Samarqand kompyuter texnologiyalari va gidromelioratsiya kolleji

«Axborot kommunikatsiya texnologiyalari» kafedrasi

«Dasturlash » o’quv amaliyotidan laboratoriya ishlarini bajarish

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Samarqand - 2012 yil

Ushbu qo’llanma «Dasturlash» kursiga doir amaliy ishlarini va ularni yechishga oid qisqacha amaliy ma’lumotlarni o’z ichiga oladi. Qo’llanmadagi amaliy ishlarini bajarishda Delphi dasturlash tilidan foydalanilgan.

Qo’llanma akademik litsey va kasb hunar kollejining EHM bo’limi talabalari uchun mo’ljallangan bo’lib, undan boshqa foydalanuvchilar ham foydalanishlari mumkin.

Qo’llanma hozirgi kunda zamonaviy dasturlash tillari qatoriga kiruvchi, hamda dasturlash texnologiyasining rivojlanishida muhim o’rin tutuvchi Delphi dasturlash tilini o’rganishga bag’ishlangan. “Objekt Paskal” dasturlash tilida dasturlash ko’nikmasiga ega bo’lganlar uchun Delphi dasturlash tilida dastur yaratish murakkablik tug’dirmaydi. Chunki Delphi dasturlash tilida “Objekt Paskal” tili elementlaridan foydalaniladi.

1-laboratoriya ishi

Mavzu: Delphi dasturlash tilining elementlari.

Ishning maqsadi:

a) Delphi dasturlash tilida o'zgarmaslar,nom,o'zgaruvchi, standart funksiya, nostandart funksiyalar, o'zgartirish funksiyalari va ifodalarni yozish ko'nikmasini hosil qilish;

b) Dasturlash tilida berilgan arifmetik ifodalarni odatdagi ko'rinishda yozish ko'nikmalarini hosil qilish;

Masalaning qo'yilishi:

a) Berilgan sodda arifmetik ifodalarni Delphi dasturlash tilida yozish.

b) Delphi dasturlash tilida sodda arifmetik ifodalarni odatdagi ko'rinishda yozish.

Vazifani bajarish usuli

1-vazifa. Berilgan sodda arifmetik ifodalarni Delphi dasturlash tilida yozing:

a) $\frac{(xy)^{b+4,75}}{ab^3z^4}$ b) $\frac{(x-y^2)(x-y^3)(x-y^4)}{2-y^5}$;

c) $\frac{\sin(\pi x)^3+|\cos^4 x^4|}{tg(x-y^3+z^4)+\frac{3}{61}x^{9.,05}}$; d) $\left[(\frac{q-1}{p})^y+y^{\alpha^z}-y^{x-\ln x}\right]$;

e) $\frac{\sin(x+|x|)}{ax^2+bx+c}-(-5)^{x+y}+\sin^{\cos x}x+x^{-1}$; f) $0.43*10^{-6}$

g) 0,0003 h) x^y

Bajarish: Berilgan soda arifmetik ifodalarni Delphi dasturlash tilida yozamiz:

a) Exp((b+4.75)*ln(x*y)) /a*exp(3*ln(b))*exp(4*ln(z));

b) sqr(x-y)*(x-exp(3*ln(y))*(x- exp(4*ln(y))/(2-exp(5*ln(y)));

c) (sin(exp(3)*ln(3.14*x)))+abs(exp(4*ln(cos(exp(4*ln(x))))*ln(4)))/(sin(x-y*y*y+exp(4*ln(z))/cos(x-y*y*y+ exp(4*ln(z)))+3/61*exp(9.05*ln(x)));

d) Exp(exp((y)*ln((q-1)/p))+exp(exp(z*ln(a))*ln(y))-exp(x+log(x)*ln(y)));

e) Sin(x+abs(x))/(a*sqr(x)+b*x+c)-exp((x+y)*ln(-5))+exp(cos(x)*ln(sin(x)))+exp(-1*ln(x));

f) 0.43E-6

g) 3E-4

h) Exp(y*ln(x))

2-vazifa. Delphi dasturlash tilida yozilgan arifmetik ifodalarni odatdagi ko'rinishda yozing:

a) (sqr(x-1)+0.1*sqr(10))/(exp(x+a)+exp(3*ln(sin(x)));

b) sqr(sin(x/3))-sqrt(1-sqrt(1+cos((x-2)/(x+1))))+0.3/sqr(x+y)+2*sqr(10).

Bajarish: Delphi dasturlash tilida keltirilgan arifmetik ifodalarni odatdagi ko'rinishda yozamiz:

a) $$\frac{\sqrt{x-1}+0.1\cdot 10^2}{e^{x+a}+\sin^3 x};$$

b) $$\sin^2\frac{x}{3}-\sqrt{1-\sqrt{1+\cos\frac{x-2}{x+1}}}+\frac{0{,}3}{(x+y)^2}+2\cdot 10^2;$$

O’zgartirish funksiyalari

1. Chr(n) – kodi n ga teng belgi
2. IntToStr(n)-butun n ni tasvirlovchi satr
3. FloatToStr(n)-haqiqiy n ni tasvirlovchi satr
4. FloatToStr(n,f,k,m)- haqiqiy n ni tasvirlovchi satr(f-fopmat, k-aniqlik, m-kasr qismidagi raqamlar soni.
5. StrToInt(s) – satrni butun songa o’tkazish
6. StrToFloat(s) – satrni haqiqiy songa o’tkazish
7. Round(n) – haqiqiy sonni yaxlitlsh
8. Trunc(s) – haqiqiy sonni kasr qismini olib tashlash
9. Frac(s) – kasrli sonni kasr qismi
10. Int(s) – kasrli sonni butun qismi

Teksirish uchun savollar

1. Sonlarning Delphi tilida yozilishi bilan odatdagi yozilishi orasida qanday farq bor?
2. Delphi da qanday o’zgaruvchilar mavjud?
3. Identifikator nima?
4. Dasturlash tilida arifmetik ifoda ta’rifi qanday beriladi?
5. Delphida qanday standart funksiyalar qabul qilingan va ular qanday yoziladi?
6. Delphida arifmetik amallarni bajarilish tartibini tushuntiring?
7. Delphida qanday standart funksiyalar mavjud?
8. O’zgartirish funksiyalari ishlash prinsipini tushuntiring.

1-laboratoriya ishiga doir vazifalar.

1-variant.

1-vazifa. Berilgan sodda arifmetik ifodalarni Delphi dasturlash tilida yozing.

a) $\frac{1{,}15ba^2 + 0{,}05a^2}{x^2 + y^{3a}}$ b) $\frac{(a-b)(a+x) + x^{0{,}05}}{x^4 - cx + e^x}$

v) $-2\sqrt{y^2} + 4x^2/3 - \cos^4 x/x$ g) a(ln|tgx/2|+cost)+asina/5x^2

d) (arctg^{2}x^3+1,5sec$\sqrt{x}$ 2x/tg)1,03x)+ln^2(1,2x^3)^2+$a\sqrt{x} + bx^3$/(ax+b)^3

e) 1000000 va 0.0000001 sonlarini eksponensial sonlar shaklida yozing

f) 3e-4 va 0.2e5 sonlarini oddiy yozuvda yozing.

2-variant.

1-vazifa. Berilgan sodda arifmetik ifodalarni Delphi dasturlash tilida yozing.

a) $\sqrt{2x-y} + \sqrt{2y-x}$;

b) $\frac{\sin^2 x - \cos^3 x}{\cos\frac{x+y}{4}}$

v) $\frac{1}{5\pi} * \frac{1}{1+(\frac{x-b}{a})^3}$;

g) x^3+e^{-x}|ax+$\sqrt{b^5 + x^5}$ +sin[x+(4+5x)]|;

d) x^2*e$^{-(x-y)}$ +(x+y)sin$\frac{1}{x}$ sin$\frac{1}{|x|}$

e) $\frac{a(x-t)^2}{x+y-a} + \frac{b(x-t)^2}{x+y-b} + \frac{c(x-t)^2}{x+y-c}$

2-Laboratoirya ishi

Mavzu: Sodda dasturlar tuzish.

Ishning maqsadi: Delphi tilida ma’lumotlarni tasvirlash, kiritish, chiqarish va o’zlashtirish operatorlaridan foydalanib, talabalarni sodda dasturlar tuzishga o’rgatish.

Masalaning qo’yilishi:

a) Argumentning berilgan qiymatida funksiya qiymatini hisoblash dasturini delphi dasturlash tilida tuzing;

b) Berilgan masala shartiga ko’ra topilgan formulaga kerakli dasturni tuzing.

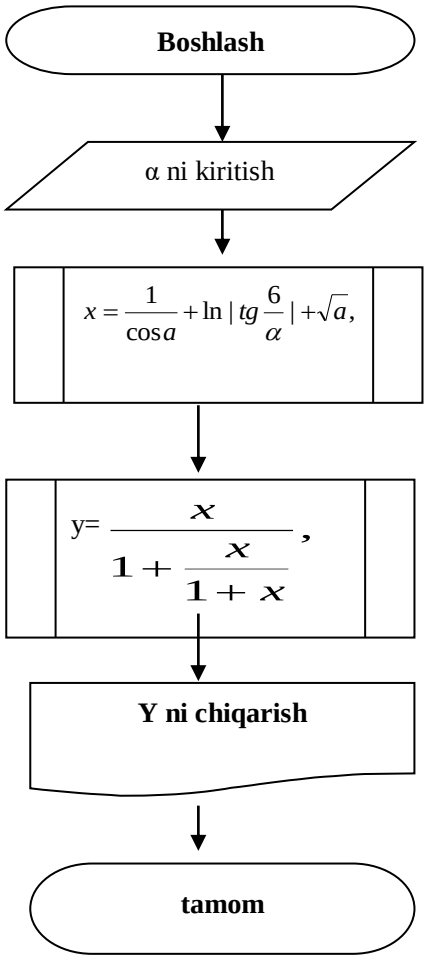
Vazifaning bajarish tartibi

1-vazifa. Delphi tilida berilgan Y= $\frac{x}{1+\frac{x}{1+x}}$,

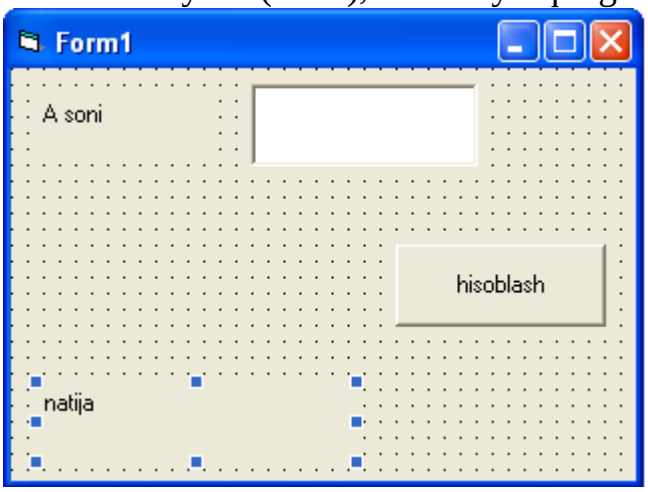
bu erda $x=\frac{1}{\cos\alpha}+\ln|tg\frac{6}{\alpha}|+\sqrt{\alpha},$ funksiya qiymatini hisoblash dasturini tuzing.

