МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

Федеральное государственное бюджетное образовательное учреждение высшего профессионального образования

**«Вятский государственный университет»**

**(ФГБОУ ВО «ВятГУ»)**

Факультет автоматики и вычислительной техники

Кафедра электронных вычислительных машин

# Представление и проецирование трехмерных объектов

Отчет

Лабораторная работа №6 по дисциплине

«Компьютерная графика»

Выполнил студент группы ИВТ-23 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/Кудяшев Я.Ю./

Проверил преподаватель\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/Коржавина А.С./

Киров 2020

**Цель работы**

Цель работы: научиться применять математический аппарат проекций для визуализации объемных геометрических тел.

**Листинг программы**

**unit** Unit1;

{$mode objfpc}{$H+}

**interface**

**uses**

Classes, SysUtils, Forms, Controls, Graphics, Dialogs, ExtCtrls, StdCtrls,

Menus;

**type**

{ TForm1 }

TForm1 = **class**(TForm)

Button1: TButton;

Button2: TButton;

Button3: TButton;

Button5: TButton;

Panel1: TPanel;

**procedure** Button1Click(Sender: TObject);

**procedure** Button2Click(Sender: TObject);

**procedure** Button3Click(Sender: TObject);

**procedure** Button5Click(Sender: TObject);

**procedure** FormCreate(Sender: TObject);

**private**

**public**

**end**;

**var**

Form1: TForm1;

**implementation**

**type**

TXYZ=**record** x,y,z:real; **end**;

**var** m:**array** [1..4,1..4] **of** real;

mm:**array** [1..8,1..4] **of** real;

V:**array**[0..7] **of** TXYZ= (

(x:-15;y: 25;z:-35),

(x:-15;y:-25;z:-35),

(x: 15;y:-25;z:-35),

(x: 15;y: 25;z:-35),

(x: 15;y: 25;z: 35),

(x: 15;y:-25;z: 35),

(x:-15;y:-25;z: 35),

(x:-15;y: 25;z: 35));

VVV:**array**[0..7] **of** TXYZ= (

(x:-15;y: 25;z:-35),

(x:-15;y:-25;z:-35),

(x: 15;y:-25;z:-35),

(x: 15;y: 25;z:-35),

(x: 15;y: 25;z: 35),

(x: 15;y:-25;z: 35),

(x:-15;y:-25;z: 35),

(x:-15;y: 25;z: 35));

i,j,k,l,x,y,z:integer;

VV:**array** [1..8,1..4] **of** real =((-15,25,-35,1),(-15,-25,-35,1),(15,-25,-35,1),

(15,25,-35,1),(15,25,35,1),(15,-25,35,1),(-15,-25,35,1),(-15,25,35,1));

summa:real;

{$R \*.lfm}

{ TForm1 }

**Procedure** DrawLine1( a, b: TXYZ);

**Function** cX( X, Z : real ) : real;

**Begin**

cX := (X + ((Form1.Width)**Div** 2)) - Z;

**End**;

**Function** cY( Y, Z : real ) : real;

**Begin**

cY := ((Form1.Top+300) **Div** 2) - Y + Z;

**End**;

**begin**

Form1.Canvas.Line(round(cX(a.x, a.Z)), round(cY(a.y, a.Z)), round(cX(b.x, b.Z)), round(cY(b.y, b.Z)));

**end**;

**Procedure** DrawLine2( a, b: TXYZ);

**Function** cX( X, Z : real) : real;

**Begin**

cX := (X + ((Form1.Width+250) **Div** 2)) - Z;

**End**;

**Function** cY( Y, Z : real ) : real;

**Begin**

cY := ((Form1.Top+400) **Div** 2) - Y + Z;

**End**;

**begin**

Form1.Canvas.Line(round(cX(a.x, a.Z)), round(cY(a.y, a.Z)), round(cX(b.x, b.Z)), round(cY(b.y, b.Z)));

**end**;

**Procedure** DrawLine3( a, b: TXYZ);

**Function** cX( X, Z : real ) : real;

**Begin**

cX := (X + ((Form1.Width+500) **Div** 2)) - Z;

**End**;

**Function** cY( Y, Z : real ) : real;

**Begin**

cY := ((Form1.Top+400) **Div** 2) - Y + Z;

