

Reading MATLAB code¹

Today we are going to practice in reading MATLAB code. Below are examples of the working functions. Your task is to explain what does the function do.

Q1. What will be the diagonal elements of the matrix **A** build according to the following code? What is the first column? What is the first row?

```
function A=mgen(n)
    A=eye(n);
    for j=2:n
        for i=1:j-1; A(i,j)=i/j; A(j,i)=i/j; end;
    end
end
```

Q2. Explain the code below in full details. What do we expect to see on the figures?

```
function [y1,y2]=plotv()
    figure(1); hold on;
    tspan=[0,15];
    for i=1:3;
        yzero=[5*rand;5*rand];
        [t,y]=ode45('twod', tspan, yzero);
        plot(y(:,1),y(:,2))
    end
    c=input('Continue? ');
    [y1, y2]=meshgrid(-4:.5:4, -4:.5:4);
    Dy1Dt=y2; Dy2Dt=-y1;
    quiver(y1, y2, Dy1Dt, Dy2Dt)
end

function yprime = twod(t,y)
    yprime = [y(2);-y(1)];
end
```

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Q3. The following function gets two real numbers b and st as an input. What is the output?

```
function bis=section(b, st)
N=b/st; k=1;
for j=1:N+1
    for i=1:N+1
        if min([st*(i-1), st*(j-1), b-st*(i-1)-st*(j-1)]) > 0.5
            bis(k,3)=b-st*(i-1)-st*(j-1);
            bis(k,2)=st*(i-1);
            bis(k,1)=st*(j-1);
            k=k+1;
        end;
    end;
end;
plot3(bis);
```

Q4. Explain how does the value y change. What will be the output for $z = 1$, $z = 3$, $z = 4$?

```
function y=pr(z)
x=5; nmax=500; eps=1; n=0;
while (eps>=1e-5) && (n<=nmax)
    y=x-(x^2-z)/(2*x);
    eps=abs(y-x);
    x=y; n=n+1;
end
```

Q5. Assuming x and y are two vectors of the same length, write down the formula for vec . Explain what values does the variable dy contain. In the case $x=[-\pi/2:0.1:\pi/2]$ and $y=\sin(x)$ suggest how the output will look like.

```
function [b,m,E]=lsquare(x,y)
P=length(x);
X=[ones(P,1) x];
vec=X\y; b=vec(1); m=vec(2);
dy=y-m*x-b;
E=dy'*dy;
plot(x,y,'bv',x,m*x+b,'b-*')
xlabel('x'), ylabel('y'), legend('data', 'model')
```