clc

clear

close all

format shortG

%1

fprintf('1 task\ndate\_n\_time')

datestr (now)

%2

fprintf('2 task\n')

A=randi([2,6],3, 5);

disp('A=');

disp(A);

figure('Units', 'normalized','OuterPosition', [0 0 1/2 1])

subplot (1,2,1)

histogram(reshape(A, 1, []))

title('$hist(A)$', 'Interpreter', 'Latex');

B=1+2\*randn(5,3);

disp('B=');

disp(B);

subplot (1,2,2)

histogram(reshape(B,1,[]))

title('$hist(B)$', 'Interpreter', 'Latex');

%3

fprintf('3 task\n')

[m, n]=size(A);

m=ceil(m/2);

n=ceil(n/2);

fprintf('\nA(%i,%i)=%g->',[m,n,A(m,n)])

A(m,n)=A(m,n)\*(-0.5)-1;

fprintf('A(%i,%i)=%g',[m,n,A(m,n)])

[m, n]=size(B);

m=ceil(m/2);

n=ceil(n/2);

fprintf('\nB(%i,%i)=%g->',[m,n,B(m,n)])

B(m,n)=B(m,n)\*(sind(45))+1;

fprintf('B(%i,%i)=%g\n',[m,n,B(m,n)])

%4

fprintf('\n4 task C=A.\*B\n')

C=A.\*B';

disp(C);

%5

fprintf('5 task D matrix \n')

[m, n]=size(C);

M=min(m, n);

N=max(m, n);

D=zeros(M);

for i=1:M

D(i,i)=1;

end

for i=1:M-1

D(i,i+1)=-0.5;

end

for i=1:M-1

D(i+1,i)=sind(45);

end

disp('D=');

disp(D);

T=A\*B+D;

disp('T=');

disp(T);

clear i

%6

fprintf('6 task - Basis\n')

%syms i j k;

a1=[2,0,0];

a2=[1,2,0];

a3=[0,0,1];

la1=sqrt(sum(a1.\*a1));

la2=sqrt(sum(a2.\*a2));

la3=sqrt(sum(a3.\*a3));

fprintf('la1=%g la2=%g la3=%g\n', [la1 la2 la3]);

V=sum(a1.\*cross(a2,a3));

fprintf('\nV=%g\n',V);

% format longEng

% disp(la1);

% disp(la2);

% disp(V);

% format short

% disp(la1);

% disp(la2);

% disp(V);

b1=2\*pi\*cross(a2,a3)/V;

b2=2\*pi\*cross(a3,a1)/V;

b3=2\*pi\*cross(a1,a2)/V;

fprintf('\nb1=[%g %g %g]\nb2=[%g %g %g]\nb3=[%g %g %g]\n', [b1 b2 b3]);

lb1=sqrt(sum(b1.\*b1));

lb2=sqrt(sum(b2.\*b2));

lb3=sqrt(sum(b3.\*b3));

fprintf('\nlb1=%g lb2=%g lb3=%g', [lb1 lb2 lb3]);

Vb=sum(b1.\*cross(b2,b3));

fprintf('\nVb=%g\n',Vb);

% format longEng

% disp(lb1);

% disp(lb2);

% disp(Vb);

a1b1=sum(a1.\*b1);

a1b2=sum(a1.\*b2);

fprintf('\na1b1=%g\na1b2=%g',[a1b1 a1b2]);

% format longEng

% disp(a1b1);

% disp(a1b2);

figure('Units', 'normalized', 'OuterPosition', [0 0 1/2 1]);

hold on

plot3([0, a1(1), a2(1), a3(1)], ...

[0, a1(2), a2(2), a3(2)], ...

[0, a1(3), a2(3), a3(3)], ...

'k.', 'MarkerSize' , 7);

plot3([0, a1(1)],[0, a1(2)],[0, a1(3)], ...

'k', 'LineWidth' , 2);

plot3([0, a2(1)],[0, a2(2)],[0, a2(3)], ...

'k', 'LineWidth' , 2);

plot3([0, a3(1)],[0, a3(2)],[0, a3(3)], ...

'k', 'LineWidth' , 2);

plot3([0, b1(1), b2(1), b3(1)], ...

[0, b1(2), b2(2), b3(2)], ...

[0, b1(3), b2(3), b3(3)], ...

'ks', 'MarkerSize' , 7, ...

'MarkerFaceColor', 'r');

plot3([0, b1(1)],[0, b1(2)],[0, b1(3)], ...

'r--', 'LineWidth' , 2);

plot3([0, b2(1)],[0, b2(2)],[0, b2(3)], ...

'r--', 'LineWidth' , 2);

plot3([0, b3(1)],[0, b3(2)],[0, b3(3)], ...

'r--', 'LineWidth' , 2);

text(a1(1)+0.1,a1(2)+0.1,a1(3),'$\vec{a\_1}$', 'Interpreter', 'latex');

text(a2(1)+0.1,a2(2)+0.1,a2(3),'$\vec{a\_2}$', 'Interpreter', 'latex');

text(a3(1)+0.1,a3(2)+0.1,a3(3),'$\vec{a\_3}$', 'Interpreter', 'latex');

text(b1(1)+0.1,b1(2)+0.1,b1(3),'$\vec{b\_1}$', 'Interpreter', 'latex');

text(b2(1)+0.1,b2(2)+0.1,b2(3),'$\vec{b\_2}$', 'Interpreter', 'latex');

text(b3(1)+0.1,b3(2)+0.1,b3(3),'$\vec{b\_3}$', 'Interpreter', 'latex');

view(3);

title('$Structure$', 'Interpreter', 'Latex');

xlabel('The coordinate of Ox, i', 'Interpreter', 'latex');

ylabel('The coordinate of Oy, j', 'Interpreter', 'latex');

zlabel('The coordinate of Oz, k', 'Interpreter', 'latex');

grid on

axis equal

%7

fprintf('\n7 task - -Fermi-Dirak\n')

V=0.2;

temp=27;

t\_to\_T=@(t) t+273;

T=t\_to\_T(temp);

Ef=0;

e=1.6e-19;

kb\_eV=8.617e-5;

ev\_J=1.6e-19;

kb\_J=kb\_eV\*ev\_J;

E=linspace(-0.25, 0.25);

FD=@(Ef) 1./(1+exp((E-Ef)/(kb\_eV\*T)));

F=FD(E);

F1=FD(V/2\*e/ev\_J);

F2=FD(-V/2\*e/ev\_J);

figure('Units', 'normalized','OuterPosition', [0 0 1/2 1])

plot(F1, E, F2,E);

ylabel('$E(eV)$','Interpreter', 'Latex');

xlabel('$Fermi function f(E), T=27^{o}C$','Interpreter', 'Latex');

ylim([-0.25 0.25]);

hold on;

plot(abs(F1-F2), E, 'g--', 'LineWidth', 2);

legend('$V=0,1V$','$V=-0,1V$', '$|F\_1-F\_2|$', 'Interpreter', 'Latex');

grid on;

dx=E(2)-E(1);

F12=abs(F1-F2);

Fprods=F12.\*dx;

Integ=sum(Fprods);

text(0.42, -0.22, ['S = ', num2str(Integ)], 'Interpreter', 'Latex');