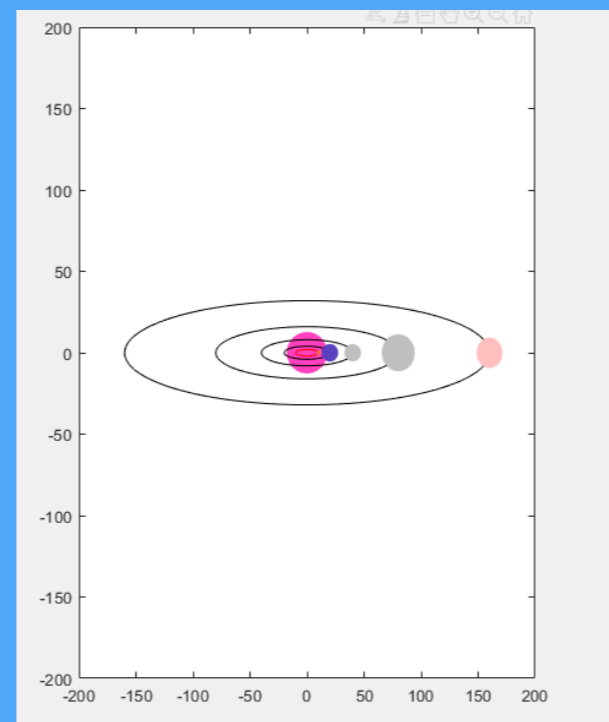
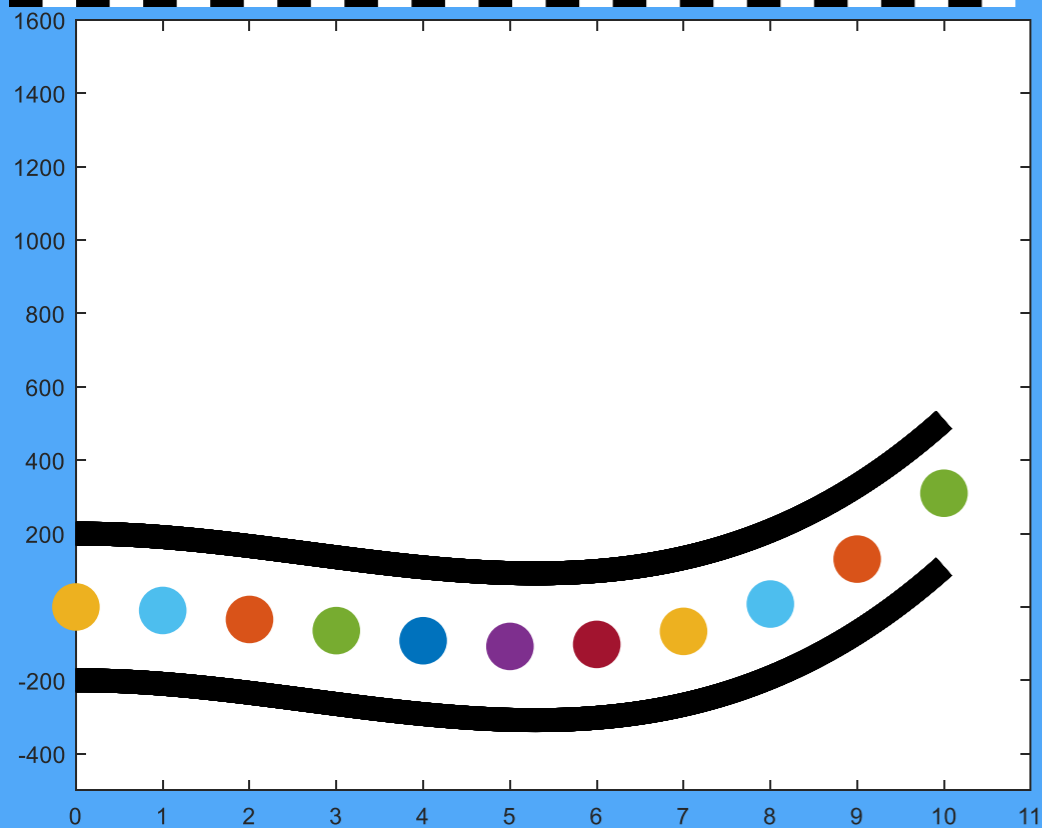
