. ganawilebuli sistemis resursebis marTvis procesis modeli

ganvixiloT kompiuteruli qseli, sadac aris ramdenime momxmarebeli da ramdenime serveri (momsaxure). davuSvaT, rom serverTagan erT-erTi asrulebs gamanawileblis funqcias, e.i. iRebs momxmareblisagan moTxovnas da ugzavnis mas momsaxurebisaTvis im servers, romelic Tavisufalia. Tu yvela serveri dakavebulia, moTxovna dgeba rigSi da elodeba erT-erTi maTganis ganTavisuflebas.

serveri, miiRebs ra moTxovnas gamanawilebeli serveridan, emsaxureba mas da ubrunebs isev gamanawilebel servers, romelic, Tavis mxriv pasuxs ubrunebs momxmarebels.

unda vigulisxmoT, rom moTxovnebi momxmareblebisgan modis uwyvetad, garkveuli sixSiriT. TiToeuli serveri erTeuli moTxovnis momsaxurebas andomebs garkveul dros. im SemTxvevaSi rodesac, moTxovnaTa formirebis sixSire didia, gamanawilebel serverTan warmoiqmneba rigi. Tuki moTxovnaTa formirebis sixSire Zalze didia qseli SeiZleba gadaitvirTos da veRar SeZlos funqcionireba.

Cveni mizania qselis arsebuli parametrebis meSveobiT davadginoT misi muSaobis kritikuli wertili, SevarCioT iseTi maxasiaTeblebi, romlebic uzrunvelyofs mis normalur funqcionirebas da SevqmnaT programuli produqti, romelic yovelive amas ganaxorcielebs. masobrivi momsaxurebis Teoriis TvalsazrisiT zemoT aRwerili sistema aris $M/M/m$ tipis.

ganvixiloT maxasiaTeblebi da maT Soris kavSirebi, romlebic gaaCnia qsels. aqve unda aRvniSnoT rom qselis funqcionirebas ganvixilavT stacionarul reJimSi. am SemTxvevaSi, rogorc cnobilia, garkveul idealizaciasTan gvaqvs saqme. realurad drois yovel t momentSi sistemaSi arsebobs moTxovnaTa raRac k raodenoba. albaToba imisa, rom

drois mocemul t momentSi sistemaSi imyofeba k moTxovna, aRvniSnoT $P_k(t)$-Ti. Cven unda vigulisxmoT, rom t-s zrdasTan erTad albaToba $P_k(t)$ TandaTan mudmivi xdeba. am SemTxvevaSi $P_k(t)$-s nacvlad SeiZleba gamoviyenoT P_k, romelic ukve aRar aris drois funqcia. es daSveba ar gulisxmobs imas, rom sistema ar gadadis erTi mdgomareobidan meoreSi, ra Tqma unda drois mixedviT icvleba qselSi arsebuli moTxovnebis raodenoba, magram albaToba imisa, rom sistemaSi sakmarisad didi drois gasvlis Semdeg imyofeba k moTxovna, gamoixateba P_k-Ti.

programuli paketSi saangariSo funqciebis dasaprogrameblad gamoviyenoT aRniSnuli klasikuri modelebi. amgvarad, serverebis raodenobiT, Semosul moTxvnaTa intensivobiT da droiT, romelsac andomebs serveri TiToeuli moTxovnis momsaxurebas, SegveZleba davadginoT qselis sxvadasxva maxasiaTebeli.

აღვნიშნოთ მოთხოვნათა მისვლის ინტენსივობა λ-თი, ხოლო თითოეული მოთხოვნის მომსახურების დროის Ts-ით. ამ შემთხვევაში ერგოდიულობის პირობა არის: λ*Ts<1 .

ქსელს გააჩნია შემდეგი მახასიათებლები:

1. მიმართვის ინტენსივობა: u=λ*Ts.
2. სერვერის დატვირთვა: ρ=u/m.

იმისათვის, რომ სისტემა იყოს სტაბილური, სერვერს უნდა შეეძლოს თავი გაართვას მოთხოვნათა მისვლის საშუალო ინტენსივობას, ეს კი ნიშნავს, რომ მიმართვის ინტენსივობა უნდა იყოს სერვერთა რაოდენობაზე ნაკლები, ან რაც იგივეა, სერვერის დატვირთვა უნდა იყოს ერთზე ნაკლები, ე.ი. u<m ან ρ<1.