**End**;

**begin**

Form1.Canvas.Line(round(cX(a.x, a.Z)), round(cY(a.y, a.Z)), round(cX(b.x, b.Z)), round(cY(b.y, b.Z)));

**end**;

**procedure** TForm1.Button5Click(Sender: TObject);

**begin**

Form1.Canvas.Pen.Color:=clWhite;

**for** i:=0 **to** 400 **do**

Form1.Canvas.Line(0,i,1000,i);

Form1.Canvas.Pen.Color:=clBlack;

DrawLine1(v[0],v[1]);

DrawLine1(v[1],v[2]);

DrawLine1(v[2],v[3]);

DrawLine1(v[3],v[0]);

DrawLine1(v[0],v[7]);

DrawLine1(v[1],v[6]);

DrawLine1(v[2],v[5]);

DrawLine1(v[3],v[4]);

DrawLine1(v[4],v[5]);

DrawLine1(v[5],v[6]);

DrawLine1(v[6],v[7]);

DrawLine1(v[7],v[4]);

**end**;

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

**begin**

Form1.Canvas.Pen.Color:=clWhite;

**for** i:=0 **to** 400 **do**

Form1.Canvas.Line(0,i,1000,i);

Form1.Canvas.Pen.Color:=clBlack;

**for** i:=1 **to** 4 **do**

**for** j:=1 **to** 4 **do**

m[i,j]:=0;

m[2,2]:=1;

m[3,3]:=1;

m[4,4]:=1;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[1,l]\*m[l,j];

mm[1,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[2,l]\*m[l,j];

mm[2,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[3,l]\*m[l,j];

mm[3,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[4,l]\*m[l,j];

mm[4,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[5,l]\*m[l,j];

mm[5,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[6,l]\*m[l,j];

mm[6,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[7,l]\*m[l,j];

mm[7,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[8,l]\*m[l,j];

mm[8,j] := Summa;

**end**;

vvv[0].x:=mm[1,1];

vvv[0].y:=mm[1,2];

vvv[0].z:=mm[1,3];

vvv[1].x:=mm[2,1];

vvv[1].y:=mm[2,2];

vvv[1].z:=mm[2,3];

vvv[2].x:=mm[3,1];

vvv[2].y:=mm[3,2];

vvv[2].z:=mm[3,3];

vvv[3].x:=mm[4,1];

vvv[3].y:=mm[4,2];

vvv[3].z:=mm[4,3];

vvv[4].x:=mm[5,1];

vvv[4].y:=mm[5,2];

vvv[4].z:=mm[5,3];

vvv[5].x:=mm[6,1];

vvv[5].y:=mm[6,2];

vvv[5].z:=mm[6,3];

vvv[6].x:=mm[7,1];

vvv[6].y:=mm[7,2];

vvv[6].z:=mm[7,3];

vvv[7].x:=mm[8,1];

vvv[7].y:=mm[8,2];

vvv[7].z:=mm[8,3];

DrawLine1(vvv[0],vvv[1]);

DrawLine1(vvv[1],vvv[2]);

DrawLine1(vvv[2],vvv[3]);

DrawLine1(vvv[3],vvv[0]);

DrawLine1(vvv[0],vvv[7]);

DrawLine1(vvv[1],vvv[6]);

DrawLine1(vvv[2],vvv[5]);

DrawLine1(vvv[3],vvv[4]);

DrawLine1(vvv[4],vvv[5]);

DrawLine1(vvv[5],vvv[6]);

DrawLine1(vvv[6],vvv[7]);

DrawLine1(vvv[7],vvv[4]);

**for** i:=1 **to** 4 **do**

**for** j:=1 **to** 4 **do**

m[i,j]:=0;

m[1,1]:=1;

m[3,3]:=1;

m[4,4]:=1;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[1,l]\*m[l,j];

mm[1,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[2,l]\*m[l,j];

mm[2,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[3,l]\*m[l,j];

mm[3,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[4,l]\*m[l,j];

mm[4,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[5,l]\*m[l,j];

mm[5,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[6,l]\*m[l,j];

mm[6,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[7,l]\*m[l,j];

mm[7,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[8,l]\*m[l,j];

mm[8,j] := Summa;