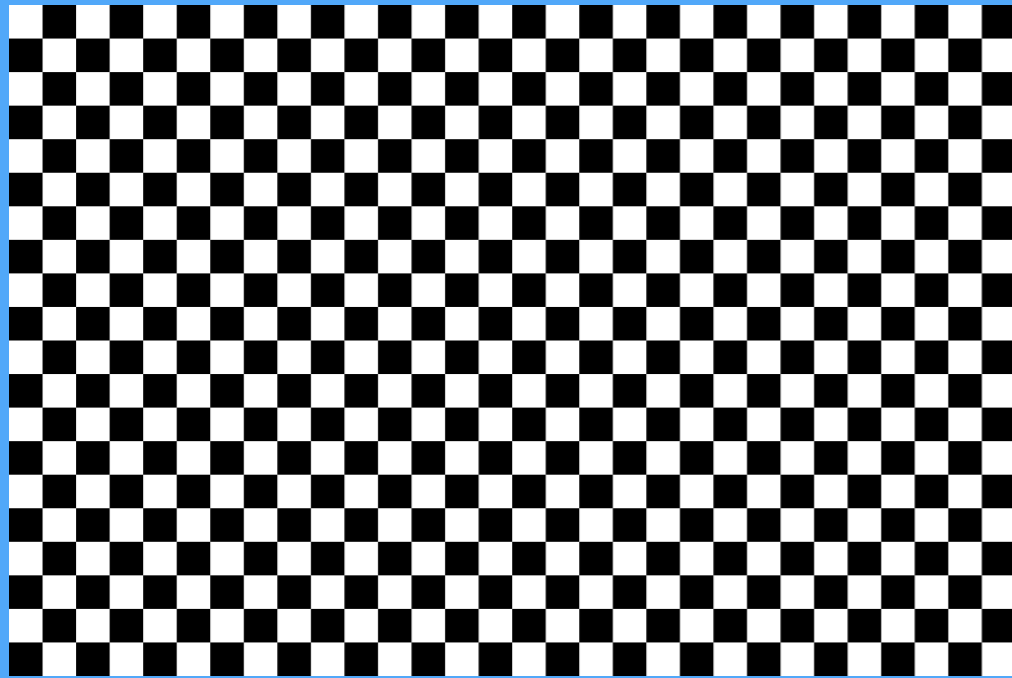