Bajarish: Kiritish, chiqarish, o’zlashtirish operatorlaridan va tavsifdan foydalanib, berilgan funksiyani hisoblash dasturini quyidagicha tuzamiz.

1. Masalaning blok sxemasini tuzamiz.



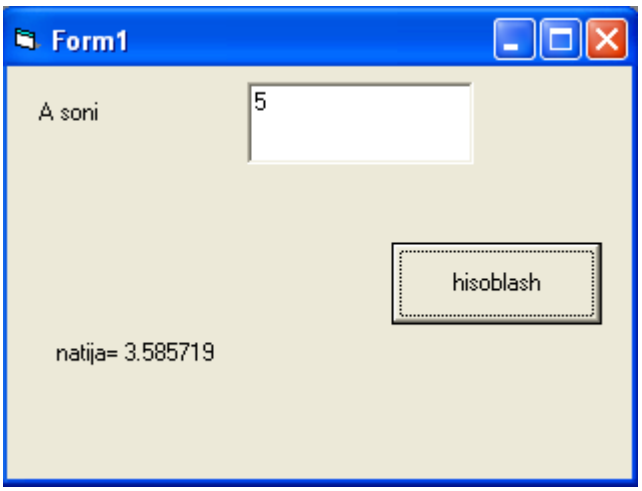
2) Maket formani yaratish. Delphi muhitini ishga tushiramiz. Natijada ishchi sohada yangi maket forma hosil bo'ladi. Maket formaga biz ikkita yozuv(label1,label2), bitta matn oynasi(edit1), bitta buyruq tugmasini(Button) joylashtiramiz.



3) Buyruq tugmasini(Button1) ikki marta sichqoncha bilan bosib, kod muharririni ochamiz va unga dastur yozamiz.

```
procedure TForm1.Button1Click(Sender: TObject);
var a, x, y: Real; // o'zgaruvchilar e'lon qilish
begin
a:= StrToFloat(Edit1.Text); // matn maydonidan satrni haqiqiy songa o'tkazish
x:= 1 / Cos(a) + Ln(Abs(Sin(6 / a) / Cos(6 / a))) + Sqr(a);
y:= x / (1 + x / (1 + x));
Label2.Caption:= 'Natija=' + FloatToStr(y); //yoziv maydoniga haqiqiy n ni satr ko'rinishda tasvirlaydi
end;
end.
```

4. Natija olish. Asboblar panelida RUN(F9) tugmasini bosib, quyidagi ochilgan maket oynada A soniga qiymat beramiz va buyruq tugmasini bosib natijaga ega bo'lamiz.



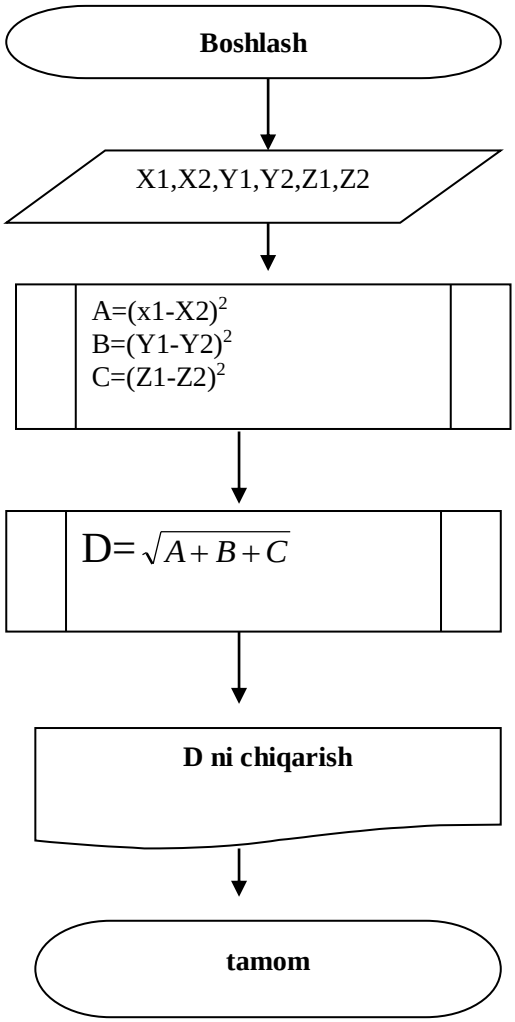
2-vazifa.

Uch o'lchovli fazoda berilgan ikki nuqta (A(X_1, Y_1, Z_1) va B(X_2,Y_2,Z_2) orasidagi masofani hisoblash dastruni tuzing.

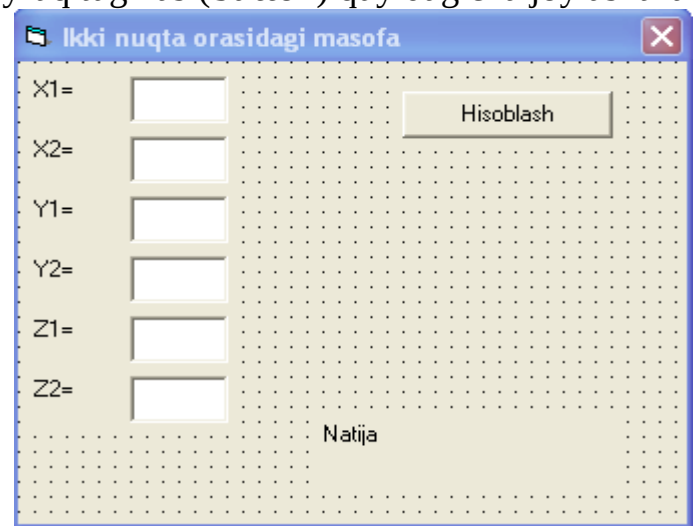
Bajarish: Analitik geometriyadan ma'lumki, uch o'lchovli fazoda berilgan ikki nuqta orasidagi masofa

$$d = \sqrt{(X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2}$$ formula bilan hisoblanadi. Masalani hisoblash dasturini tuzamiz:

2) Masalaga blok sxema tuzamiz:



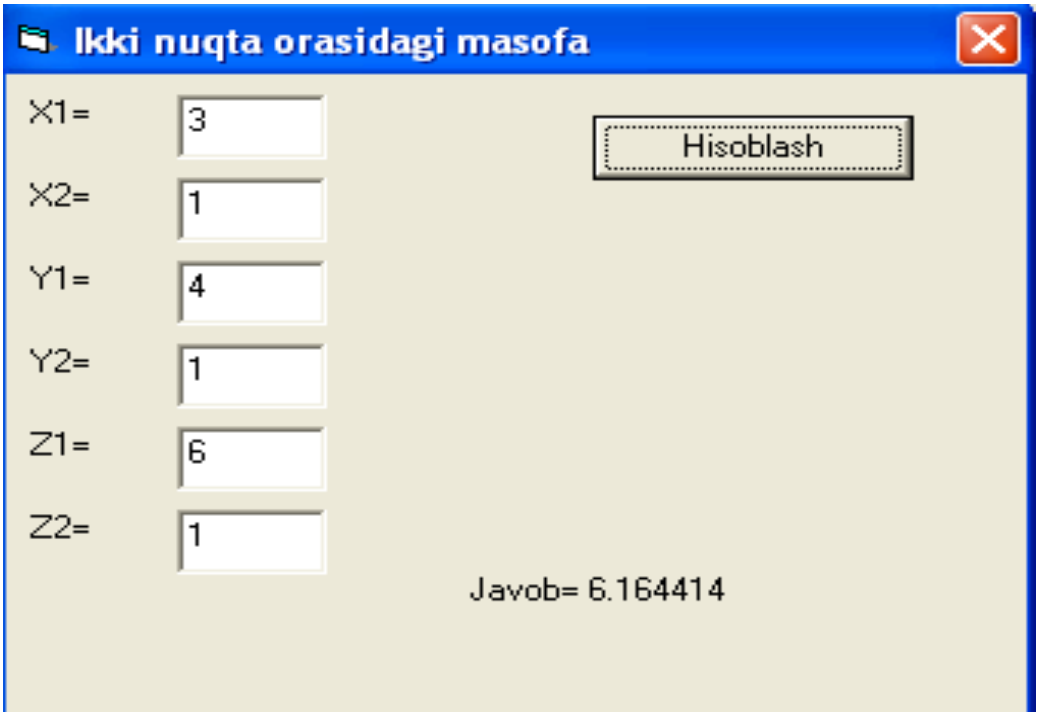
2. Maket formani yaratish. Delphi muhitini ishga tushiramiz va **File** menyusidan **NEW** buyrug'I uning ichidana **FORM** buyrug'ini tanlaymiz. Natijada ishchi sohada yangi maket forma hosil bo'ladi. Maket formaga biz yettita yozuv(**label**), 6-ta matn oynasi(**edit**), bitta buyruq tugmasi(**button**) quyidagicha joylashtiramiz.



2. Buyruq tugmaga sichqonchani uzluksiz ikki marta bosib, kod muharririni ochamiz va quyidagi dasturni yozamiz.

```
procedure TForm1.Button1Click(Sender: TObject);
Var x1, x2, y1, y2, z1, z2:Real;
   a, b, c, d: Real;
begin
x1 := StrToFloat(Edit1.Text);
x2 := StrToFloat(Edit2.Text);
y1 := StrToFloat(Edit3.Text);
y2 := StrToFloat(Edit4.Text);
z1 := StrToFloat(Edit5.Text);
z2 := StrToFloat(Edit6.Text);
a := sqr(x1 - x2);
b := sqr(y1 - y2);
c := sqr(z1 - z2);
d := Sqrt(a + b + c);
Label7.Caption := 'Javob=' + FloatToStr(d);
end;
```

4. Natija olish. Asboblar panelida Start yoki menyular qatoridan RUN menyusining run tugmasini bosib, quyidagi ochilgan maket oynada o’zgaruvchilarga qiymat beramiz va Hisoblash buyruq tugmasini bosib natijaga ega bo’lamiz.



2-laboratoriya ishiga doir vazifalar.

1-vazifa. Delphi dasturlash tilida berilgan ifodalarning dasturini tuzing.