M/M/m ***saxis sistemebis kvlevisas mniSvnelovani adgili ukavia erlangis funqcias. es funqcia gansazRvravs imis albaTobas, rom yvela serveri dakavebulia, da imavdroulad imis albaTobasac, rom mosul moTxovnas mocda mouwevs. erlangis funqciisTvis gamoviyenebT gamosaxulebas***

P_0 ***aris albaToba imisa, rom qselSi saerTod araa moTxovna.***

$$Ec(m,u) = (u^m / m!)/(u^m / m! + (1-\rho)\sum_{k=0}^{m-1}(u^m / m!))$$

მომხმარებლისთვის დიდი მნიშვნელობა აქვს მოთხოვნის რიგში დგომის (მოცდის) საშუალო დროს, იგი გამოითვლება ფორმულით:

$$Tw = \frac{Ec(m,u)Ts}{m(1-\rho)}$$

აუცილებელია განვსაზღვროთ მოთხოვნის სისტემაში ყოფნის საშუალო დრო: Tq=Tw+Ts.

ალბათობა იმისა, რომ მოთხოვნის სისტემაში ყოფნის დრო ნაკლებია ტ-ზე დამოკიდებულია u=m-1 თუ არა. თუ ეს პირობა სრულდება, მაშინ ადგილი აქვს შემდეგ ტოლობას:

$$P(\text{სისტემაში ყოფნის დრო}<t)=1-\left(1+\frac{t}{Ts}Ec(m,u)\right)e^{\frac{-t}{Ts}}$$

წინააღმდეგ შემთხვევაში:

$$P(\text{სისტემაში ყოფნის დრო}<t)=$$

$$=1+\frac{B+Ec(m,u)}{B}e^{\frac{-t}{Ts}}+\frac{Ec(m,u)}{B}e^{-(m-u)\frac{t}{Ts}}$$

სადაც B=m-1-u.

დროის ყოველ მომენტში ქსელში იარსებებს მოთხოვნათა გარკვეული რაოდენობა. რაც ნაკლები მოთხოვნაა ქსელში, მით უკეთ ფუნქციონირებს იგი. ალბათობა იმისა, რომ ქსელში არის k მოთხოვნა არის P_k სადაც

$$Pk = \frac{u}{k!}P0 \qquad \text{როცა } k<=m$$

და

$$Pk = \frac{u^k}{m!\,m^{k-m}}P0 \qquad \text{როცა } k>=m$$

es rac Seexeboda albaTobebs. TviT sistemaSi arsebul moTxovnaTa raodenoba ki aris** Lq, **sadac

Tuki qselSi aris** m **an** m**-ze naklebi moTxovna, maSin im moTxovnebis raodenoba, romlebic rigSi dganan 0-is tolia,

$$Lq = u + \frac{pEc(m,u)}{1-\rho}$$

xolo Tu viciT, rom x ***moTxovna rigSi dgas, maSin mTlianad sistemaSi iqneba*** $x+m$ ***moTxovna. ase, rom gvaqvs Semdegi maxasiaTeblebi:***

albaToba imisa, rom arcerTi moTxovna ar icdis:

obieqt-orientirebuli daprogramebis safuZvelze, kompiuteruli qselisaTvis mizanSewonilia SevqmnaT klasi,

$$P\{\text{არცერთი მოთხოვნა არ იცდის}\}=\sum_{k=0}^{m} Pk$$

ალბათობა იმისა, რომ x მოთხოვნა დგას რიგში:

$$P\{x \text{ მოთხოვნა იცდის}\}=P_{x+m} \quad \text{სადაც } x>m$$

მომლოდინე მოთხოვნათა საშუალო რიცხვი:

$$Lw = \frac{pEc(m,u)}{1-\rho}$$

romlis daxuruli parametrebi iqneba moTxovnaTa mosvlis sixSire, momsaxurebis dro, serverebis raodenoba da a.S. funqcia - wevrebis saxiT ki realizebuli iqneba yvela zemoT CamoTvlili maxasiTeblebis gamoTvla, Sesabamisi formulebis gamoyenebiT.