**end**;

vvv[0].x:=mm[1,1];

vvv[0].y:=mm[1,2];

vvv[0].z:=mm[1,3];

vvv[1].x:=mm[2,1];

vvv[1].y:=mm[2,2];

vvv[1].z:=mm[2,3];

vvv[2].x:=mm[3,1];

vvv[2].y:=mm[3,2];

vvv[2].z:=mm[3,3];

vvv[3].x:=mm[4,1];

vvv[3].y:=mm[4,2];

vvv[3].z:=mm[4,3];

vvv[4].x:=mm[5,1];

vvv[4].y:=mm[5,2];

vvv[4].z:=mm[5,3];

vvv[5].x:=mm[6,1];

vvv[5].y:=mm[6,2];

vvv[5].z:=mm[6,3];

vvv[6].x:=mm[7,1];

vvv[6].y:=mm[7,2];

vvv[6].z:=mm[7,3];

vvv[7].x:=mm[8,1];

vvv[7].y:=mm[8,2];

vvv[7].z:=mm[8,3];

DrawLine2(vvv[0],vvv[1]);

DrawLine2(vvv[1],vvv[2]);

DrawLine2(vvv[2],vvv[3]);

DrawLine2(vvv[3],vvv[0]);

DrawLine2(vvv[0],vvv[7]);

DrawLine2(vvv[1],vvv[6]);

DrawLine2(vvv[2],vvv[5]);

DrawLine2(vvv[3],vvv[4]);

DrawLine2(vvv[4],vvv[5]);

DrawLine2(vvv[5],vvv[6]);

DrawLine2(vvv[6],vvv[7]);

DrawLine2(vvv[7],vvv[4]);

**for** i:=1 **to** 4 **do**

**for** j:=1 **to** 4 **do**

m[i,j]:=0;

m[1,1]:=1;

m[2,2]:=1;

m[4,4]:=1;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[1,l]\*m[l,j];

mm[1,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[2,l]\*m[l,j];

mm[2,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[3,l]\*m[l,j];

mm[3,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[4,l]\*m[l,j];

mm[4,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[5,l]\*m[l,j];

mm[5,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[6,l]\*m[l,j];

mm[6,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[7,l]\*m[l,j];

mm[7,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[8,l]\*m[l,j];

mm[8,j] := Summa;

**end**;

vvv[0].x:=mm[1,1];

vvv[0].y:=mm[1,2];

vvv[0].z:=mm[1,3];

vvv[1].x:=mm[2,1];

vvv[1].y:=mm[2,2];

vvv[1].z:=mm[2,3];

vvv[2].x:=mm[3,1];

vvv[2].y:=mm[3,2];

vvv[2].z:=mm[3,3];

vvv[3].x:=mm[4,1];

vvv[3].y:=mm[4,2];

vvv[3].z:=mm[4,3];

vvv[4].x:=mm[5,1];

vvv[4].y:=mm[5,2];

vvv[4].z:=mm[5,3];

vvv[5].x:=mm[6,1];

vvv[5].y:=mm[6,2];

vvv[5].z:=mm[6,3];

vvv[6].x:=mm[7,1];

vvv[6].y:=mm[7,2];

vvv[6].z:=mm[7,3];

vvv[7].x:=mm[8,1];

vvv[7].y:=mm[8,2];

vvv[7].z:=mm[8,3];

DrawLine3(vvv[0],vvv[1]);

DrawLine3(vvv[1],vvv[2]);

DrawLine3(vvv[2],vvv[3]);

DrawLine3(vvv[3],vvv[0]);

DrawLine3(vvv[0],vvv[7]);

DrawLine3(vvv[1],vvv[6]);

DrawLine3(vvv[2],vvv[5]);

DrawLine3(vvv[3],vvv[4]);

DrawLine3(vvv[4],vvv[5]);

DrawLine3(vvv[5],vvv[6]);

DrawLine3(vvv[6],vvv[7]);

DrawLine3(vvv[7],vvv[4]);

**end**;

**procedure** TForm1.Button2Click(Sender: TObject);

**begin**

Form1.Canvas.Pen.Color:=clWhite;

**for** i:=0 **to** 400 **do**

Form1.Canvas.Line(0,i,1000,i);

