Assignment 2

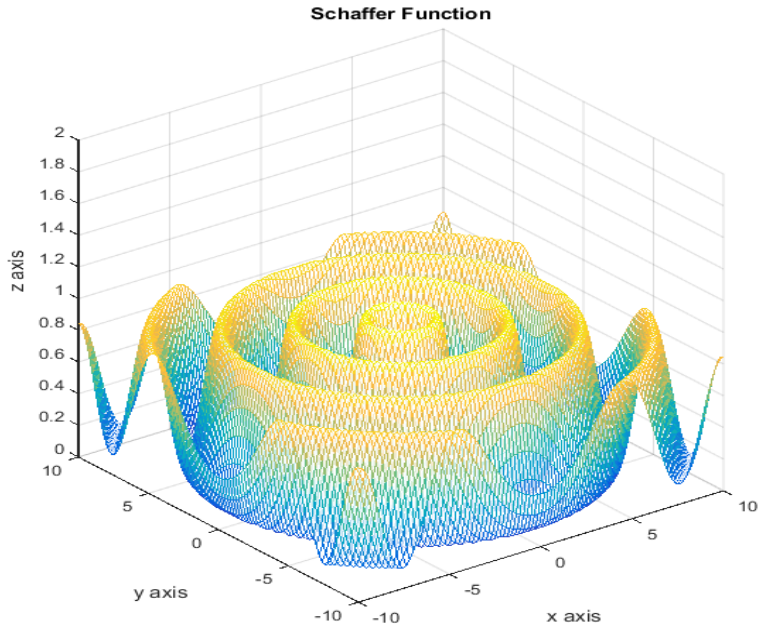
B. Pranav Chakra Varthy
14110026

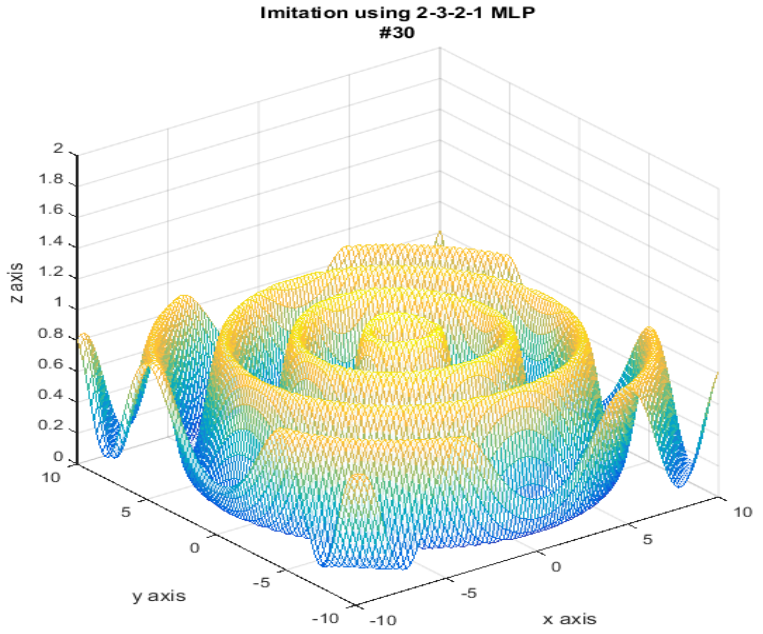
Ans

MATLAB code:

```
%%Schaffer function plot
f=@(x,y) 0.5+((sin((power(x,2)+power(y,2))^0.5))^2-
0.5)/(0.001*(power(x,2)+power(y,2))+1)^2;
pa=101;
x=linspace(-10,10,pa);
y=linspace(-10,10,pa);
z=zeros(pa);
for i=1:pa
    for j= 1:pa
        z(i,j)=f(x(i),y(j));
    end
end
subplot(1,2,1);
mesh(x,y,z,'FaceAlpha',0.7)
xlabel('x axis')
ylabel('y axis')
zlabel('z axis')
title('Schaffer Function')
axis([-10 10 -10 10 0 2])

%% Multi Layer Perceptron

M=3; N=2; lr=0.1+rand(1)*0.1; %learning rate is 0.1
W1=rand(M,2); b1=rand(M,1);
W2=rand(N,M); b2=rand(N,1);
W3=rand(1,N); b3=rand(1);
p3=zeros(pa);
e=zeros(pa);

subplot(1,2,2);
mesh(x,y,p3,'FaceAlpha',0.7);
xlabel('x axis')
ylabel('y axis')
zlabel('z axis')
title({'Imitation using 2-3-2-1 MLP';['#',num2str(0),]})
axis([-10 10 -10 10 0 2])
pause(5)
for itr=1:30
for i=1:pa
    for j=1:pa
        p=[x(i);y(j)];
        p1=tanh(W1*p+b1);
        p2=tanh(W2*p1+b2);
        p3(i,j)=W3*p2+b3;
        e(i,j)=z(i,j)-p3(i,j);
        W3=W3+2*lr*e(i,j)*p2';
        b3=b3+2*lr*e(i,j);
        W2=W2+2*lr*e(i,j)*diag(1-p2.^2)*W3'*p1';
        b2=b2+2*lr*e(i,j)*diag(1-p2.^2)*W3';
        W1=W1+2*lr*e(i,j)*diag(1-p1.^2)*W2'*diag(1-p2.^2)*W3'*p';
        b1=b1+2*lr*e(i,j)*diag(1-p1.^2)*W2'*diag(1-p2.^2)*W3';
    end
end
subplot(1,2,2);
mesh(x,y,p3,'FaceAlpha',0.7);
xlabel('x axis')
ylabel('y axis')
zlabel('z axis')
axis([-10 10 -10 10 0 2])
title({'Imitation using 2-3-2-1 MLP';['#',num2str(itr),]})
drawnow()
end
```

Plots:





Note that the learning rate used is a random number from 0.1-0.2. Compared to 0.01, higher learning rate resulted in better approximation.

Youtube Link: https://youtu.be/-IUsT5Hy88A