VIT-AP UNIVERSITY

Final Review and Lab Report

MATLAB

WIN SEM 2019-20

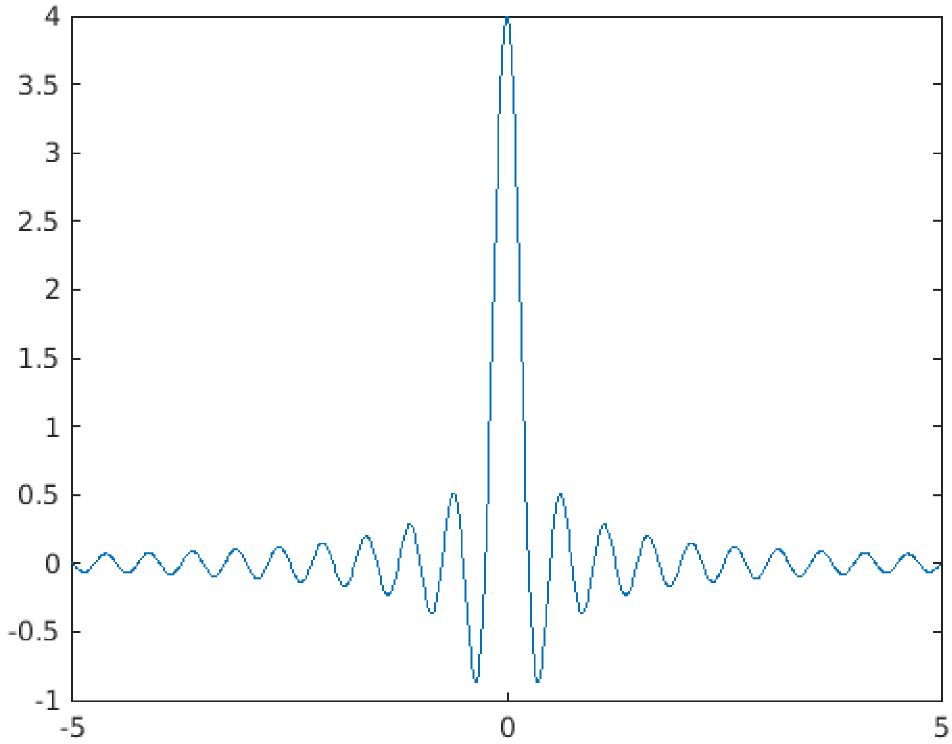
SLOT: L 13-14

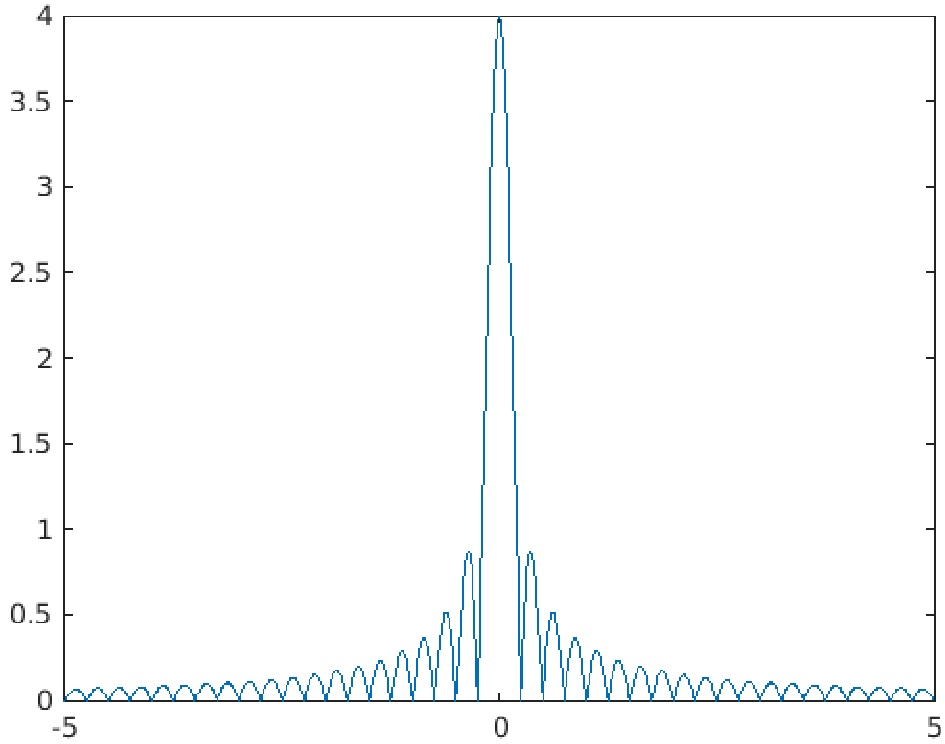
CONTENT

```
%SHASHWAT KUMAR
%19BCE7600
%Fourier Series of a Periodic Function
clc
clear all

f=-5:0.01:5;
X=4*sinc(4*f);

plot(f,X)
figure
plot(f,abs(X))
```





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```
%SHASHWAT KUMAR
%19BCE7600
%Fourier Series of a Periodic Function
clc
clear all