calke klasebad iqneba realizebuli momxmareblis interfeisi da parametrTa Soris damokidebulebaTa grafikebis agebisa da vizualizaciis funqciebi.

zemoT ganxiluli sidideebi srulad axasiaTebs kompiuteruli qselis muSaobis stacionalur reJims. Cvens mier Seqmnili programuli saSualeba swored am sidideebs da formulebs iyenebs qselis parametrebis analizisaTvis da maTi optimaluri mniSvnelobis SerCevisaTvis.

igi, iRebs ra informacias qselSi moTxovnebis mosvlis sixSireze, serverTa raodenobasa da TiToeuli moTxovnis

momsaxurebis droze, angariSobs iseT parametrebs rogoricaa moTxovnis rigSi dgomis dro, buferSi moTavsebuli momlodine moTxovnaTa raodenoba, serveris datvirTva da moZraobis intensivoba, sxvadasxva albaTobebi da a.S.

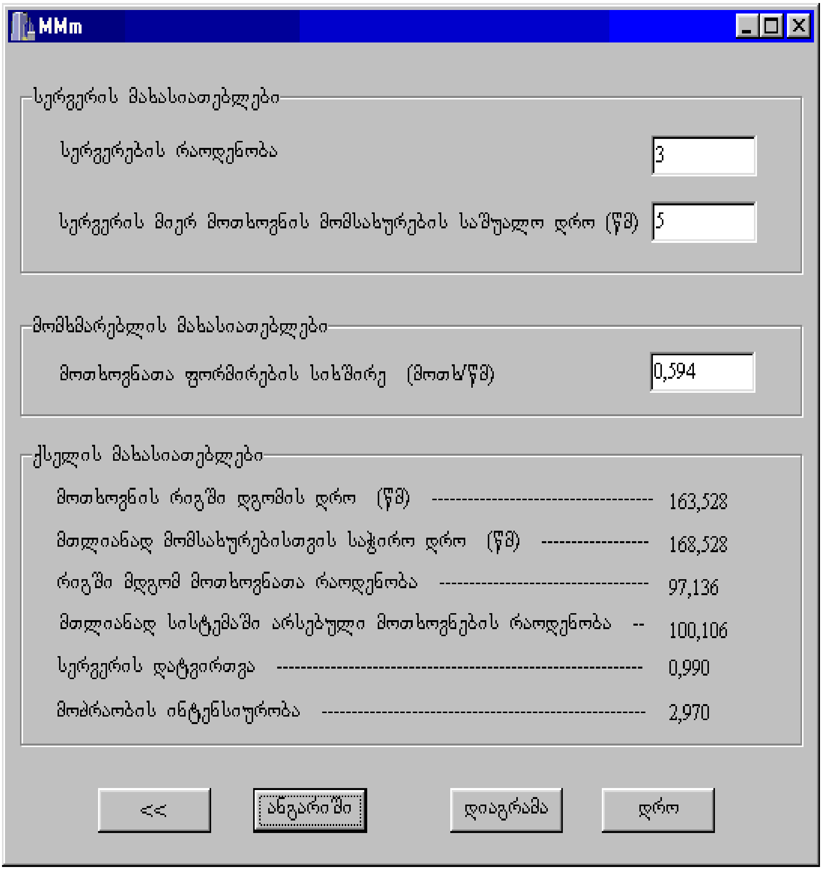
garda amisa, gamoiTvlis mocemul pirobebSi optimaluri muSaobisaTvis saWiro parametrebs da agebs maT Soris damokidebulebaTa grafikebs.

2.26 naxazze mocemulia *Borland_C++Builder* instrumentiT agebuli momxmareblis interfeisi, romelSic muSaoba warimarTeba vizualuri da tradiciuli daprogramebis komponentebis reversuli teqnologiiT.