1) **u=(1+z)** $\dfrac{x+\dfrac{y}{z}}{a-\dfrac{1}{1-x^2}}$, **bu yerda** **z=** $\dfrac{\sin^2 x}{x^2+y^2}$

2) **w=** $\dfrac{1-x\ln|x|}{xe^x}$, **bu yerda** **x=** $\dfrac{(u+v)^n}{\dfrac{3}{4}+u+v}$

3) **y=** $\dfrac{x^2+z^2}{1+x^2+z^2}+\dfrac{1}{\sqrt{1-x}}+\dfrac{1}{(x+1)^2-4}$

4) **y=** $(x^2+x\sqrt[n]{x})(2x+\dfrac{6}{5}\sqrt[n]{x}-\sin^2(x+\dfrac{n}{4}$

5) **w=** $\dfrac{1}{a^2-\sqrt{a^2-1}}$, **bu yerda** **a=** $\dfrac{u^3+e^y-\sin x}{\sqrt[5]{\cos x}+|x|}$

6) y= $\sqrt{\dfrac{\pi}{8}}\sqrt{\dfrac{\sqrt{a^2+b^2+c^2}}{a^2+b^2}}-\dfrac{1}{2a}e^{|\frac{|x-a|}{b}}$

7) y= $\dfrac{1}{\cos x}+\ln|tg\dfrac{x}{2}|+\dfrac{a+bx}{c+dx}-\dfrac{\cos^4 x}{4}+\dfrac{ab}{xy}$

8) z= $\dfrac{3{,}75a+b}{a^3+b^3}$, **bu yerda** a= $\dfrac{\sin x+y}{\cos y+x}$, b= $\dfrac{\sqrt[4]{x}+e^{|x|}}{\ln|x-3|}$

9) $a = \dfrac{\sqrt{|x|-1}-\sqrt[3]{|y|}}{1+\dfrac{x^2}{2}+\dfrac{y^2}{4}}$, b = x (arctgz + $e^{-(x+z)}$);

10) $a = \dfrac{3+e^{y-1}}{1+x^2|y-tgz|}$, $b = 1+|y-x|+\dfrac{(y-x)^2}{2}+\dfrac{(y-x)^3}{3}$;

11) $a = (1+y)\dfrac{x+y/(x^2+4)}{e^{-x-2}+1/(x^2+4)}$, $b = \dfrac{1+\cos(y-2)}{x^4/2+\sin^2 z}$;

12) $a = y+\dfrac{x}{y^2\left|\dfrac{x^2}{y+x^3/3}\right|}$, $b = \left(1+tg^2\dfrac{z}{2}\right)$;

13) $a = \dfrac{2\cos(x-\pi/6)}{1/2+\sin^2 y}$, $b = 1+\dfrac{z^2}{3+z^2/5}$;

14) $a = x\dfrac{1+\sin^2(x+y)}{2+|x-2x|(1+x^2y^2)}+x$, $b = \cos^2\left(arctg\dfrac{1}{z}\right)$;

15) $a = \ln\left|\left(y-\sqrt{|x|}\right)\left(x-\dfrac{y}{z+x^2/y}\right)\right|$, $b = x-\dfrac{x^2}{3!}+\dfrac{x^5}{5!}$;

16) $a = x\left(arctgz+e^{-(x-z)}\right)$, $b = y+\dfrac{x}{y^2+\left|\dfrac{x^2}{y-x^3/5}\right|}$;

3- laboratoriya ishi

Mavzu: Delphi da tarmoqlanuvchi algoritmlarni dasturlash.

Ishning maqsadi:

1. O’tish operatorini qo’llashni o’rganish;
2. Shartsiz va shartli operatorlarning tadbiqlarini o’rganish;

Masalaning qo’yilishi:

1. Argument x ning berilgan qiymatida ikkiga tarmoqlanuvchi jarayonning hisoblash dasturini tuzing;
2. Argument x ning berilgan qiymatiga mos keladigan uchga tarmoqlanuvchi jarayonning hisoblash dasturini tuzing
3. Har ikkala jarayonning hisoblash blok sxemasini chizing;

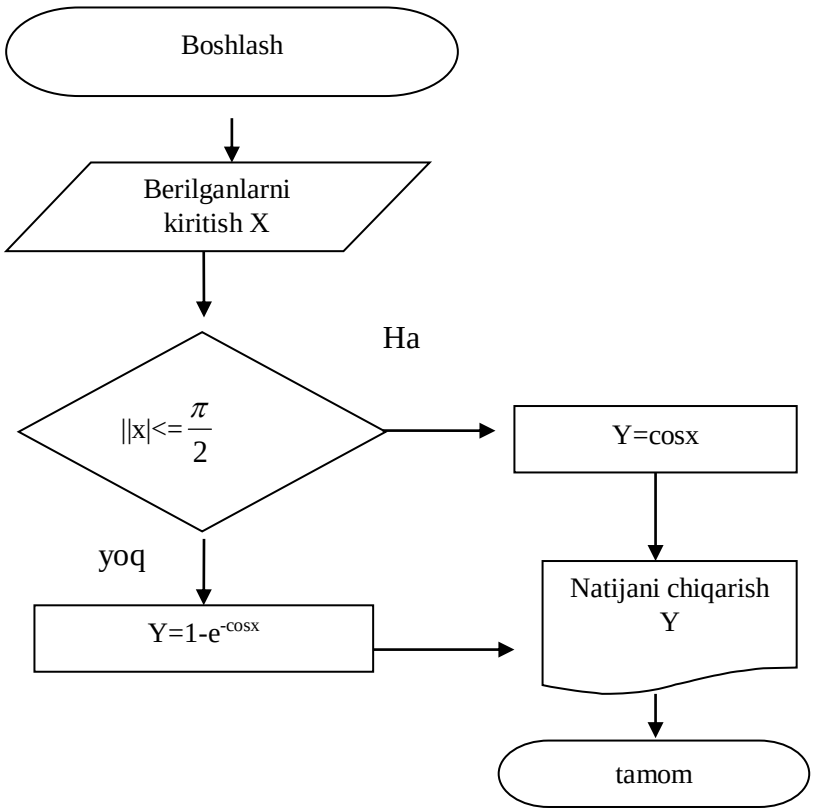
Vazifani bajarish usuli

1-vazifa. Argument x ning berilgan qiymatida

$$Y=\begin{cases}\cos x, & agar\ \ |x|\le\dfrac{\pi}{2}\ bo'lsa\\ 1-e^{-\cos x}, & agar\ |x|>\dfrac{\pi}{2}\ bo'lsa\end{cases}$$

hisoblash algoritmi va dasturini yarating.

1. Funksiya qiymatini hisoblash blok sxemasini tuzing.

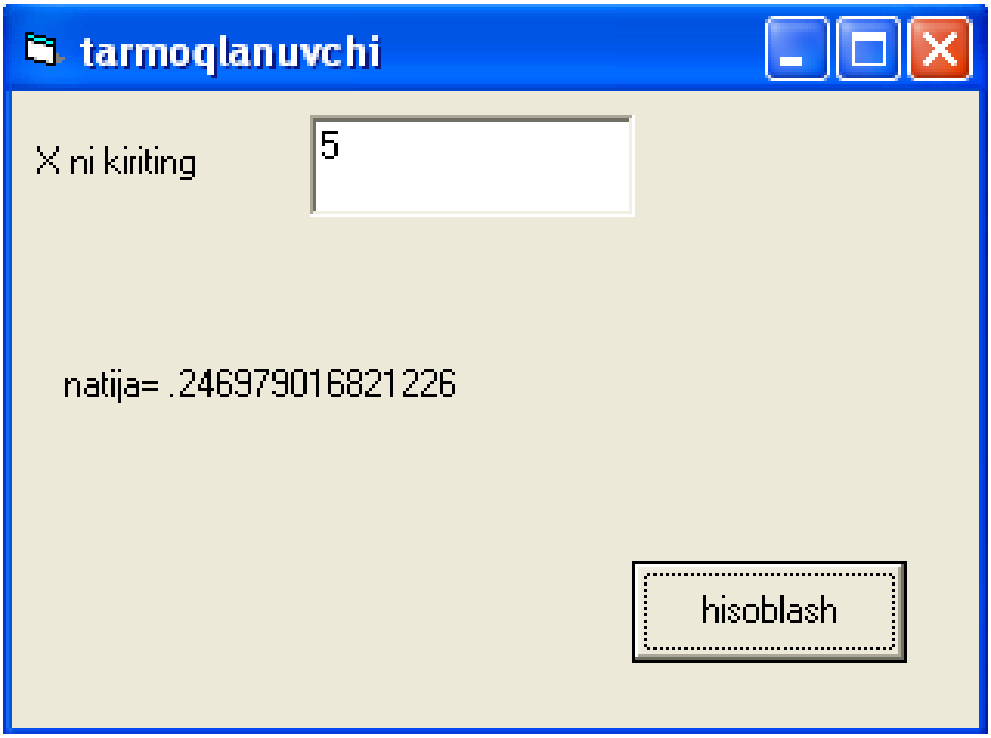


2. **Maket formani yaratish**. Delphi muhitini ishga tushiramiz va yangi maket formaga ikkita yozuv(label) komponentasini joylashtirib uning caption xususiyatiga “X ni kiriting” so’zini yozamiz, 1-ta matn oyna(edit) komponentasini kiritib, text xususiyatida edit1 so’zini o’chiramiz va 1-ta buyruq tugma(button) komponentasini joylashtirib, caption xususiyatiga “hisoblash” so’zini yozamiz.

3. Funksiyaning Delphi dasturlash tilidagi dasturi quyidagicha bo’ladi.

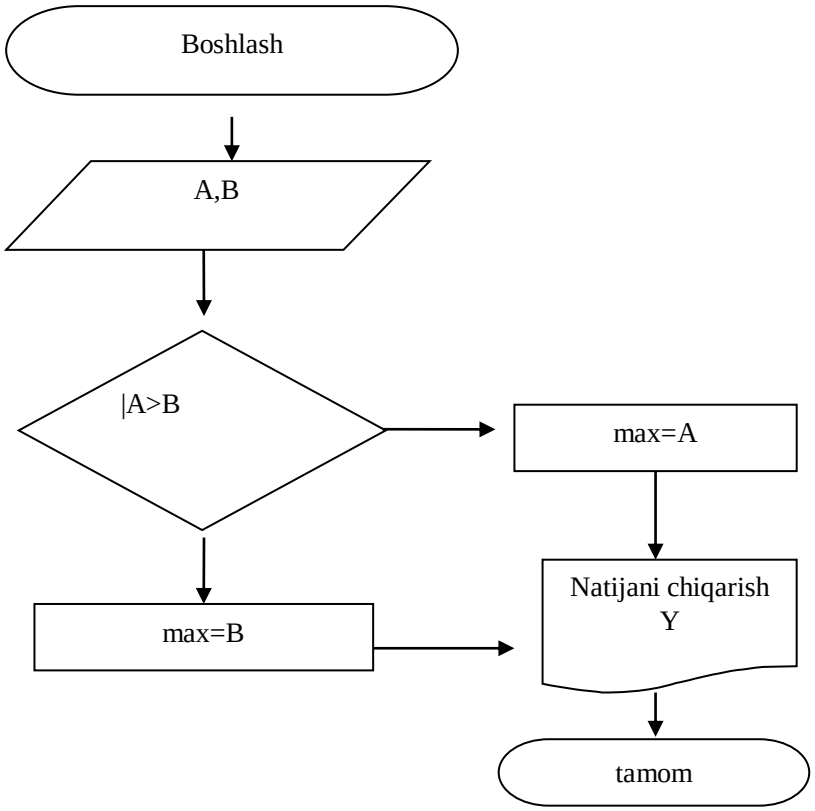
```
procedure TForm1.Button1Click(Sender: TObject);

Var x, y, pi:Real;

begin

x:= StrToFloat(Edit1.Text);

pi:= 3.14;

If Abs(x) <= pi / 2 Then y:= Cos(x) Else y:= 1 - Exp(-Cos(x));

Label2.Caption := 'natija=' + FloatToStr(y);

end;
```

4. Natija quyidagicha bo’ladi.

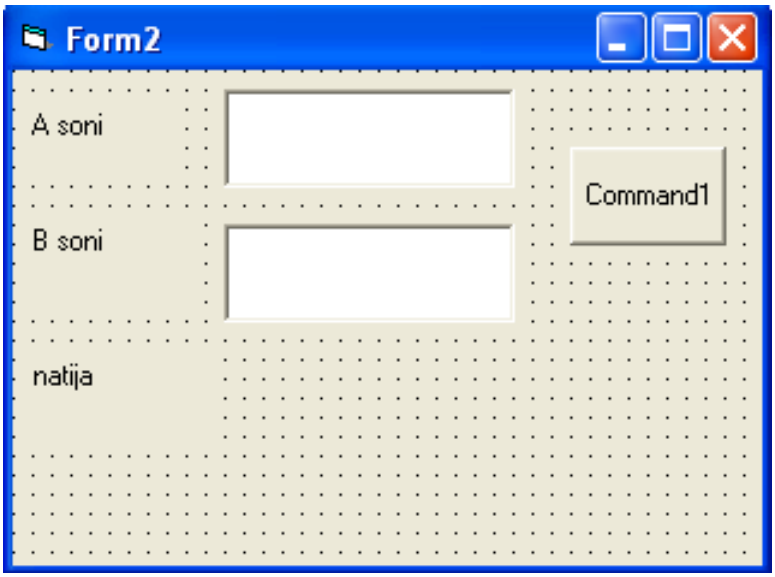


2-vazifa. Ikki sondan kattasini topish dasturini tuzing.