F=0;
t=-2:0.01:2;
trapz(t,exp(-j*2*pi*F*t))
```

```
ans =

     4
```

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```
%19BCE7600
%Shashwat Kumar
%Eigen value problem
clc
clear all

A=[0 1 0 1/3 0;1/2 0 1/2 0 1/3;0 0 0 1/3 1/3;0 0 0 0 1/3;1/2 0 1/2 1/3
 0];
d=eig(A)
[n,n2]=size(d);

[V D]=eig(A);


Vr=round(V,5)
dr=round(d,5)
for i=1:n
    M=A*Vr(:,i);
     N=Vr(:,i);

         if(M(i,1)==N(i,1))
             [k]=i;
         end

end

[m m2]=size(k);

  for i=1:m
    Vr(:,k(i))
  end
```

```
d =

   1.0000 + 0.0000i
  -0.5719 + 0.2441i
  -0.5719 - 0.2441i
   0.1437 + 0.0000i
   0.0000 + 0.0000i


Vr =

  Columns 1 through 4

  -0.6230 + 0.0000i  -0.3424 + 0.4151i  -0.3424 - 0.4151i  -0.7311 +
 0.0000i
  -0.5711 + 0.0000i   0.2026 - 0.2748i   0.2026 + 0.2748i  -0.1681 +
 0.0000i
  -0.2077 + 0.0000i  -0.1935 - 0.0019i  -0.1935 + 0.0019i   0.6283 +
 0.0000i
```

```
  -0.1557 + 0.0000i  -0.3242 - 0.1384i  -0.3242 + 0.1384i   0.1893 +
 0.0000i
  -0.4673 + 0.0000i   0.6575 + 0.0000i   0.6575 + 0.0000i   0.0816 +
 0.0000i

  Column 5

   0.7071 + 0.0000i
   0.0000 + 0.0000i
  -0.7071 + 0.0000i
   0.0000 + 0.0000i
   0.0000 + 0.0000i


dr =

   1.0000 + 0.0000i
  -0.5718 + 0.2441i
  -0.5718 - 0.2441i
   0.1437 + 0.0000i
   0.0000 + 0.0000i


ans =

    0.7071
         0
   -0.7071
         0
         0
```

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```
% 19BCE7600
% Shahswat Kumar
% Hill Cypher Encryption
clc
clear all

A='CALCULUS';

key=[3,1;0,5];
s2=size(key);

A1=double(A);

A1=A1-65;

s1=size(A1);
j=1;

for i=1:s1(2)

         if(mod(i,2)==0)
           A2(2,j)=A1(i);
           j=j+1;

         else
             A2(1,j)=A1(i);

         end

end

A3=key*A2;

A4=mod(A3,26);

 j=1;
for i=1:s1(2)


        if(mod(i,2)==0)
            A5(i)=A4(2,j);
            j=j+1;
        else
            A5(i)=A4(1,j);

        end



end
A5=A5+65;
```

```
A6=char(A5)
```

```
A6 =

    'GAJKTDAM'
```

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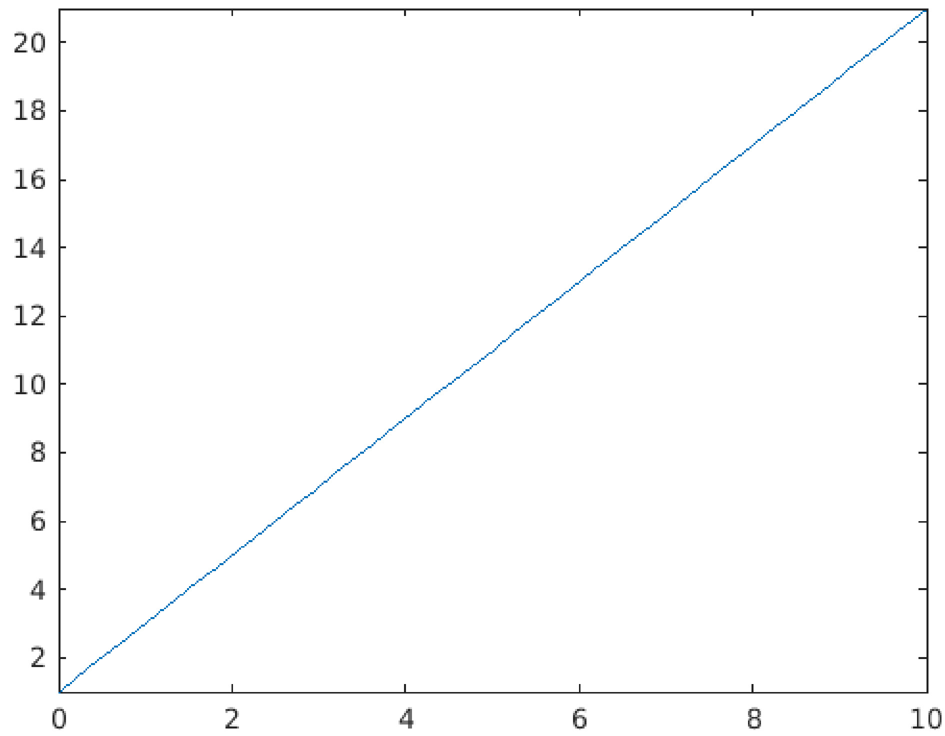
```
%19BCE7600
%SHASHWAT KUMAR
%Power Series Solution
clear all
clc

syms x

n=20;
a=sym('a',[1 (n+1)]);
y=sum(a.*x.^[0:n]);