Form1.Canvas.Pen.Color:=clBlack;

**for** i:=1 **to** 4 **do**

**for** j:=1 **to** 4 **do**

m[i,j]:=0;

m[1,1]:=cos(0.7854);

m[2,2]:=cos(0.6155);

m[3,1]:=sin(0.7854);

m[1,2]:=sin(0.6155)\*sin(0.7854);

m[3,2]:=sin(0.6155)\*cos(0.7854);

m[4,4]:=1;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[1,l]\*m[l,j];

mm[1,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[2,l]\*m[l,j];

mm[2,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[3,l]\*m[l,j];

mm[3,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[4,l]\*m[l,j];

mm[4,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[5,l]\*m[l,j];

mm[5,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[6,l]\*m[l,j];

mm[6,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[7,l]\*m[l,j];

mm[7,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[8,l]\*m[l,j];

mm[8,j] := Summa;

**end**;

vvv[0].x:=mm[1,1];

vvv[0].y:=mm[1,2];

vvv[0].z:=mm[1,3];

vvv[1].x:=mm[2,1];

vvv[1].y:=mm[2,2];

vvv[1].z:=mm[2,3];

vvv[2].x:=mm[3,1];

vvv[2].y:=mm[3,2];

vvv[2].z:=mm[3,3];

vvv[3].x:=mm[4,1];

vvv[3].y:=mm[4,2];

vvv[3].z:=mm[4,3];

vvv[4].x:=mm[5,1];

vvv[4].y:=mm[5,2];

vvv[4].z:=mm[5,3];

vvv[5].x:=mm[6,1];

vvv[5].y:=mm[6,2];

vvv[5].z:=mm[6,3];

vvv[6].x:=mm[7,1];

vvv[6].y:=mm[7,2];

vvv[6].z:=mm[7,3];

vvv[7].x:=mm[8,1];

vvv[7].y:=mm[8,2];

vvv[7].z:=mm[8,3];

DrawLine1(vvv[0],vvv[1]);

DrawLine1(vvv[1],vvv[2]);

DrawLine1(vvv[2],vvv[3]);

DrawLine1(vvv[3],vvv[0]);

DrawLine1(vvv[0],vvv[7]);

DrawLine1(vvv[1],vvv[6]);

DrawLine1(vvv[2],vvv[5]);

DrawLine1(vvv[3],vvv[4]);

DrawLine1(vvv[4],vvv[5]);

DrawLine1(vvv[5],vvv[6]);

DrawLine1(vvv[6],vvv[7]);

DrawLine1(vvv[7],vvv[4]);

**for** i:=1 **to** 4 **do**

**for** j:=1 **to** 4 **do**

m[i,j]:=0;

m[1,1]:=cos(0.3876);

m[2,2]:=cos(0.3614 );

m[3,1]:=sin(0.3876);

m[1,2]:=sin(0.3614)\*sin(0.3876);

m[3,2]:=sin(0.3614)\*cos(0.3876);

m[4,4]:=1;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[1,l]\*m[l,j];

mm[1,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[2,l]\*m[l,j];

mm[2,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[3,l]\*m[l,j];

mm[3,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[4,l]\*m[l,j];

mm[4,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[5,l]\*m[l,j];

mm[5,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[6,l]\*m[l,j];

mm[6,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[7,l]\*m[l,j];

mm[7,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[8,l]\*m[l,j];

mm[8,j] := Summa;

**end**;

vvv[0].x:=mm[1,1];

vvv[0].y:=mm[1,2];

vvv[0].z:=mm[1,3];

vvv[1].x:=mm[2,1];

vvv[1].y:=mm[2,2];

vvv[1].z:=mm[2,3];

vvv[2].x:=mm[3,1];

vvv[2].y:=mm[3,2];

vvv[2].z:=mm[3,3];

vvv[3].x:=mm[4,1];

vvv[3].y:=mm[4,2];

vvv[3].z:=mm[4,3];

vvv[4].x:=mm[5,1];

vvv[4].y:=mm[5,2];

vvv[4].z:=mm[5,3];

vvv[5].x:=mm[6,1];

vvv[5].y:=mm[6,2];

vvv[5].z:=mm[6,3];

vvv[6].x:=mm[7,1];

vvv[6].y:=mm[7,2];

vvv[6].z:=mm[7,3];

vvv[7].x:=mm[8,1];

vvv[7].y:=mm[8,2];

vvv[7].z:=mm[8,3];