1. Masalaning blok sxemasini tuzamiz.



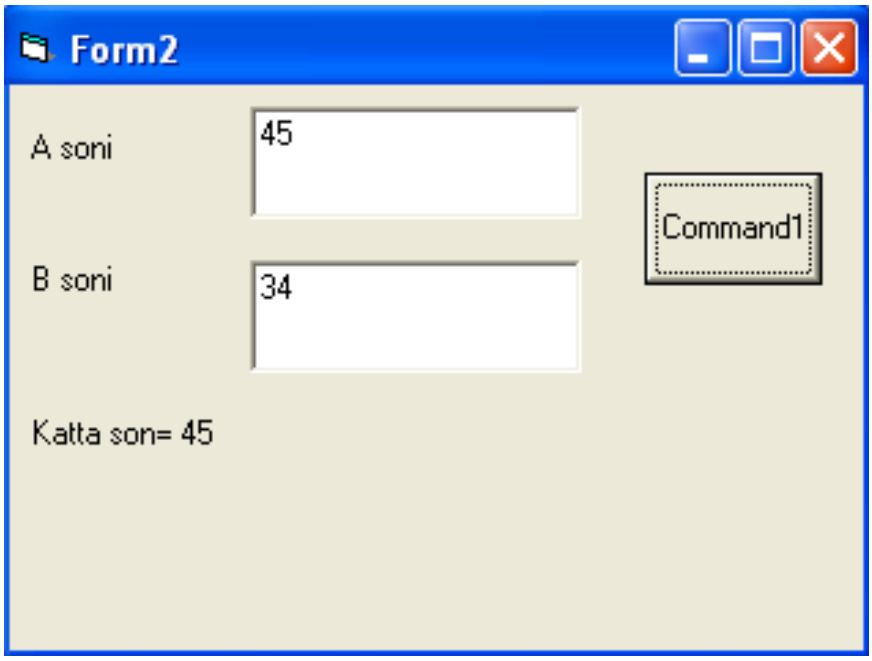
2. Maket formaga quyidagicha komponentalarni jihozlaymiz. 3 ta yoziv(label), 2 ta matn oyna(edit), 1 ta buyruq tugma(button) joylashtiramiz.



3. Masalaning Delphi tilidagi dasturi quyidagicha bo'ladi.

```
procedure TForm1.Button1Click(Sender: TObject);

Var max, a, b : Integer;

begin

a := StrToInt(Edit1.Text);

b := StrToInt(Edit2.Text);

If a > b Then max := a  else max := b;

Label3.Caption := 'Eng kattasi '+IntToStr(max);

end;
```

5. Natija sifatida quyidagiga ega bo'lamiz.



Tekshirish uchun savollar.

1. Tarmoqlanuvchi operatorning umumiy ko'rinishi qanday?
2. Tarmoqlanuvchi operatorning qisqa shakli qanday?
3. Dasturda shartsiz o'tish qanday bajariladi?
4. Dasturda shartli o'tish operatorining ishlash prinsipini tushuntiring
5. Quyidagi dastur bo'lagi natijasini aniqlang: x:=0; y:=1; if x>y th**en** begin x:=x-10; y:=y+10 end; Writeln('x=',x; 'y=', y);

3- laboratoiya ishiga doir vazifalar

1-vazifa. Funksiya qiymatini hisoblash dasturi va blok sxemasini tuzing**.**

1) **y=** $\left\{ \begin{cases} x^2+4x-7, & x<2 \\ 1/(x^2+4x-7), & x\ge 2 \end{cases} \right\}$

2) **y=** $\left\{ \begin{cases} x^3-3\sin x+8, & x\le 1 \\ \cos x/(x^3-3\sin x+8), & x>1 \end{cases} \right\}$

3) **y=** $\left\{ \begin{cases} \sqrt[3]{x}+x^2+7, & x>0 \\ x^3-3x+9, & x\le 0 \end{cases} \right\}$

4) **y=** $\left\{ \begin{cases} x^2-7x-12, & x<0 \\ 3/(x^2-7x-12), & x\ge 0 \end{cases} \right\}$

5) **y=** $\begin{cases} tgx+\sqrt{x+1}, & x>0 \\ x^3-3x^2-4x+7, & x\le 0 \end{cases}$

6) **y=** $\begin{cases} \sin x, & x\le 0 \\ x, & x>0 \end{cases}$

7) **y=** $\begin{cases} \cos x, & x\le 0 \\ 1-x, & x>0 \end{cases}$

8) y= $\begin{cases} tgx, & x\le \dfrac{\pi}{4} \\ 1, & x>\dfrac{\pi}{4} \end{cases}$

9) y= $\begin{cases} \sqrt{x}, & x\ge 0 \\ \sin x, & x<0 \end{cases}$

10) y= $\begin{cases} x^2+3x+9, & x<0 \\ 1/(x^2+3x+9, & x\ge 0 \end{cases}$

11) y= $\begin{cases} 3x^2-7x+1, & x\ge 2 \\ 2x^2-4, & x<2 \end{cases}$

12) y= $\begin{cases} 2x^3+6x+9, & x<1 \\ 1/(2x^3+6x+9), & x\le 1 \end{cases}$

13) y= $\begin{cases} x^3-23, & x>0 \\ 25/(x^3-23, & x\le 0 \end{cases}$

14) y= $\begin{cases} x^2+16x+75, & x\le -2 \\ x^3-23, & x>2 \end{cases}$

15) y= $\begin{cases} x^2-19x-69, & x>4 \\ 3/(x^2-19x-69, & x\le 4 \end{cases}$

16) y= $\begin{cases} x^2-7, & x\ge -3 \\ 56/(x^2-7), & x<-3 \end{cases}$

17) y= $\begin{cases} 5x^2-6x+29, & x>2 \\ 1/(5x^2-6x+29, & x\le 2 \end{cases}$

18) y= $\begin{cases} true, & x>0 \\ false, & x\le 0 \end{cases}$

19) y= $\begin{cases} 3x-7, & x<-5 \\ 29/(x^3-7x+15), & x\ge -5 \end{cases}$

20) y= $\begin{cases} 64x+9, & x<6 \\ 63/(x^2-7x+17), & x\ge 6 \end{cases}$

2-vazifa. Tarmoqlanuvchi operatordan foydalanib, argumentlarning berilgan qiymatida funksiyaning qiymatini hisoblash dasturini tuzing:

1) $z=\begin{cases} x^2+y^2, & x^2+y^2 \le 1 \\ x+y, & x^2+y^2>1 \ va \ y \ge x \\ 0.5, & x^2+y^2>1 \ va \ y<x \end{cases}$

2) $z=\begin{cases} 3/4, & x>0 \\ \dfrac{x^2+y^2}{8}, & x \ge 0,\ x^2+y^2 \ge A \\ 4(x-y), & x \le 0, \quad x^2+y^2<A \end{cases}$

3) $z=\begin{cases} 1700-0.485R^2, & R-120<0 \\ 0, & R-120=0 \\ 1800/(1+R/1800), & R-120>0 \end{cases}$

4) $z=\begin{cases} a+bx+cx^2, & x<2 \\ d+ex+rx^2, & 2 \le x \le 3 \\ q+hx+mx^2, & x>3 \end{cases}$

5) $z=\begin{cases} x^3-2x+3.2, & x \le 0 \\ 3\sin x+x^3+1, & x \ge 3 \\ x^2+x, & 0<x<3 \end{cases}$

6) $z=\begin{cases} \ln x, & x>0 \\ \ln(-x), & x<0 \\ 0, & x=0 \end{cases}$

7) $z=\begin{cases} x^2+3-\sqrt[3]{\pi-x}, & x<0 \\ (x^2+3)^2+\sqrt{0.5+x}, & 0 \le x<1 \\ x(x^2+3)+\ln(\pi+x), & x \le 1 \end{cases}$

8) $z=\begin{cases} \sqrt[3]{x}, & x \le 1 \\ 2-x, & 1<x \le 2 \\ \sin(x-2), & x>2 \end{cases}$

9) $z=\begin{cases} -x^2, & x<0 \\ 0, & 0 \le x \le 0.5 \\ (x-0.5)^2, & x>0.5 \end{cases}$

10) $z=\begin{cases} \sqrt{x}+\cos x+10^{-0.7}, & x<4 \\ \sqrt{13a-2bx+x^2}, & 4 \le x \le 10 \\ a^2-e^x+|x|+\ln x, & x>10 \end{cases}$

11) $z=\begin{cases} x^2+\sqrt[3]{x+10^{-1.6}}, & x<-3 \\ \sin x+\ln|x|, & -3 \le x \le -2 \\ x^2+\sqrt{e^{-x^2}-x^2+x}, & x>-2 \end{cases}$

12) $z=\begin{cases} 2\sqrt{\sin x+tgx^2}, & 1 \le x \le 3 \\ x^3-\sqrt[6]{x}-x^a, & x>3,\ x \ne 4 \\ 1+x/a+abc, & x=4 \end{cases}$

13) $z=\begin{cases} 5b-ar^2-bx, & x<-2 \\ 2ab-3rx^2+5, & -2 \le x \le 4 \\ \sqrt{a^2r+3ax-2b}, & x>4 \end{cases}$

14) $z=\begin{cases} \dfrac{x-y}{x-3}-\dfrac{x-z}{3.05y}, & |x|<1 \\ (x^n)^{m+2}+x^{n^m}, & |x|=1 \\ 2x^3+3x^2+x+5, & |x|>1 \end{cases}$

15. a, b, c haqiqiy sonlar berilgan. Agar a ≥ b ≥ c shart bajarilsa bu sonlarni o'z-o'ziga ko'paytiring, aks holda bu sonlarni o'zlarining absolyut qiymatlari bilan almashtiring.