Dy=diff(y,x);
D2y=diff(y,x,2);

ode=-8*y+D2y;

ode=collect(ode,x);
cof=coeffs(ode,x)

condn1=subs(y,x,0)==1;
condn2=subs(Dy,x,0)==2;


 a=solve([condn1,condn2,cof(3:n)],[a(1:n+1)]);

y=subs(y,a)

fplot(y,[0,10])
```

```
cof =

[ 2*a3 - 8*a1, 6*a4 - 8*a2, 12*a5 - 8*a3, 20*a6 - 8*a4, 30*a7 - 8*a5,
 42*a8 - 8*a6, 56*a9 - 8*a7, 72*a10 - 8*a8, 90*a11 - 8*a9, 110*a12 -
 8*a10, 132*a13 - 8*a11, 156*a14 - 8*a12, 182*a15 - 8*a13, 210*a16 -
 8*a14, 240*a17 - 8*a15, 272*a18 - 8*a16, 306*a19 - 8*a17, 342*a20 -
 8*a18, 380*a21 - 8*a19, -8*a20, -8*a21]


y =

2*x + 1
```



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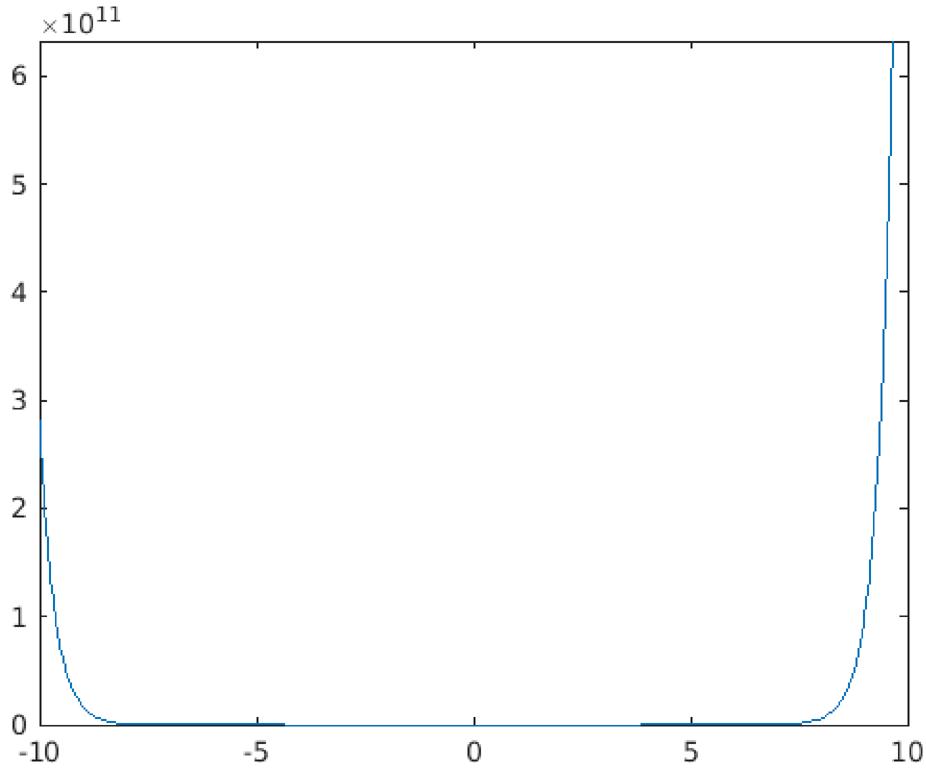
```
%19BCE7600
%SHASHWAT KUMAR
%Power Series Solution
clear all
clc
syms r(t)

odeq=diff(r,t,2)-8*r;
dr=diff(r,t);
condit1=r(0)==1;
condit2=dr(0)==2
sol=dsolve(odeq,[condit1,condit2])

fplot(sol,[-10,10])
```

```
condit2 =

subs(diff(r(t), t), t, 0) == 2


sol =

(2^(1/2)*exp(2*2^(1/2)*t)*(2^(1/2) + 1))/4 -
 exp(-2*2^(1/2)*t)*(2^(1/2)/4 - 1/2)
```



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```
%19BCE7600
%SHASHWAT KUMAR
%PowerSeriesFrobeniousMethod
clear all
clc

syms x r

n=4;

a=sym('a',[1 (n+1)]);
y=sum(a.*x.^[0:n])*x.^r;

Dy=diff(y,x);
D2y=diff(y,x,2);

ode=(x^2)*D2y-x*Dy+y==0;

ode=collect(ode,x);
cof=coeffs(ode,x)
```

```
cof =

a5*r*x^(r - 2)*(r - 1)*x^6 + (7*a5*r*x^(r - 1) + a4*r*x^(r - 2)*(r -
 1))*x^5 + (9*a5*x^r + 5*a4*r*x^(r - 1) + a3*r*x^(r - 2)*(r - 1))*x^4
 + (4*a4*x^r + 3*a3*r*x^(r - 1) + a2*r*x^(r - 2)*(r - 1))*x^3 +
 (a3*x^r + a2*r*x^(r - 1) + a1*r*x^(r - 2)*(r - 1))*x^2 + (-a1*r*x^(r
 - 1))*x + a1*x^r == 0
```