DrawLine2(vvv[0],vvv[1]);

DrawLine2(vvv[1],vvv[2]);

DrawLine2(vvv[2],vvv[3]);

DrawLine2(vvv[3],vvv[0]);

DrawLine2(vvv[0],vvv[7]);

DrawLine2(vvv[1],vvv[6]);

DrawLine2(vvv[2],vvv[5]);

DrawLine2(vvv[3],vvv[4]);

DrawLine2(vvv[4],vvv[5]);

DrawLine2(vvv[5],vvv[6]);

DrawLine2(vvv[6],vvv[7]);

DrawLine2(vvv[7],vvv[4]);

**for** i:=1 **to** 4 **do**

**for** j:=1 **to** 4 **do**

m[i,j]:=0;

m[1,1]:=cos(45);

m[2,2]:=cos(35.264);

m[3,1]:=sin(45);

m[1,2]:=sin(35.264)\*sin(45);

m[3,2]:=sin(35.264)\*cos(45);

m[4,4]:=1;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[1,l]\*m[l,j];

mm[1,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[2,l]\*m[l,j];

mm[2,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[3,l]\*m[l,j];

mm[3,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[4,l]\*m[l,j];

mm[4,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[5,l]\*m[l,j];

mm[5,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[6,l]\*m[l,j];

mm[6,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[7,l]\*m[l,j];

mm[7,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[8,l]\*m[l,j];

mm[8,j] := Summa;

**end**;

vvv[0].x:=mm[1,1];

vvv[0].y:=mm[1,2];

vvv[0].z:=mm[1,3];

vvv[1].x:=mm[2,1];

vvv[1].y:=mm[2,2];

vvv[1].z:=mm[2,3];

vvv[2].x:=mm[3,1];

vvv[2].y:=mm[3,2];

vvv[2].z:=mm[3,3];

vvv[3].x:=mm[4,1];

vvv[3].y:=mm[4,2];

vvv[3].z:=mm[4,3];

vvv[4].x:=mm[5,1];

vvv[4].y:=mm[5,2];

vvv[4].z:=mm[5,3];

vvv[5].x:=mm[6,1];

vvv[5].y:=mm[6,2];

vvv[5].z:=mm[6,3];

vvv[6].x:=mm[7,1];

vvv[6].y:=mm[7,2];

vvv[6].z:=mm[7,3];

vvv[7].x:=mm[8,1];

vvv[7].y:=mm[8,2];

vvv[7].z:=mm[8,3];

DrawLine3(vvv[0],vvv[1]);

DrawLine3(vvv[1],vvv[2]);

DrawLine3(vvv[2],vvv[3]);

DrawLine3(vvv[3],vvv[0]);

DrawLine3(vvv[0],vvv[7]);

DrawLine3(vvv[1],vvv[6]);

DrawLine3(vvv[2],vvv[5]);

DrawLine3(vvv[3],vvv[4]);

DrawLine3(vvv[4],vvv[5]);

DrawLine3(vvv[5],vvv[6]);

DrawLine3(vvv[6],vvv[7]);

DrawLine3(vvv[7],vvv[4]);

**end**;

**procedure** TForm1.Button3Click(Sender: TObject);

**begin**

Form1.Canvas.Pen.Color:=clWhite;

**for** i:=0 **to** 400 **do**

Form1.Canvas.Line(0,i,1000,i);

Form1.Canvas.Pen.Color:=clBlack;

**for** i:=1 **to** 4 **do**

**for** j:=1 **to** 4 **do**

m[i,j]:=0;

m[1,1]:=1;

m[2,2]:=1;

m[3,1]:=cos(3.14/4);

m[3,2]:=sin(3.14/4);

m[4,4]:=1;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[1,l]\*m[l,j];

mm[1,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[2,l]\*m[l,j];

mm[2,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[3,l]\*m[l,j];

mm[3,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[4,l]\*m[l,j];

mm[4,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[5,l]\*m[l,j];

mm[5,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[6,l]\*m[l,j];

mm[6,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[7,l]\*m[l,j];

mm[7,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[8,l]\*m[l,j];

mm[8,j] := Summa;