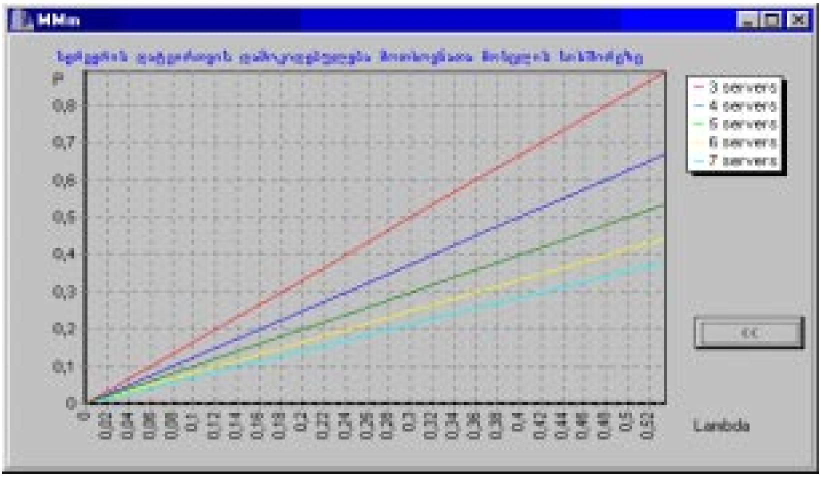
rogorc naxazidan Cans, momxmarebels SeuZlia Seitanos (da cvalos) sami parametris mniSvneloba: serverebis raodenoba, momsaxurebis saSualo dro da moTxovnaTa raodenobis intensiuroba. Rilakit `angariSi~ sistema gaiangariSebs qselis ZiriTad maxasiaTeblebs, kerZod: serveris datvirTva, moZraobis intensiuroba, moTxovnis rigSi dgomis dro, mTlianad momsaxurebisTvis saWiro dro, rigSi mdgom moTxovnaTa raodenoba, sistemaSi myof moTxovnaTa saerTo, raodenoba.

RilakiT `diagrama~ gamoitaneba gaangariSebis Sedegad miRebuli grafikebi. kerZod, 2.27 naxazze mocemulia programulad miRebuli diagrama serveris datvirTvis damokidebulebisa moTxovnaTa mosvlis sixSireze serverebis sxvadasxva raodenobisaTvis (mag., 3-:-7).

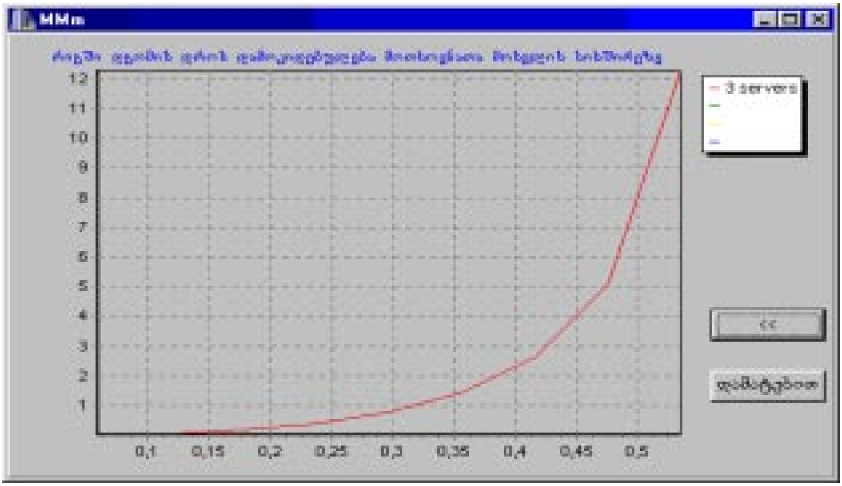
2.28 da 2.29 naxazebze ki mocemulia diagramebi moTxovnaTa rigSi dgomis drois damokidebulebisa moTxovnaTa mosvlis sixSireze serverebis sxvadasxva raodenobis (mag., 3-:-6) SemTxvevaSi. bolo diagramebidan kargad Cans, Tu rogor iklebs moTxovnaTa rigSi dgomid dro momsaxure arxebis momatebiT.