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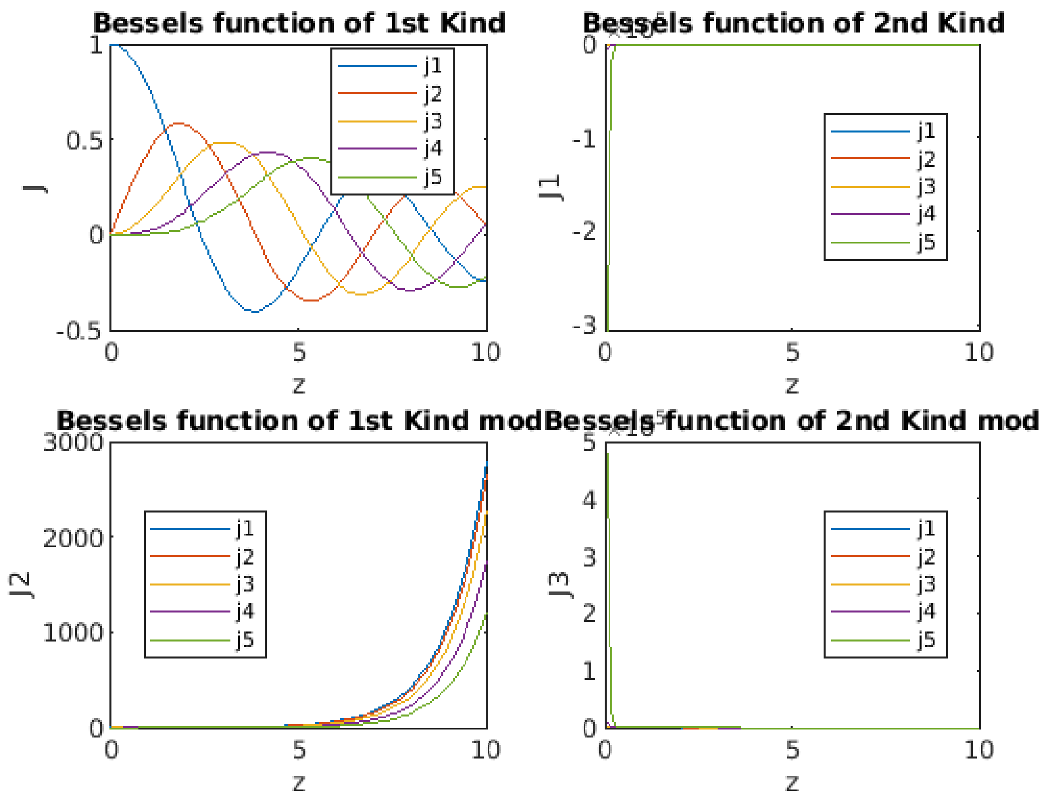
```
%19BCE7600
%SHASHWAT KUMAR
%Bessels eqn
clear all
clc

z=0:0.1:10;

for i = 0:4
    J(i+1,:) = besselj(i,z);
end


for i = 0:4
    J1(i+1,:) = bessely(i,z);
end

for i = 0:4
    J2(i+1,:) = besseli(i,z);
end

for i = 0:4
    J3(i+1,:) = besselk(i,z);
end

subplot(2,2,1);
plot(z,J)
title('Bessels function of 1st Kind')
xlabel('z')
ylabel('J')
legend('j1','j2','j3','j4','j5','location','best')

subplot(2,2,2);
plot(z,J1)
title('Bessels function of 2nd Kind')
xlabel('z')
ylabel('J1')
legend('j1','j2','j3','j4','j5','location','best')

subplot(2,2,3);
plot(z,J2)
title('Bessels function of 1st Kind mod')
xlabel('z')
ylabel('J2')
legend('j1','j2','j3','j4','j5','location','best')

subplot(2,2,4);
plot(z,J3)
title('Bessels function of 2nd Kind mod')
xlabel('z')
ylabel('J3')
legend('j1','j2','j3','j4','j5','location','best')
```