**end**;

vvv[0].x:=mm[1,1];

vvv[0].y:=mm[1,2];

vvv[0].z:=mm[1,3];

vvv[1].x:=mm[2,1];

vvv[1].y:=mm[2,2];

vvv[1].z:=mm[2,3];

vvv[2].x:=mm[3,1];

vvv[2].y:=mm[3,2];

vvv[2].z:=mm[3,3];

vvv[3].x:=mm[4,1];

vvv[3].y:=mm[4,2];

vvv[3].z:=mm[4,3];

vvv[4].x:=mm[5,1];

vvv[4].y:=mm[5,2];

vvv[4].z:=mm[5,3];

vvv[5].x:=mm[6,1];

vvv[5].y:=mm[6,2];

vvv[5].z:=mm[6,3];

vvv[6].x:=mm[7,1];

vvv[6].y:=mm[7,2];

vvv[6].z:=mm[7,3];

vvv[7].x:=mm[8,1];

vvv[7].y:=mm[8,2];

vvv[7].z:=mm[8,3];

DrawLine1(vvv[0],vvv[1]);

DrawLine1(vvv[1],vvv[2]);

DrawLine1(vvv[2],vvv[3]);

DrawLine1(vvv[3],vvv[0]);

DrawLine1(vvv[0],vvv[7]);

DrawLine1(vvv[1],vvv[6]);

DrawLine1(vvv[2],vvv[5]);

DrawLine1(vvv[3],vvv[4]);

DrawLine1(vvv[4],vvv[5]);

DrawLine1(vvv[5],vvv[6]);

DrawLine1(vvv[6],vvv[7]);

DrawLine1(vvv[7],vvv[4]);

**for** i:=1 **to** 4 **do**

**for** j:=1 **to** 4 **do**

m[i,j]:=0;

m[1,1]:=1;

m[2,2]:=1;

m[3,1]:=cos(3.14/4)\*0.5;

m[3,2]:=sin(3.14/4)\*0.5;

m[4,4]:=1;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[1,l]\*m[l,j];

mm[1,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[2,l]\*m[l,j];

mm[2,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[3,l]\*m[l,j];

mm[3,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[4,l]\*m[l,j];

mm[4,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[5,l]\*m[l,j];

mm[5,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[6,l]\*m[l,j];

mm[6,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[7,l]\*m[l,j];

mm[7,j] := Summa;

**end**;

**for** j:=1 **to** 4 **do**

**begin**

Summa:= 0;

**for** l:= 1 **to** 4 **do**

Summa:= Summa + vv[8,l]\*m[l,j];

mm[8,j] := Summa;

**end**;

vvv[0].x:=mm[1,1];

vvv[0].y:=mm[1,2];

vvv[0].z:=mm[1,3];

vvv[1].x:=mm[2,1];

vvv[1].y:=mm[2,2];

vvv[1].z:=mm[2,3];

vvv[2].x:=mm[3,1];

vvv[2].y:=mm[3,2];

vvv[2].z:=mm[3,3];

vvv[3].x:=mm[4,1];

vvv[3].y:=mm[4,2];

vvv[3].z:=mm[4,3];

vvv[4].x:=mm[5,1];

vvv[4].y:=mm[5,2];

vvv[4].z:=mm[5,3];

vvv[5].x:=mm[6,1];

vvv[5].y:=mm[6,2];

vvv[5].z:=mm[6,3];

vvv[6].x:=mm[7,1];

vvv[6].y:=mm[7,2];

vvv[6].z:=mm[7,3];

vvv[7].x:=mm[8,1];

vvv[7].y:=mm[8,2];

vvv[7].z:=mm[8,3];

DrawLine3(vvv[0],vvv[1]);

DrawLine3(vvv[1],vvv[2]);

DrawLine3(vvv[2],vvv[3]);

DrawLine3(vvv[3],vvv[0]);

DrawLine3(vvv[0],vvv[7]);

DrawLine3(vvv[1],vvv[6]);

DrawLine3(vvv[2],vvv[5]);

DrawLine3(vvv[3],vvv[4]);

DrawLine3(vvv[4],vvv[5]);

