Question 5

(a)

```
format long

A=[4,-1,2;1,2,3;-1,7,-5];

norm_1=norm(A,1); % 1- norm of A
norm_2=norm(A,2);  % 2- norm of A
norm_inf=norm(A,"inf"); % inf- norm of A
norm_frob=norm(A,"fro"); % Frobenius norm of A


spectral_radius=max(abs(eig(A)));
```

(b)

```
n=size(A,1);

if(1/sqrt(n)*norm_2 <=norm_1 && norm_1<=sqrt(n)*norm_2)
    disp("True")
end
```

```
True
```

```

if(1/sqrt(n)*norm_2 <=norm_inf && norm_inf<=sqrt(n)*norm_2)
    disp("True")
end
```

```
True
```

```

if(1/n*norm_inf <=norm_1&& norm_1<=n*norm_inf)
    disp("True")
end
```

```
True
```

```

if(norm_1 <=norm_frob&& norm_frob<=sqrt(n)*norm_2)
    disp("True")
end
```

```
True
```

```

A_norm=[norm_1,norm_2,norm_inf];
```

```
for i=1:length(A_norm)
    if(spectral_radius<=A_norm(i))
        fprintf("True \n")
    end
end
```

```
True
True
True
```

```

```

Question 6

(b)

```
lis=[2^4,2^5,2^6,2^7];
table(lis',Implementation(lis), 'VariableNames', {'matrix size','Norm of Difference'})
```

ans = 4×2 table

	matrix size	Norm of Difference
1	16	0
2	32	7.904787935331115e-14
3	64	4.298783551348606e-13
4	128	2.703615109567181e-12

```
function Diff=Implementation(lis)
n=length(lis);
Diff=zeros(n,1);
for i=1:n
    M=rand(lis(i),lis(i));
    N=rand(lis(i),lis(i));
    strass_n=strass(M,N);
    reg=M*N;
    norm_diff=norm(strass_n-reg,"inf");
    Diff(i)=norm_diff;
end

end



function c = strass(a,b)
 nmin = 16;
 [~,n] = size(a);
 if n <= nmin
```

```
    c = a*b;
else
     m = n/2; u = 1:m; v = m+1:n;
     p1 = strass(a(u,u)+a(v,v),b(u,u)+b(v,v));
     p2 = strass(a(v,u)+a(v,v),b(u,u));
     p3 = strass(a(u,u),b(u,v)-b(v,v));
     p4 = strass(a(v,v),b(v,u)-b(u,u));
     p5 = strass(a(u,u)+a(u,v),b(v,v));
     p6 = strass(a(v,u)-a(u,u),b(u,u)+b(u,v));
     p7 = strass(a(u,v)-a(v,v),b(v,u)+b(v,v));
     c = [p1+p4-p5+p7,p3+p5; p2+p4, p1-p2+p3+p6];
 end
end
```