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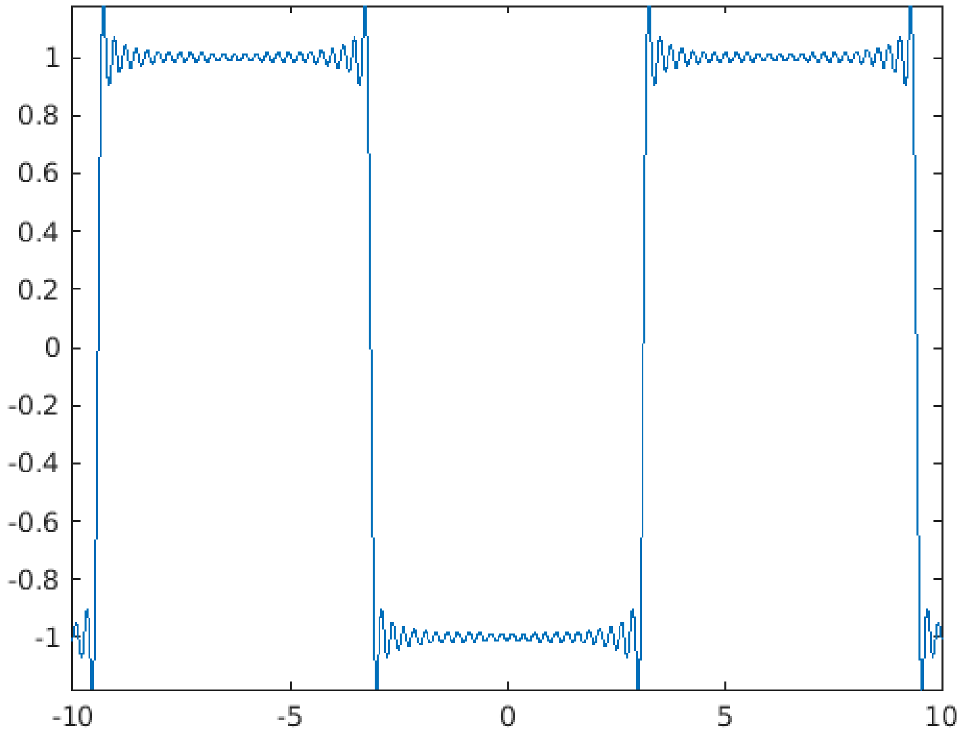
```
%SHASHWAT KUMAR
%19BCE7600
%Fourier Series of a Periodic Function
clc
clear all

syms x

n=50;
k=1;
L=2*pi;

a0=(vpaintegral(-k,x,-pi,pi)+vpaintegral(k,x,pi,3*pi))/(2*L);

sum=a0;

for i=1:n

    an=(vpaintegral(-k*cos(i*pi*x/L),x,-
pi,pi)+vpaintegral(k*cos(i*pi*x/L),x,pi,3*pi))/L;
    bn=(vpaintegral(-k*sin(i*pi*x/L),x,-
pi,pi)+vpaintegral(k*sin(i*pi*x/L),x,pi,3*pi))/L;

    sum=sum+an*cos(i*pi*x/L)+bn*sin(i*pi*x/L);
end

display(sum);


fplot(sum,[-10,10])


sum =

(0.0000000000000000074934674761904190340572154402116*cos(2*x))/pi -
 (4.0*cos(x/2))/pi +
 (0.000000000000000019074280848484705727100833160619*cos(3*x))/pi
 - (0.0000000000000000046834171726190125763797712618749*cos(4*x))/
pi + (1.333333333333333326972680588085*cos((3*x)/2))/pi +
 (0.000000000000000021458565954545293942988437305696*cos(5*x))/pi
 + (0.0000000000000000034694469519536141888238489627838*cos(6*x))/
pi - (0.80000000000000000624500451351651*cos((5*x)/2))/pi +
 (0.000000000000000016519689663419789776348230654141*cos(7*x))/pi
 + (0.0000000000000000045131110936146848114221175194245*cos(8*x))/
pi + (0.57142857142857005764424727090045*cos((7*x)/2))/pi +
 (0.0000000000000000020436729480519328183799803367989*cos(9*x))/pi
 + (0.0000000000000000044452289071905681794305564835668*cos(10*x))/
pi - (0.44444444444444443061484339985157*cos((9*x)/2))/pi +
 (0.0000000000000000083449978712120587556066145077707*cos(11*x))/pi
 - (0.000000000000000020166160408230382472538622096181*cos(12*x))/
pi + (0.36363636363636363778295557125375*cos((11*x)/2))/pi +
 (0.000000000000000060118045888527688397155042119989*cos(13*x))/pi
 - (0.0000000000000000010842021724855044340074528008699*cos(14*x))/
```

```
pi - (0.30769230769230757928378583443418*cos((13*x)/2))/pi -
 (0.00000000000000010269456563960962110229141166667*cos(15*x))/pi
 + (0.0000000000000000292713573288688285707762822366 15*cos(16*x))/
pi + (0.26666666666666661354712086762219 77*cos((15*x)/2))/pi -
 (0.000000000000000045301417015151176246309224585512*cos(17*x))/pi
 - (0.000000000000000045319650809894085341511527076364*cos(18*x))/
pi - (0.23529411764705880551890038177021*cos((17*x)/2))/pi -
 (0.00000000000000002673805440367945354324745422279*cos(19*x))/pi
 - (0.000000000000000022280354644577116118853155057877*cos(20*x))/
pi + (0.21052631578947370873632072285631*cos((19*x)/2))/pi -
 (0.000000000000000085323345581168192459025194766802*cos(21*x))/pi
 + (0.0000000000000000021141942363467336463145329616964*cos(22*x))/
pi - (0.19047619047619048101259442429267*cos((21*x)/2))/pi -
 (0.00000000000000011223170606385197372510058519857*cos(23*x))/pi
 - (0.000000000000000034748679628160417109938862267882*cos(24*x))/
pi + (0.17391304347826084695724513373705*cos((23*x)/2))/pi -
 (0.000000000000000050069987227272352533639687046624*cos(25*x))/
pi - (0.15999999999999999855497534451132*cos((25*x)/2))/pi
 + (0.14814814814814802239675839423683*cos((27*x)/2))/pi
 - (0.13793103448275772864549393315059*cos((29*x)/2))/pi
 + (0.12903225806450605950108367903084*cos((31*x)/2))/pi
 - (0.12121212121212155920038124057303 01*cos((33*x)/2))/pi
 + (0.11428571428571432388749534725392*cos((35*x)/2))/pi
 - (0.10810810810813046927390812523839*cos((37*x)/2))/pi
 + (0.10256410256404729604891995498051*cos((39*x)/2))/pi -
 (0.09756097560975606213136412936393 1*cos((41*x)/2))/pi +
 (0.09302325581395351375250946102113 4*cos((43*x)/2))/pi -
 (0.08888888888888888967264659268785 46*cos((45*x)/2))/pi +
 (0.08510638297872339492426002616198 8*cos((47*x)/2))/pi -
 (0.08163265306122445314103430735741 5*cos((49*x)/2))/pi -
 (0.000000000000000004938876291125504157612410037 2394*sin(2*x))/pi -
 (0.0000000000000000069388939039072283776476979255676*sin(x/2))/pi +
 (0.00000000000000002949029909160572060500271618 3662*sin(3*x))/pi -
 (0.0000000000000000028952033430735714024270060006467*sin(4*x))/pi +
 (0.000000000000000014745149545802860302501358091831*sin((3*x)/2))/pi
 + (0.0000000000000000021684043449710088680149056017399*sin(5*x))/pi
 - (0.0000000000000000037467337380952100586964045790159*sin(6*x))/pi
 - (0.000000000000000014745149545802860302501358091831*sin((5*x)/2))/
pi - (0.000000000000000022985086056692694000957999378443*sin(7*x))/pi
 + (0.0000000000000000037467337380952100526778735028058*sin(8*x))/pi -
 (0.000000000000000031225022567582527699414640665054*sin((7*x)/2))/pi
 - (0.0000000000000000032526065174565133020223584026098*sin(9*x))/pi
 - (0.00000000000000005211366017532428520757492155438*sin(10*x))/pi -
 (0.00000000000000000065052130349130266040447168052197*sin((9*x)/2))/
pi - (0.0000000000000000026020852139652106416178867220879*sin(11*x))/
pi - (0.00000000000000014441955499566991442291612241355*sin(12*x))/pi
 -
 (0.0000000000000000097578195523695399060670752078295*sin((11*x)/2))/
pi - (0.000000000000000041633363423443370265886187553406*sin(13*x))/pi
 + (0.00000000000000026116437215313657369369961642918*sin(14*x))/pi -
 (0.000000000000000021250362580715886906546074897051*sin((13*x)/2))/pi
 - (0.000000000000000083266726846886740531772375106812*sin(15*x))/pi
 - (0.00000000000000016179077505411134301803409070373*sin(16*x))/pi -
 (0.000000000000000047271214720367993322724942117929*sin((15*x)/2))/pi
```

```
 + (0.0000000000000000067654215563095476682065054774284*sin(17*x))/pi
 - (0.000000000000000025264906820292018738378393584631*sin(18*x))/pi -
 (0.0000000000000000027321894746634711736987810581923*sin((17*x)/2))/pi
 - (0.000000000000000007285838599102589796530082821846*sin(19*x))/pi +
 (0.000000000000000002622713616666470314578334833749*sin(20*x))/pi +
 (0.0000000000000000027972416050126014397392282262444*sin((19*x)/2))/pi
 - (0.0000000000000000071123662515049090870888903737068*sin(21*x))/pi
 + (0.0000000000000000064886616100648864925226747629506*sin(22*x))/pi
 - (0.0000000000000000021250362580715886906546074897051*sin((21*x)/2))/
pi - (0.0000000000000000082399365108898336984566412866116*sin(23*x))/pi
 + (0.000000000000000020010964283008508207469307170975*sin(24*x))/pi +
 (0.0000000000000000055511151231257827021181583404541*sin((23*x)/2))/pi
 + (0.000000000000000013400738851920834804332116618752*sin(25*x))/pi +
 (0.000000000000000016740081543176188461075071245432*sin((25*x)/2))/pi
 - (0.0000000000000000012143064331837649660883471369743*sin((27*x)/2))/
pi -
 (0.000000000000000012316536679435330370324663817883*sin((29*x)/2))/pi
 + (0.000000000000000025500435096859064287855289876461*sin((31*x)/2))/
pi -
 (0.0000000000000000011709383462843447887280490249395*sin((33*x)/2))/pi
 + (0.000000000000000010581813203458523275912739336491*sin((35*x)/2))/
pi +
 (0.000000000000000020729945537922844778222497552633*sin((37*x)/2))/pi
 - (0.0000000000000000075460471204991108606918714940548*sin((39*x)/2))/
pi -
 (0.0000000000000000048572257327350598643533885478973*sin((41*x)/2))/pi
 - (0.0000000000000000048572257327350598643533885478973*sin((43*x)/2))/
pi -
 (0.0000000000000000055294310796760726134380092844367*sin((45*x)/2))/pi
 - (0.0000000000000000017347234759768070944119244813919*sin((47*x)/2))/
pi -
 (0.000000000000000029490299091605720605002716183662*sin((49*x)/2))/pi
 - (0.00000000000000000057904066861471428108725430775035*cos(x))/pi -
 (0.00000000000000000034694469519536141888238489627838*sin(x))/pi
```