DrawLine3(vvv[5],vvv[6]);

DrawLine3(vvv[6],vvv[7]);

DrawLine3(vvv[7],vvv[4]);

**end**;

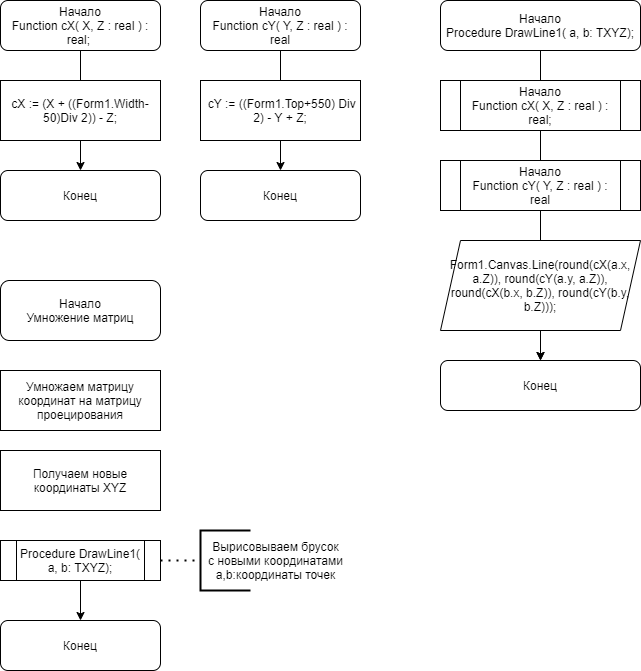
**procedure** TForm1.FormCreate(Sender: TObject);

**begin**

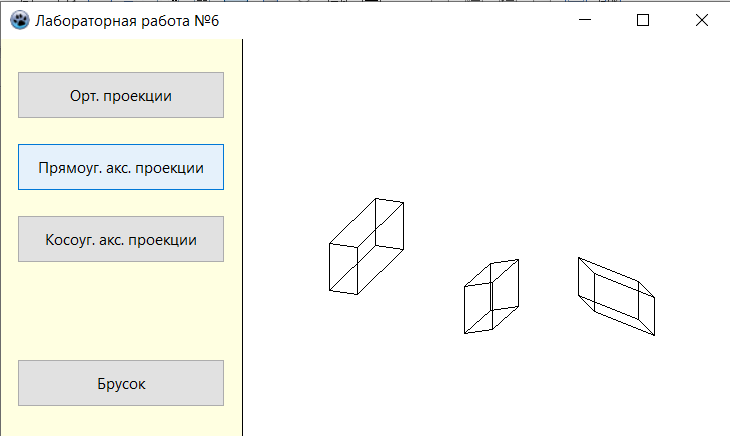
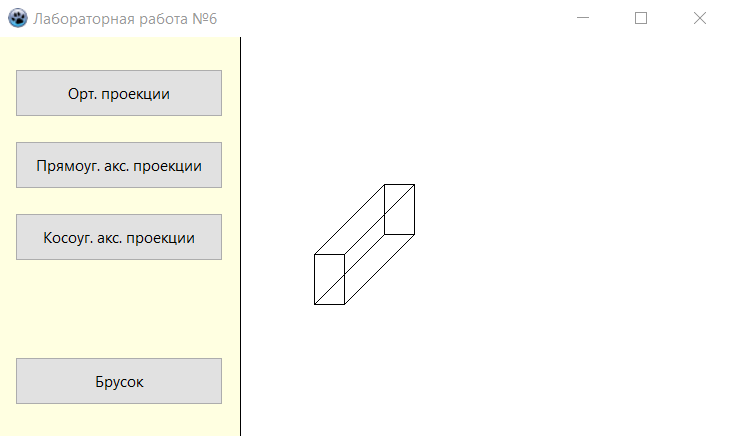
**end**;

**end**.

**Схемы алгоритмов**



**Экранные формы**



**Вывод**

В ходе выполнения данной лабораторной работы были получены навыки в применении математического аппарата проекций для визуализации объёмных геометрических тел. При помощи среды программирования Lazarus была впервые построена объёмная фигура «Брусок». В отличие от Декартовой системы координат потребовалось использовать 3 координаты XYZ, путем задания матрицы.