16. Uchta haqiqiy son berilgan. Bu sonlar orasidan (1;3) intervalga tegishli sonlarni toping.

17. a, b, c ($a \ne 0$) lar berilgan.

$ax^2 + bx + c = 0$ tenglama haqiqiy ildizga ega ekanligini aniqlang. Agar ildizlari mavjud bo'lsa, ularni toping. Agar mavjud bo'lmasa, bu haqda aniq ma'lumot bering.

4-laboratoriya ishi.

Mavzu: Takrorlanuvchi(Siklik) jarayonlarga dastur tuzish.

Ishning maqsadi: Delphi dasturlash tilining qo'shma operatorlarining o'rganish va talabalarda siklik operatorlardan foydalanib, Delphi dastrulash ilida dastur tuzish ko'nikmasini hosil qilish.

Masalaning qo'yilishi:

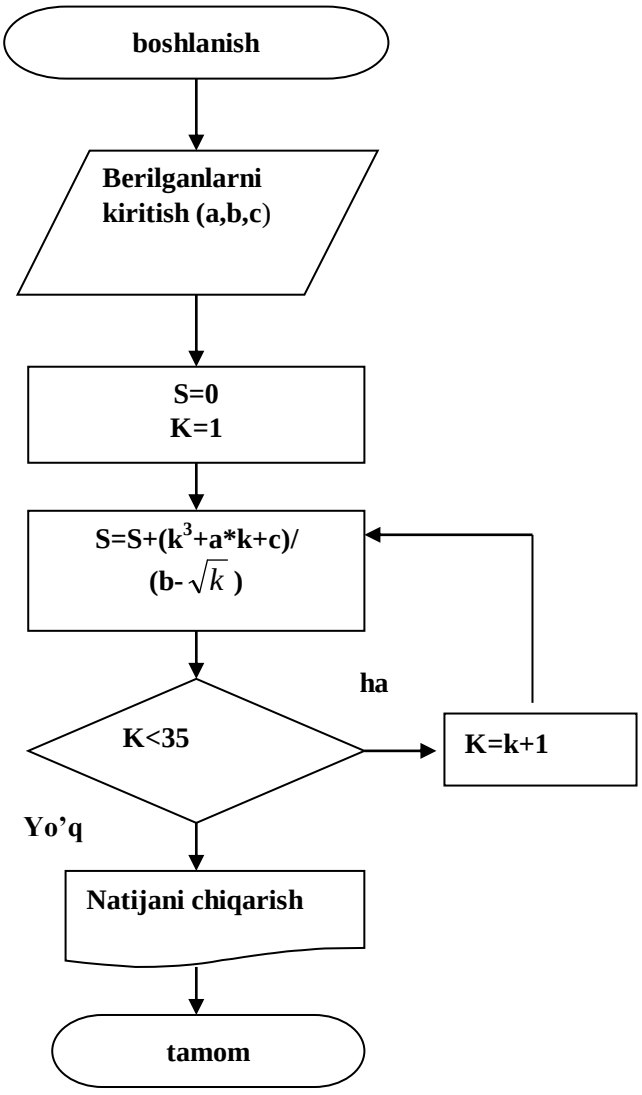
4) hisoblash jarayoning blok sxemasini tuzing.
5) Siklik operaztordan foydalanib berilgan jarayonga dastur tuzing.
6) Shartli operatordan foydalanib, berilgan jarayonga dastur tuzish

Vazifani bajarilish usuli

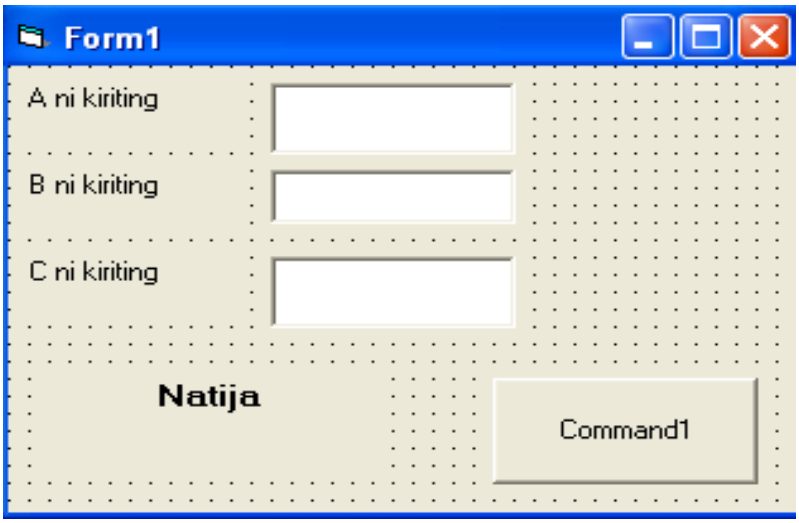
1-vazifa. Berilgan $S = \sum_{k=1}^{35} \frac{k^3 + a \cdot k + c}{b + \sqrt{k}}$ yig'indini hisoblash dasturi va blok sxemasini tuzing.

Bajarish. Avvalo berilgan hisoblash jarayoniga mos keladigan blok sxemani chizamiz.

Masalaning blok sxemasi quyida ko'rinishda tuziladi.



Maket formani yaratish. Formaga 4 ta yozuv, 3 ta matn oyna va bitta buyruq tugma joylashtiramiz.



Sikl operatoridan foydalanib berilgan mos dasturni DELPHI tilida yozing.

Takrorlanishlar soni oldindan ma'lum bo'lgan holda **For Do** instruksiyasidan foydalaniladi.

```
procedure TForm1.Button1Click(Sender: TObject);
var A, B, C, S : Real;
    k : Integer;
begin
A := StrToFloat(Edit1.Text);
B := StrToFloat(Edit2.Text);
C := StrToFloat(Edit3.Text);
S := 0;
For k := 1 To 35 Do
  S:=S+(k*k*k+A*k+C)/(B+Sqrt(k));
Label4.Caption:='yig`indi='+FloatToStr(S);
end;
```

Takrorlanishlarni tashkil qilishda While instruksiyasidan foydalanish.

Takrorlanishlar soni oldindan ma'lum bo'lmagan holda While <shart> do takrorlanish operatoridan foydalanamiz. Unda yuqoridagi dastur quyidagi ko'rinishda bo'ladi. Bu erda takrorlanish soni dastur ishi vaqtida aniqlanadi.

```
procedure TForm1.Button1Click(Sender: TObject);
var A, B, C, S : Real;
    k : Integer;
begin
A := StrToFloat(Edit1.Text);
B := StrToFloat(Edit2.Text);
C := StrToFloat(Edit3.Text);
S := 0; k:=1;
while k<=5 do
```

```
begin
  S:=S+(k*k*k+A*k+C)/(B+Sqrt(k)); k:=k+1;
end;
Label4.Caption:='yig`indi='+FloatToStr(S);
end;
 end.
```

Takrorlanishlarni tashkil qilishda Repeat instruksiyasidan foydalanish.

Dasturda Repeat operatori ham huddi While operatori kabi, qayta hisoblashlarni(sikl) tashkil qilishda ishlatiladi. Lekin takrorlanishlar soni dasturni qayta ishlash vaqtida noma’lum bo’lib, u dastur bajarilishi jarayonida hisoblash yo’li bilan aniqlanadi. Bunda agar shart rost qiymatga ega bo’lganda takrorlanish tugaydi. Yuqoridagi dastur unda quyidagicha yoziladi.

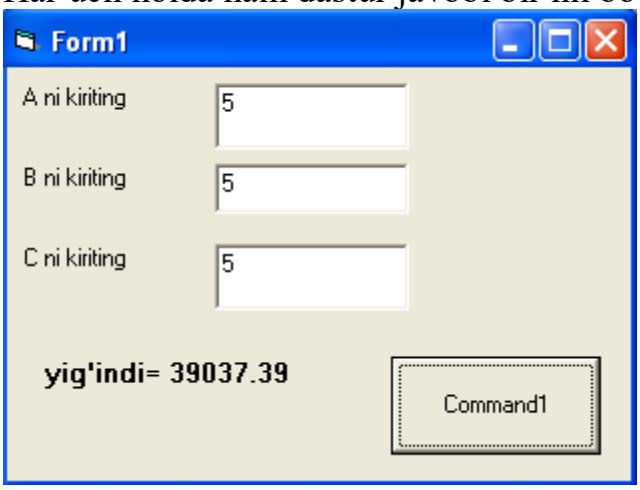
```
procedure TForm1.Button1Click(Sender: TObject);
var A, B, C, S : Real;
    k : Integer;
begin
A := StrToFloat(Edit1.Text);
B := StrToFloat(Edit2.Text);
C := StrToFloat(Edit3.Text);
S := 0; k:=1;
Repeat
    S:=S+(k*k*k+A*k+C)/(B+Sqrt(k)); k:=k+1;
 until k>35;
 Label4.Caption:='yig`indi='+FloatToStr(S);
end;
end.
```

Endi yuqoridagi masalani shartli operatordan foydalanib, dasturini tuzamiz. Maket forma oldingi ko’rinishdagidek jihozlanadi.

Dastur ko’rinishi quyidagicha bo’ladi.

```
procedure TForm1.Button1Click(Sender: TObject);
label 1;
var A, B, C, S : Real;
    k : Integer;
begin
A := StrToFloat(edit1.Text);
B := StrToFloat(edit2.Text);
C := StrToFloat(edit3.Text);
S := 0;  k := 0;
1: k := k + 1;
S := S + (k*k*k+ A * k + C) / (B + Sqrt(k));
If k < 35 Then GoTo 1;
Label4.Caption := 'yig`indi=' + FloatToStr(S);
end;
```

Har uch holda ham dastur javobi bir hil bo’ladi.



Tekshirish uchun savollar

1. Siklik operator qanday qismlardan tashkil topgan?
2. Sikl sarlavhasi deganda nimani tushunasiz? Tanasi deganda-chi?
3. Siklik operatorining umumiy ko’rinishini yozing?
4. Sikl operatorini ishlash prinsipini tushuntirib bering
5. Siklik jarayonlarga sikl operatordan foydalanmasdan dastur tuzish
6. Quyidagi dasturni While operatori o’rniga repeat-until operatorini ishlatib yozing: n:=10; m:=2; while m<n do m:=m+3;
7. Quyidagi dastur bo’lagida “begin” va “end” orasidagi operatorlar necha marta takrorlanadi: a) for i:=j to j+1 do begin …..end; b) k:=0; for i:=2 downto k do begin ….end;

4-laboratoriya ishiga doir vazifalar.