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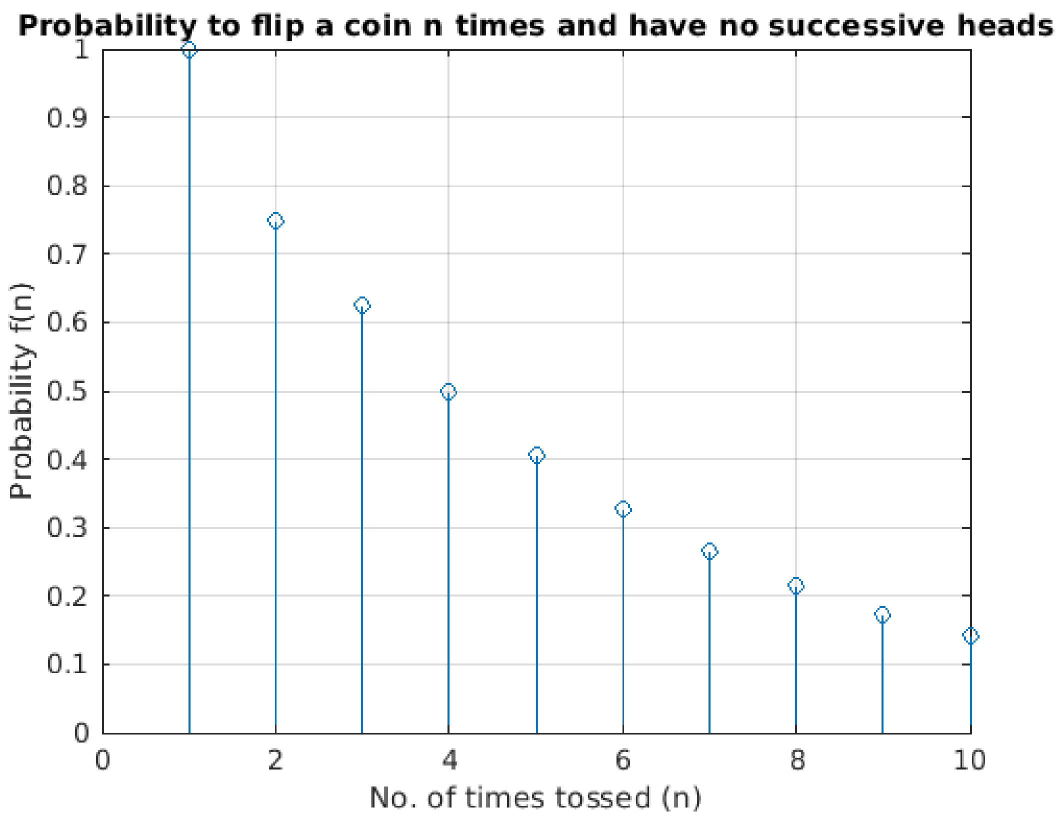
```
%19BCE7600
%Shashwat Kumar
%Application of Matrices: Google Page Rank
clc
clear all

A=[0 1 0 1/3 0;1/2 0 1/2 0 1/3;0 0 0 1/3 1/3;0 0 0 0 1/3;1/2 0 1/2 1/3
 0];
d=eig(A);
[n,n2]=size(d);

[V,D]=eig(A);


Vr=round(V,5);
dr=round(d,5);
for i=1:n
    M=A*Vr(:,i);
     N=Vr(:,i);

         if(M(i,1)==N(i,1))
             [k]=i;
         end

end

[m,m2]=size(k);

  for i=1:m
    Vr(:,k(i))
  end


ans =

    0.7071
         0
   -0.7071
         0
         0
```