MMm
სერვერის მახასიათებლები
სერვერების რაოდენობა
3
სერვერის მიერ მოთხოვნის მომსახურების საშუალო დრო (წმ)
5
მომხმარებლის მახასიათებლები
მოთხოვნათა ფორმირების სიხშირე (მოთხ/წმ)
0,594
ქსელის მახასიათებლები
მოთხოვნის რიგში დგომის დრო (წმ)
163,528
მთლიანად მომსახურებისთვის საჭირო დრო (წმ)
168,528
რიგში მდგომ მოთხოვნათა რაოდენობა
97,136
მთლიანად სისტემაში არსებული მოთხოვნების რაოდენობა
100,106
სერვერის დატვირთვა
0,990
მოძრაობის ინტენსიურობა
2,970
<<
ანგარიში
დიაგრამა
დრო

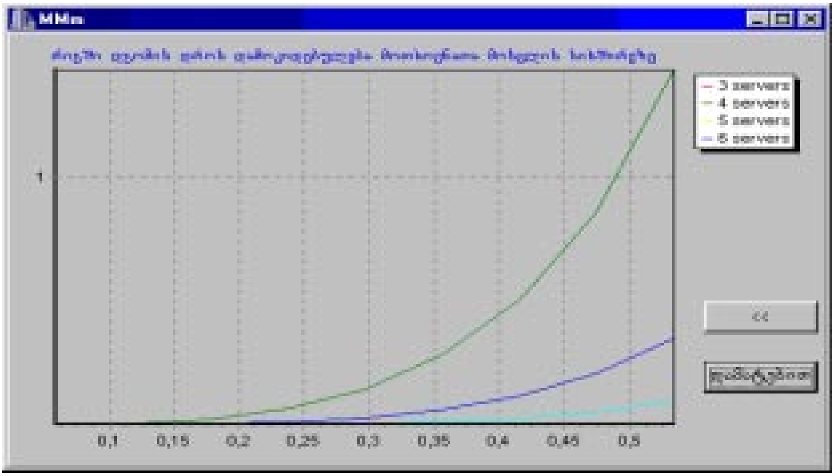
nax.2.26



nax.2.27



nax.2.28


MMm
3 servers
4 servers
5 servers
6 servers
1
0,1
0,15
0,2
0,25
0,3
0,35
0,4
0,45
0,5
<<

nax.2.29

sakontrolo kiTxvebi da savarjiSoebi

1. rogor SevqmnaT monacemTa bazis cxrilebi (Tables) klasebisaTvis studenti, leqtori, jgufi da leqcia ?

2. aageT mravalgverdiani forma oTxi furcliT da gamoitaneT TiToeulze studentebis, leqtorebis, leqciebisa da jgufebis cxrilebi, maTSi monacemebis Setanisa da koreqtirebis SesaZleblobiT.

3. daaxasiaTe vizualuri komponentis (DataModule) muSaobis principebi. aage ori dakavSirebuli cxrili.

4. risTvis da rogor gamoiyeneba vizualuri instrumenti QBE ? moiyvane magaliTebi.

5. ra aris SQL ena ? daaxasiaTe misi ZiriTadi elementebi (operatorebi).

6. ras warmoadgens Session-komponenta da rogor gamoiyeneba igi ?

7. rogor xorcieldeba monacemTa filtracia ?

8. ra dros da rogor gamoiyeneba LookUp-komponenta ?

9. rogor xorcieldeba BC++BkavSiri Excel-failebTan da ra kavSiri aqvs mas Active-X panelTan ?

10. rogor vimuSaoT SQL Explorer-Si, risTvisaa igi saWiro da ra kavSiri aqvs mas monacemTa bazis aliasTan da cxrilebTan?

11. rogor movamzadoT angariSi dasabeWdad ? aageT `xelfasis uwyisis~ cxrili da gamobeWdeT igi.

12. rogor proeqtdeba saproblemo sferos gamoyenebiTi sistema BC++Builder-is garemoSi ?

13. moamzadeT proeqti programuli paketisaTvis `biblioTekaSi mkiTxvelTa momsaxureba~.

14. aageT proeqti da programuli paketi amocanisaTvis `institutSi studentTa gamocda~.

15. rogor davaproeqtoT `xelfasis~ amocana BC++Builder-is garemoSi ?

16. daaproeqteT amocana `sabanko kreditebis kontroli~ BC++Builder-is garemoSi.

17. daaproeqteT amocana `produqciis moZraoba sawyobSi~ BC++Builder-is garemoSi.

18. daaproeqteT amocana `kompiuteruli resursebis marTva klient-server sistemaSi~ BC++Builder-is garemoSi.

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