1) $s=\sum_{m=1}^{10}\frac{1}{n^3(n+1)};$

2) $s=\sum_{r-1}^{4}\frac{r^2+|r-1|}{\ln r+3r};$

3) $s=\sum_{\kappa=1}^{3}\sum_{\text{ь}=1}^{14}\frac{rm+|r^m-13|}{\ln r+3m}$

4) $s=\sum_{n=1}^{6}\frac{n^2}{(2n+1)^3}$

5) $s=\sum_{\kappa=1}^{4}\frac{r+1}{\sin r+e^{r^2+1}+1}$

6) $s=\prod_{r=1}^{6}\sum_{i=1}^{14}\frac{r+1}{r^3+3ir+i^3}$

7) $s=\sum_{r=1}^{7}\frac{1}{r(r+1)}$

8) $\mathbf{s=\sum_{r=1}^{10}\frac{r^{r+1}}{a^{r+1}+(r+1)^q}}$

9) $s=\sum_{b=1}^{10}\prod_{i=1}^{5}\frac{(r+1)^i+3}{(-r1)^r+3(-1)^i+i^r}$

10) $s=\sum_{\text{ь}=1}^{10}\frac{1}{m^2+m+4}$

11) $s=\sum_{r=1}^{7}\frac{(100-r)^2}{10r+5^r}$

12) $s=\sum_{i=1}^{6}\sum_{r=1}^{3}\frac{(-1)^i\cos(i+r)}{5i+7^r+i^r}$

13) $p=\prod_{n=1}^{28}\frac{n+3}{n^2+4n+1}$

14) $p=\prod_{i=1}^{6}\frac{i+5}{i^4+27i+7}$

15) $p=\prod_{i=1}^{5}\prod_{j=1}^{10}(-1)^i\frac{\sqrt{5i^4+e^j}}{\cos(i+j)^5+i^j}$

16) $p=\prod_{i=1}^{10}\frac{i}{2i+1}$

17) $s=\sum_{i=1}^{10}\frac{(-1)^{i+1}}{i(i+1)(i+2)};$

18) $s=\sum_{i=1}^{\infty}\frac{1}{4^i+5^{i+1}};$

5-laboratoriya ishi

Mavzu: Prosedura va funksiyalar bilan ishlash

Ishning maqsadi: Talabalarni prosedura va funksiyalar yordamida hisoblash jarayonlarini tashkil qilishga o'rgatish.

Masalaning qo'yilishi: Berilgan hisoblash jarayonining algoritmiga mos dastur tuzing.

Vazifani bajarish usuli

DELPHI da har bir dastur aslida tarkibi bo'yicha proseduradir. Ammo DELPHI da dasturning takrorlanuvchi fragmentlarini ma'lum tartibda funksional operatorlar blokiga birlashtirib, kerak bo'lganda ularga murojat qilish imkoniyatini yaratuvchi proseduralarga va funksiyalarga birlashtirish mumkin. Agar dasturda bir nechta proseduralar ishlatilayotgan bo'lsa, ularda ishlatilayotgan o'zgaruvchilar local va global tartibda e'lon qilinishi lozim. Lokal o'zgaruvchilar faqat prosedura yoki funcsiya bajarilayotgan vaqtda aniqlanadi. Global o'zgaruvchilar dasturga kiruvchi hamma prosedura va funksiyalar uchun bajariladi. Prosedura nomiga qiymat berish mumkin emas. DELPHI da proseduraga nomlari orqali murojat qilinadi.

Masalan **prosedure <nom>(<formal parametrlar>);**

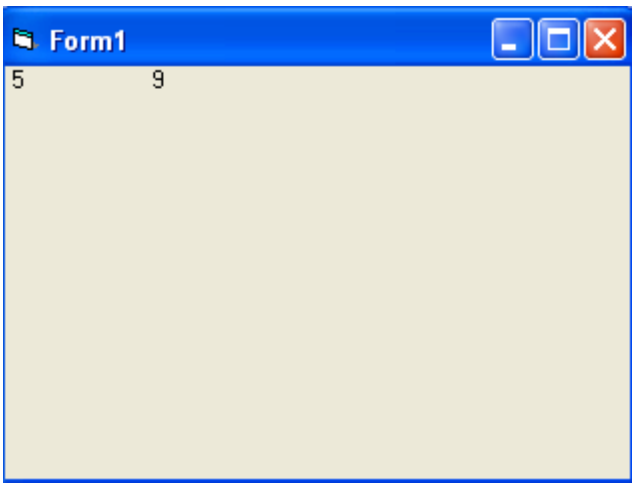
Prosedure AB(x,y);

Quyida biz ikki sonni qo'shish prosedurasini ko'rib chiqamiz.

DELPHI muhitida yangi forma yaratib, uning kod muharririga quyidagi dasturni yozamiz. Forma kod muharririni ochish uchun, formaga sichqonchani ikki marta uzluksiz bosish kerak.

```
procedure sum(a,b:Integer; var c:Integer);
begin
c:= a + b;
End;
procedure TForm1.FormClick(Sender: TObject);
var x,z:Integer;
begin
x:=5;
sum(x, 4, z);
Canvas.TextOut(10,10,IntToStr(x)+'  '+IntToStr(z));
end;
```

Dastur natijasi quyidagicha bo'ladi.



Funksiyalarni yaratish.

Funksiyalardan foydalanish va ularni tashkil qilish xuddi prosedura kabi bo'lib,ularni e'lon qilish dasturning bosh qismida keltiriladi va quyidagicha boshlanadi.

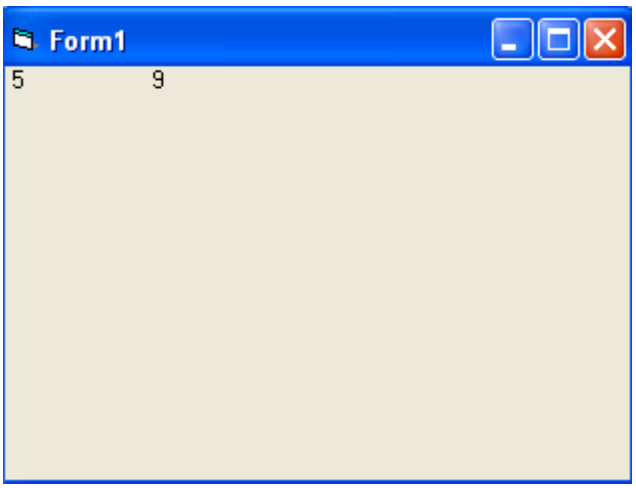
Function <funksiya nomi> (<formal parametrlar>):<funksiya turi>;

M: Funksion Min(x,y:real):real;

Funksiya nomi foydalanuvchi tamonidan beriladi. Funksiya ham proseduraga o'xshab bosh va asosiy qismlardan tashkil topadi. Funksiyaga murojat qilinganda natija faqat bitta bo'lib, u shu funksiya nomiga uzatiladi.

```
function sum(a,b:Integer):Integer;
begin
sum:= a + b;
end;
procedure TForm1.FormClick(Sender: TObject);
var x,z:Integer;
begin
x:=5;
z:=sum(x, 4);
Canvas.TextOut(10,10,IntToStr(x)+'  '+IntToStr(z));
end;
```

Dastur bajarilish natijasi . Delphi muhitida standart asboblar panelidan **start** tugmasini bosamiz va sichqonchani formaga bir marta bosamiz.



Tekshirish uchun savollar.

1. **Prosedura va funksiyalar dasturda qanday hollarda ishlatiladi?**
2. **Prosedura va funksiyalar qanday tavsiflanadi?**
3. **Funksiya proseduradan nima bilan farqlanadi?**

5-chi laboratoriya ish uchun vazifalar.

1. $ax^2+bx+c=0$ ko'rinishdagi ikkita kvadrat tenglamaning haqiqiy ildizlari qiymatini hisoblash dasturi tuzilsin.

2. Kvadrat matrisani vektorga ko'raytirish dasturini tuzing.

3. berilgan $x=x_1,x_2,\ldots\ldots x_{30}$ uchun

$$I(x)=\sum_{s=0}^{10}\frac{1}{s!(n+s)!}\bullet\left(\frac{x}{2}\right)^{2s+n}$$

Bessel funksiyasini taqribiy qiymatlarini berilgan aniqlikda hisoblash algoritmining dasturini tuzing.

c) To'g'ri to'rtburchakli matrisani tronsponirlash dasturini yozing

d) Berilgan musbat N sonni kiritib, $\sum_{i,k=1}^{n} a_{i,k}$ yig'indini hisoblasah dasturini tuzing. Bu erda $A_{i,k}=1/i^k$.

e) O'chovlari mos ravishda m×l va l×n bo'lgan ixtiyoriy ikki A va B matrisalar ko'paytmasiga teng bo'lgan C matrisa elementlarini aniqlash dasturini tuzing.

f) Berilgan musbat n sonni kiritishni ta'minlaydigan $\sum_{i,k=1}^{n} a_{i,k}$ yig'indini hisoblash dasturini tuzing. Be erda $A_{i,k}=\frac{i+k}{i!+k}$.

g) Ikkita to'rtburchakli A[1:m,1:p] va B[1:p,1:n] matrisalarni ko'paytirish dasturini tuzing.

h) $\frac{(n+m)!}{n!m!}$ ifodani hisoblaydigan n,m o'zgaruvchili dasturni yozing.

i) Tog'ri to'rtburchakli matrisa elementlari orasidan eng katta va eng kichigini topish dasturini yozing.

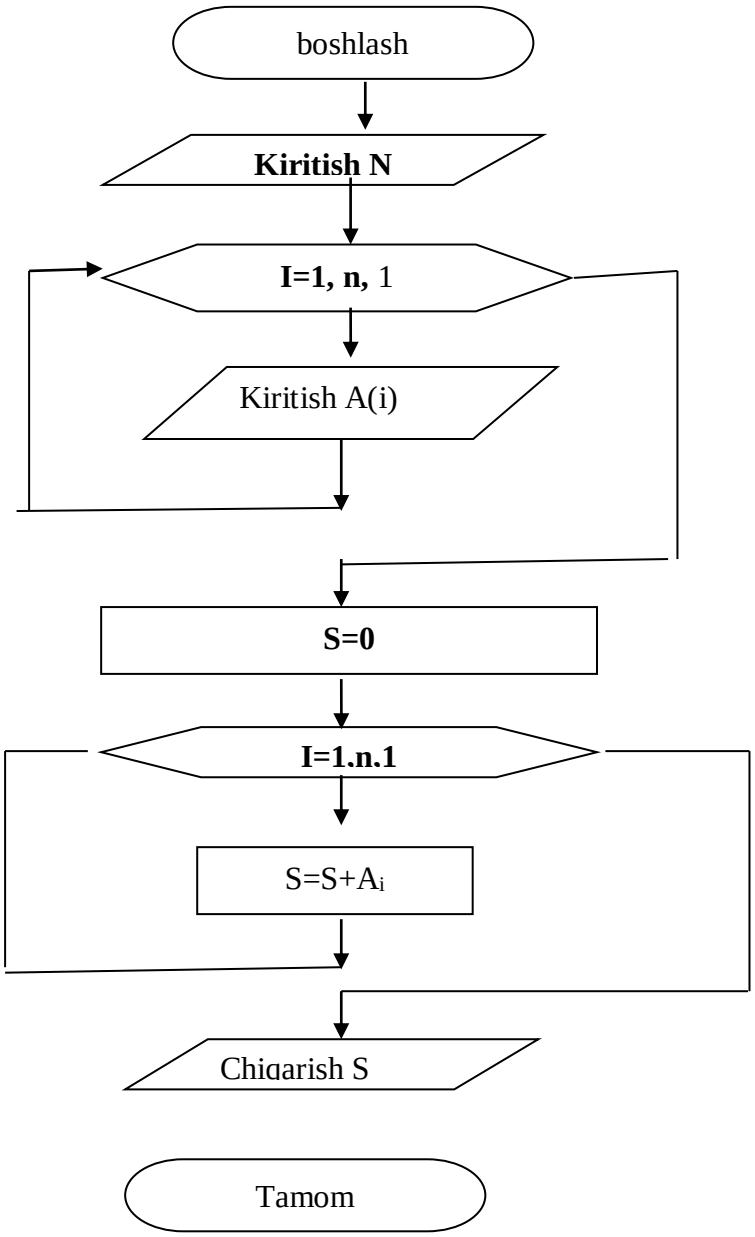
j) $C_m^n =$ (m elementdan n tadan gruppalash soni)ni hisoblash dasturini va undan foydalanib, $Z=C_{15}^1+C_{14}^2+.....+C_8^8$ miqdorni hisoblash dasturini tuzing.