Published with MATLAB® R2020a

```
%19BCE7600
%Shashwat Kumar
%Determine the probability to #ip a coin n times and have no
 successive heads
%Using Z transform

clc
clear all

syms f(n) z F
assume(n>=0 & in(n,'integer'))
eq = f(n+2) - f(n+1) - f(n)
Zt = ztrans(eq,n,z)
Zt = subs(Zt,ztrans(f(n),n,z),F)
F = solve(Zt,F)
pSol = iztrans(F,z,n);
pSol = simplify(pSol);
pSol = pSol/(2^n)
pSol = subs(pSol,[f(0) f(1)],[1 2])
nvalues = 1:10;
pSolValues = subs(pSol,n,nvalues);
pSolValues = double(pSolValues);
pSolValues = real(pSolValues)
stem(nvalues,pSolValues)
title('Probability to #ip a coin n times and have no successive
 heads')
xlabel('No. of times tossed (n)')
ylabel('Probability f(n)')
grid on
```

```
eq =

f(n + 2) - f(n + 1) - f(n)


Zt =

z*f(0) - z*ztrans(f(n), n, z) - z*f(1) + z^2*ztrans(f(n), n, z) -
 z^2*f(0) - ztrans(f(n), n, z)


Zt =

z*f(0) - F*z - F - z*f(1) + F*z^2 - z^2*f(0)


F =

-(z*f(1) - z*f(0) + z^2*f(0))/(- z^2 + z + 1)


pSol =
```

```
(2*(-1)^(n/2)*cos(n*(pi/2 + asinh(1/2)*1i))*f(1) + (2^(2 -
 n)*5^(1/2)*(5^(1/2) + 1)^(n - 1)*(f(0)/2 - f(1)))/5 - (2*2^(1 -
 n)*5^(1/2)*(1 - 5^(1/2))^(n - 1)*(f(0)/2 - f(1)))/5)/2^n


pSol =

(4*(-1)^(n/2)*cos(n*(pi/2 + asinh(1/2)*1i)) - (3*2^(2 -
 n)*5^(1/2)*(5^(1/2) + 1)^(n - 1))/10 + (3*2^(1 - n)*5^(1/2)*(1 -
 5^(1/2))^(n - 1))/5)/2^n


pSolValues =

  Columns 1 through 7

    1.0000    0.7500    0.6250    0.5000    0.4062    0.3281    0.2656

  Columns 8 through 10

    0.2148    0.1738    0.1406
```