6- laboratoriya ishi.
Mavzu: Bir o’lchovli matrisalar bilan ishlash.

Ishning maqsadi: Talabalarni bir o’lchovli matrisalar ustida amallar bajarishni dasturlashni o’rgatish.

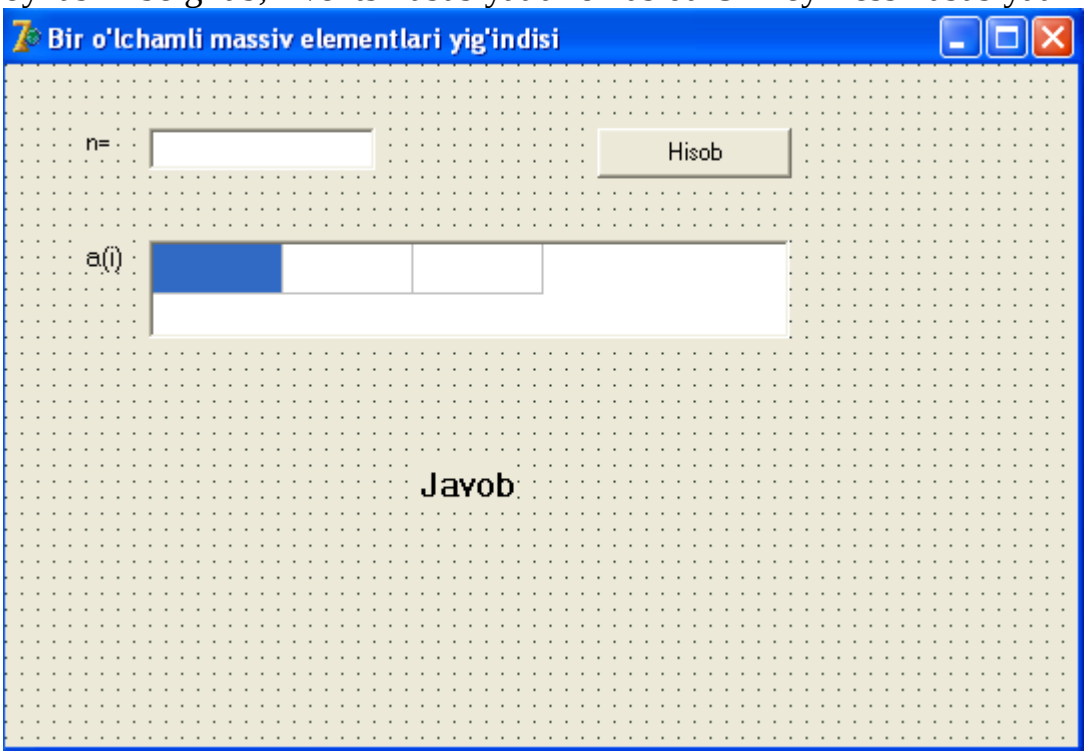
Masalaning qo’yilishi: Bir o’lchovli massiv elementlari yig’indisini toping. Berilgan hisoblash jarayonining algoritmiga mos dastur tuzing.

Masalaning blok sxemasini tuzamiz.



Masalaning maket formasi qiyidagicha jihozlanadi.

Yangi loyiha fayli yaratamiz. Formaga standart saahifasidan 2 ta Label, 1 ta Button, 1 ta Edit va Additional sahifasidan 1 ta StringGreed elementlarini joylashtiramiz. Label1 va Label2 komponentalarining Caption xususiyatlarini “n=” va “natija” deb, “Button1 komponentasining Caption xususiyatini “Hisob” deb belgilaymiz. Edit1 komponentasining text xususiyatidagi”Edit1” matnini o’chirib tashlaymiz. StringGrid komponentasining Options xususiyati oldidagi “+” belgisini bosamiz. StringGrid1 komponentasining doEditing xususiyatini true deb belgilaymiz. Matn oynasini belgilab, Events xususiyatlar oinasida OnKeyPress xususiyatini faollashtiramiz.



Masalaning dasturi.

```
unit Unit1;

interface

uses
  Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,
```

```
  Dialogs, StdCtrls, Grids;

type
  TForm1 = class(TForm)
    Label1: TLabel;
    Edit1: TEdit;
    Button1: TButton;
    Label2: TLabel;
    StringGrid1: TStringGrid;
    Label3: TLabel;
    procedure Edit1KeyPress(Sender: TObject; var Key: Char);
    procedure Button1Click(Sender: TObject);

  private
    { Private declarations }
  public
    { Public declarations }
  end;

  var
  Form1: TForm1;
  n:integer;
  a:array[1..20] of integer;

implementation

{$R *.dfm}
procedure TForm1.Edit1KeyPress(Sender: TObject; var Key: Char);
begin
if key=#13 then begin
n:=StrToInt(Edit1.Text);
StringGrid1.ColCount:=n;
StringGrid1.SetFocus;
end;
end;
  procedure TForm1.Button1Click(Sender: TObject);
var i:integer;
    s:integer;
begin
for i:=1 to n do
begin
a[i]:=StrToint(StringGrid1.Cells[i-1,0]);
end;
s:=0;
for i:=1 to n do begin
```

```
s:=s+a[i];
end;
Label3.Caption:='S='+FloatToStr(s);
end;
end.
```

Dasrutni asboblar panelidan RUN tugmasini bosib ishga tushiramiz. Natijada maket forma ochiladi. Massiv o'lchami N ning qiymatini kiritib, Enter tugmasini bosamiz va massiv elementlarini kiritamiz. So'ngra Hisob tugmasini bosamiz. Natija maket formaning pastki qismida Label3 komponentaasi o'rnida hosil bo'ladi.

6-chi laboratoriya ishiga doyir misollar.

1. Berilgan $x=x_1+x_2+x_3+\ldots..+x_{30}$ uchun

   $I(x)=\sum_{s=0}^{10}\frac{1}{S!(n+s)!}*(\frac{x}{2})^{2s+n}$ Bessel funksiyasining taqribiy qiymatlarini berilgan aniqlikda hisoblash algoritmining dasturini tuzing.

2. Berilgan n sonini kiritib,
   $Y=\sum_{i=1}^{10} i^2 = 1^2+2^2+\text{-----}+10^2$ ni hisoblash dasturini tuzing.

3. Berilgan n va $A_1,A_2,\ldots\ldots A_n$ lar uchun
   a) $\max\{a_1,a_3,a_5,\ldots\}$
   b) $\min\{a_2,a_4,a_6,\ldots.\}$
   c) $\max\{a_1,a_2,a_3,\ldots a_n\}+\min\{a_1,a_2,\ldots a_n\}$

4. $\{x_1+y_1,x_2+y_2,\ldots,x_{20+}y_{20}\}$
5. $\{\cos(x_1+1),\cos(x_2+2),\ldots.,\cos(x_n+n)\}$

6.Berilgan A va B massiv elementlari ichidan faqat toq elementlarni yig'indisini hisoblash dasturini tuzing.

7. Berilgan A massiv eng kichik elementini topish dasturini tuzing.

8. $a_1, a_2, \ldots$, butun sonlar berilgan bo'lib,ulardan $a_1>0$ ekanligi va $a_2, a_3, \ldots$, larning orasida hech bo'lmaganda birontasi manfiy ekanligi ma'lum. $a_1, a_2, \ldots, a_n$ sonlar shu berilgan ketma-ketlikning manfiy songacha bo'lgan n ta hadini tashkil qilsin. (n oldindan ma'lum emas). Quyidagilarni topish kerak:

а) $\max (a_1^2, \ldots, a_n^2)$;
б) $\max (a_1^3, \ldots, a_n^3)$;
в) $\min (a_1, 2a_2, \ldots, na_n)$;
г) $\min (a_1+ a_2, a_2+ a_3+ \ldots+ a_{n-1}+ a_n)$;
д) $\max (a_1, a_1a_2, \ldots, a_1a_2\ldots a_n)$;
ж) $a_1, a_2, a_3, \ldots, a_n$ Sonlarning orasidagi ikkilangan toq sonlarni;

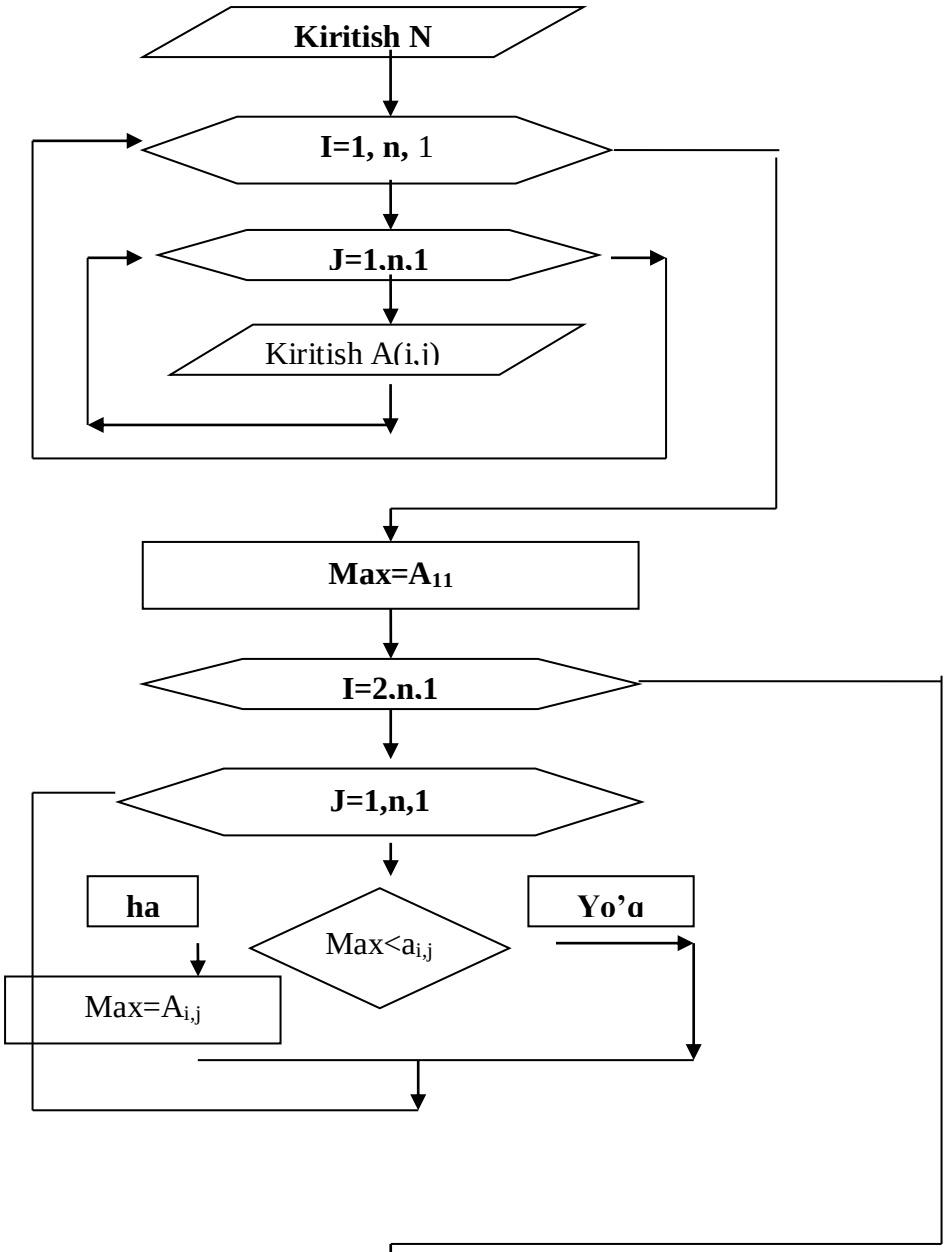
з) $a_1, a_2, \dots, a_n$ Sonlar orasidagi to'la kvadratlar sonini;
е) $a_1, a_2, \dots, a_n$ lar orasidagi juft sonlar sonini;
и) $a_1, a_2, \dots, a_n$ lar orasidagi toq sonlar sonini;

7- labaratoriya ishi.
Mavzu: Ikki o'lchovli matrisalar bilan ishlash.

Ishning maqsadi: Talabalarni ikki o'lchovli matrisalar ustida amallar bajarishni dasturlashni o'rgatish.

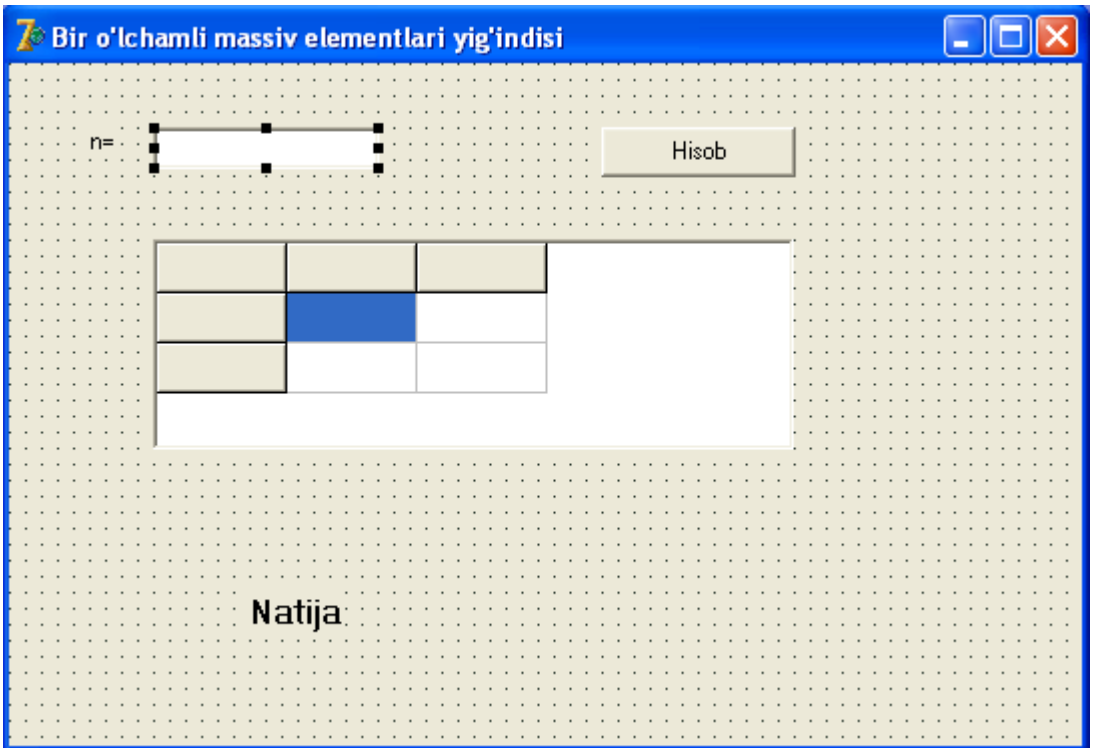
Masalaning qo'yilishi: n natural son va a(i,j) matrisa berilgan. Shu matrisa elementlari orasida eng katta qiymatga ega bo'lganini toping. Berilgan hisoblash jarayonining algoritmiga mos dastur tuzing.

Masalaning blok sxemasini tuzing.



Maket formani jihozlash

Yangi loyiha fayli yaratamiz. Formaga standart asboblar sahifasidan 2 ta Label, 1 ta Button, 1 ta Edit va Additional sahifasidan 1 ta StringGreed elementlarini joylashtiramiz. Label1 va Label2 komponentalarining Caption xususiyatlarini “n=” va “natija” deb, “Button1 komponentasining Caption xususiyatini “Hisob” deb belgilaymiz. Edit1 komponentasining text xususiyatidagi”Edit1” matnini o’chirib tashlaymiz. StringGrid komponentasining Options xususiyati oldidagi “+” belgisini bosamiz. StringGrid1 komponentasining doEditing xususiyatini true deb belgilaymiz. Matn oynasini belgilab, Events xususiyatlar oinasida OnKeyPress xususiyatini faollashtiramiz.



Masalaning dasturi.

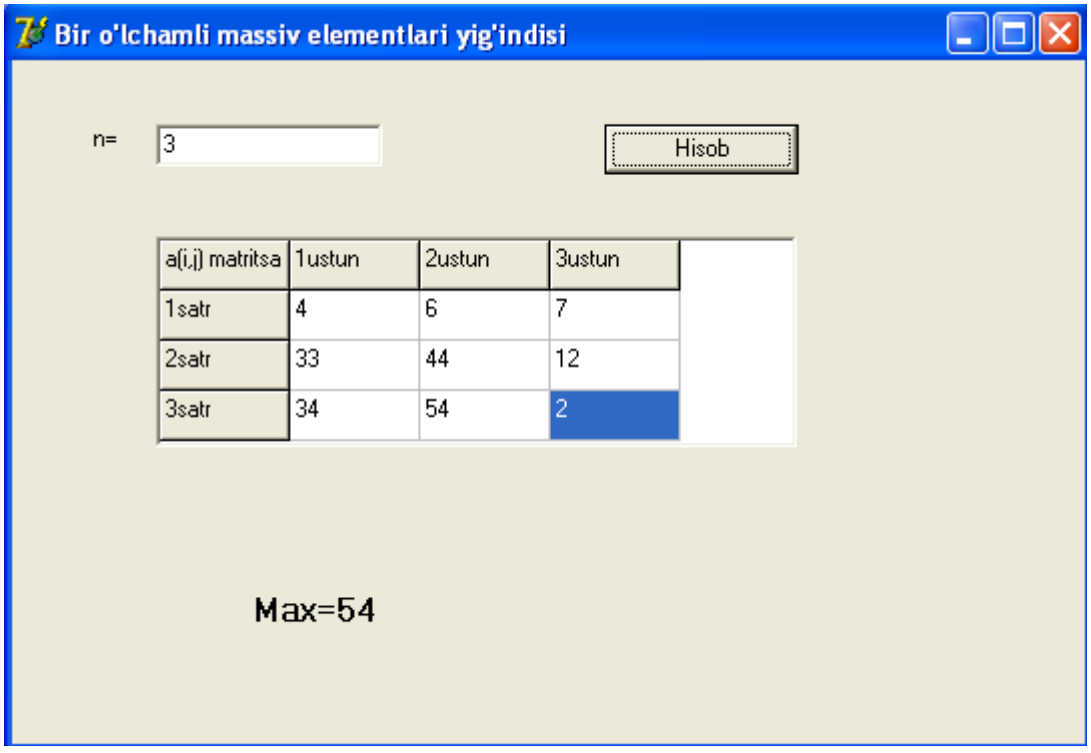
Hisob tugmasiga sichqonchani ikki marta bosib, kod oynasiga (redaktorida) quyidagi dasturni kiritamiz.

```
unit Unit1;

interface
```

```
uses
  Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,
  Dialogs, StdCtrls, Grids;

const maxn=20;

type
  TForm1 = class(TForm)
    Label1: TLabel;
    Label2: TLabel;
    Edit1: TEdit;
    StringGrid1: TStringGrid;
    Button1: TButton;
    procedure Edit1KeyPress(Sender: TObject; var Key: Char);
    procedure Button1Click(Sender: TObject);
  private
    { Private declarations }
  public
    { Public declarations }
  end;

var
  Form1: TForm1;
  n:integer;
  a:array[1..maxn,1..maxn] of real;

implementation

{$R *.dfm}

procedure TForm1.Edit1KeyPress(Sender: TObject; var Key: Char);
var i:integer;
begin

if key=#13 then begin
n:=StrToInt(Edit1.Text);
StringGrid1.ColCount:=n+1;
StringGrid1.RowCount:=n+1;
StringGrid1.Cells[0,0]:='a(i,j) matritsa';
for i:=1 to n do begin
StringGrid1.Cells[i,0]:=IntToStr(i)+'ustun';
StringGrid1.Cells[0,i]:=IntToStr(i)+'satr';
end;
StringGrid1.SetFocus;
end;
```

```
end;

procedure TForm1.Button1Click(Sender: TObject);
var i,j:integer;
    max:real;
begin
for i:=1 to n do
  for j:=1 to n do begin
   a[i,j]:=StrToFloat(StringGrid1.Cells[j,i]);
  end;
max:=a[1,1];
for i:=1 to n do
for j:=1 to n do begin
if max<a[i,j] then max:=a[i,j];
end;
Label2.Caption:='Max='+FloatToStr(max);

end;

end.
```

Dastur natijasi.



7- laboratoriya ishi doir topshiriqlar.

1. Butun qiymatli A(4,4) massiv elementlari yig’indisi va o’rta arifmetik qiymati topilsin.
2. Xaqiqiy qiymatli A(n,m) massiv berilgan. Massiv elementlari uchidan dioganalda joylashgan elementlar qiymatlarini chiqaruvchi dastur tuzing.
3. Berilgan A(5,4) va B(3,3) massiv elementlari yig’indisini hisoblash dasturini tuzung.
4. Butun qiymatli A(n,m) va B(n,m) massiv elementlari yig’indisi topilsin.
5. Butun qiymatli A(4,4) massiv elementlari ichidan topish kerak:
6. max (a(n,m));
7. min (a(n,m));
8. A(n,m) massivning juft elementlarini kattasini;
9. A(n,m) massivning toq elementlarini kichigini;
10. min (a_2, a_4, ... , a_n) + max(a_1, a_3, ... , a_n);
11. max $(|a_1|,.....,|a_n|)$;
12. A(n) va B(n,m) massiv elementlarini ko’paytirish dasturini tuzing.