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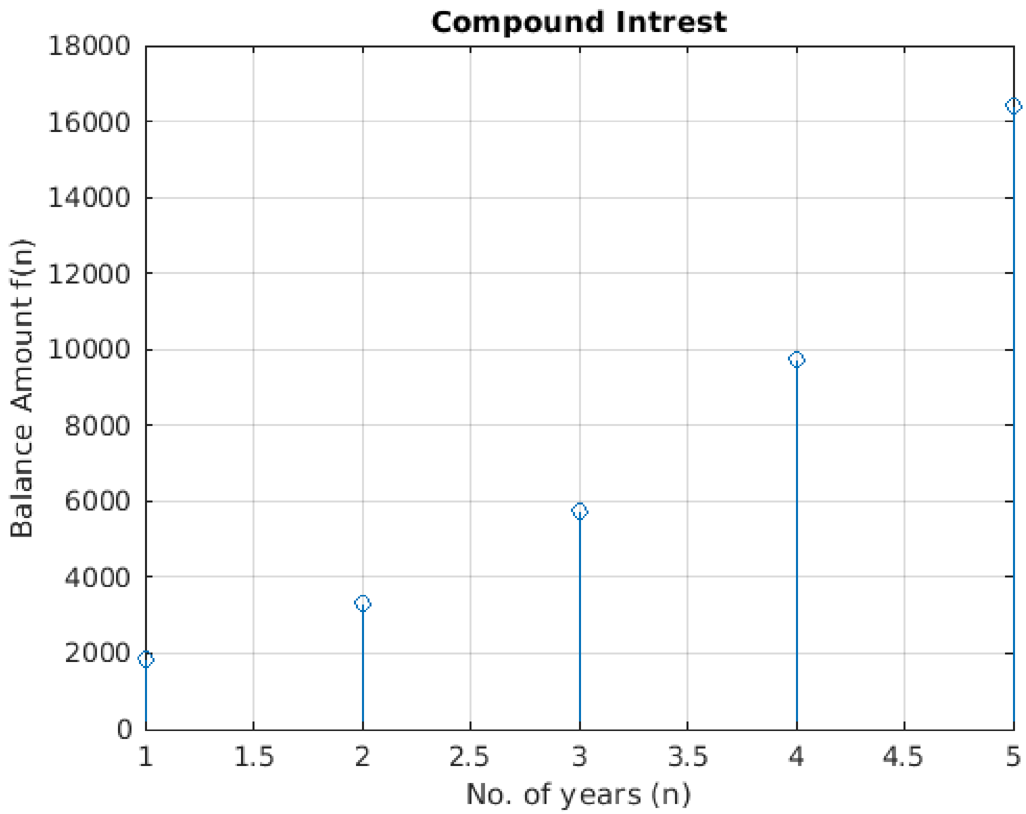
```
%19BCE7600
%Shashwat Kumar
% A bank account gives an interest rate of 5% compounded monthly.
% If you invest initially Rs. 1000, and add Rs. 10 every month.
% How much money do you have after 5 years?
%Using Z transform

clc
clear all

syms f(n) z F
assume(n>=0 & in(n,'integer'))
eq= f(n) - 0.6*f(n+1) + 120
Zt = ztrans(eq,n,z)
Zt = subs(Zt,ztrans(f(n),n,z),F)
F = solve(Zt,F)
pSol = iztrans(F,z,n);
pSol = simplify(pSol);
pSol = subs(pSol,f(0),1000)
nvalues = 1:5;
pSolValues = subs(pSol,n,nvalues);
pSolValues = double(pSolValues);
pSolValues = real(pSolValues)
stem(nvalues,pSolValues)
title('Compound Intrest')
xlabel('No. of years (n)')
ylabel('Balance Amount f(n)')
grid on
```

```
eq =

f(n) - (3*f(n + 1))/5 + 120


Zt =

(120*z)/(z - 1) - (3*z*ztrans(f(n), n, z))/5 + (3*z*f(0))/5 +
 ztrans(f(n), n, z)


Zt =

F + (120*z)/(z - 1) - (3*F*z)/5 + (3*z*f(0))/5


F =

((120*z)/(z - 1) + (3*z*f(0))/5)/((3*z)/5 - 1)


pSol =
```

```
1300*(5/3)^n - 300

pSolValues =

   1.0e+04 *

    0.1867    0.3311    0.5719    0.9731    1.6418
```



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