Introduction to Scientific Computation

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Lecture 6 - Flow and Decision Control



IF statement

If statement is used to choose whether or not a statement, or group of statements, is executed. **if** statement is written as,

if logic expression or relational expression

arguments

elseif logic or relational expression

Arguments

end

end

Decision Control: If else if

We used if statements to control the decision making process in Matlab

If

Elseif

else

End

```
a=1
for k=1:4;
    if a==k;
        fprintf('if loop runs when a=%i \n', a)

    else
        disp('else loop runs')

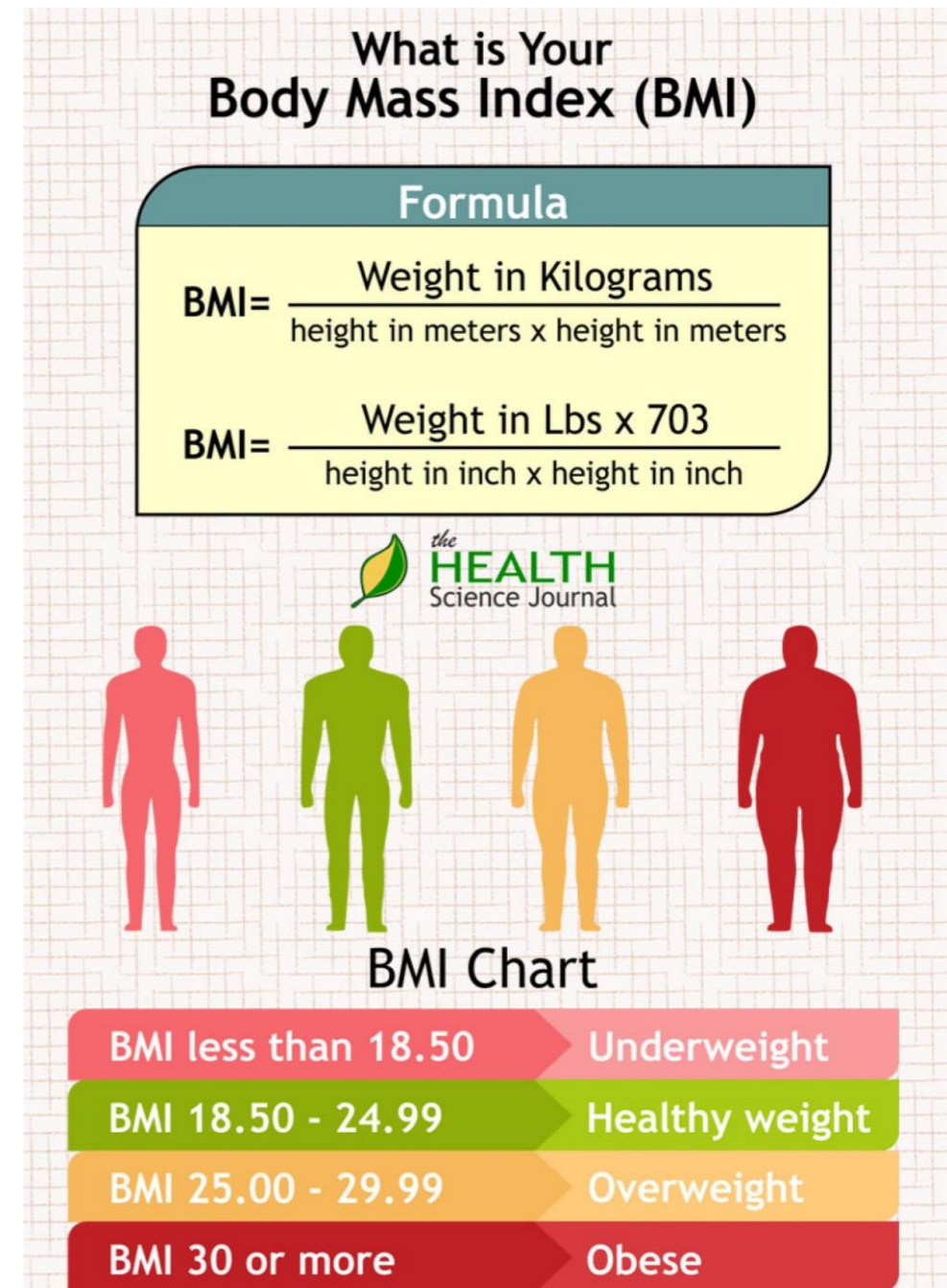
    end
end
```

Decision Control: If else if

```
weight=150
height=1.90
BMI=weight/(height^2)
disp(BMI)
if BMI < 18.5
    disp('You are underweight')

elseif BMI >=18.5 & BMI < 24.9
    disp('You have a normal weight')
elseif BMI >=24.9 & BMI<30
    disp('You are overweight')

else
    disp('You are obese')
end
```



```
%% whether a number is even or odd.
```

```
x = input('enter a number:');
```

```
if mod(x,2) == 0
```

```
    %i= i is an integer
```

```
    fprintf("%f is an even \n\n",x);
```

```
else mod(x,2) ~= 0
```

```
    fprintf("%i is an odd number\n",x);
```

```
    num=string(x)
```

```
    disp(num)
```

```
end
```

```
x = input('enter a number:');
```

```
if mod(x,7) == 0
```

```
    %i= i is an integer
```

```
    fprintf("%i can be divided by 7",x);
```

```
else
```

```
    fprintf("%i cannot be divided by 7",x);
```

```
end
```

```
a=1:100;
```

```
b=[];
```

```
f=1
```

```
for x=1:100
```

```
    if mod(a(x),10)==8 %if statement
```

```
        b(f,1)=a(x);
```

```
        f=f+1
```

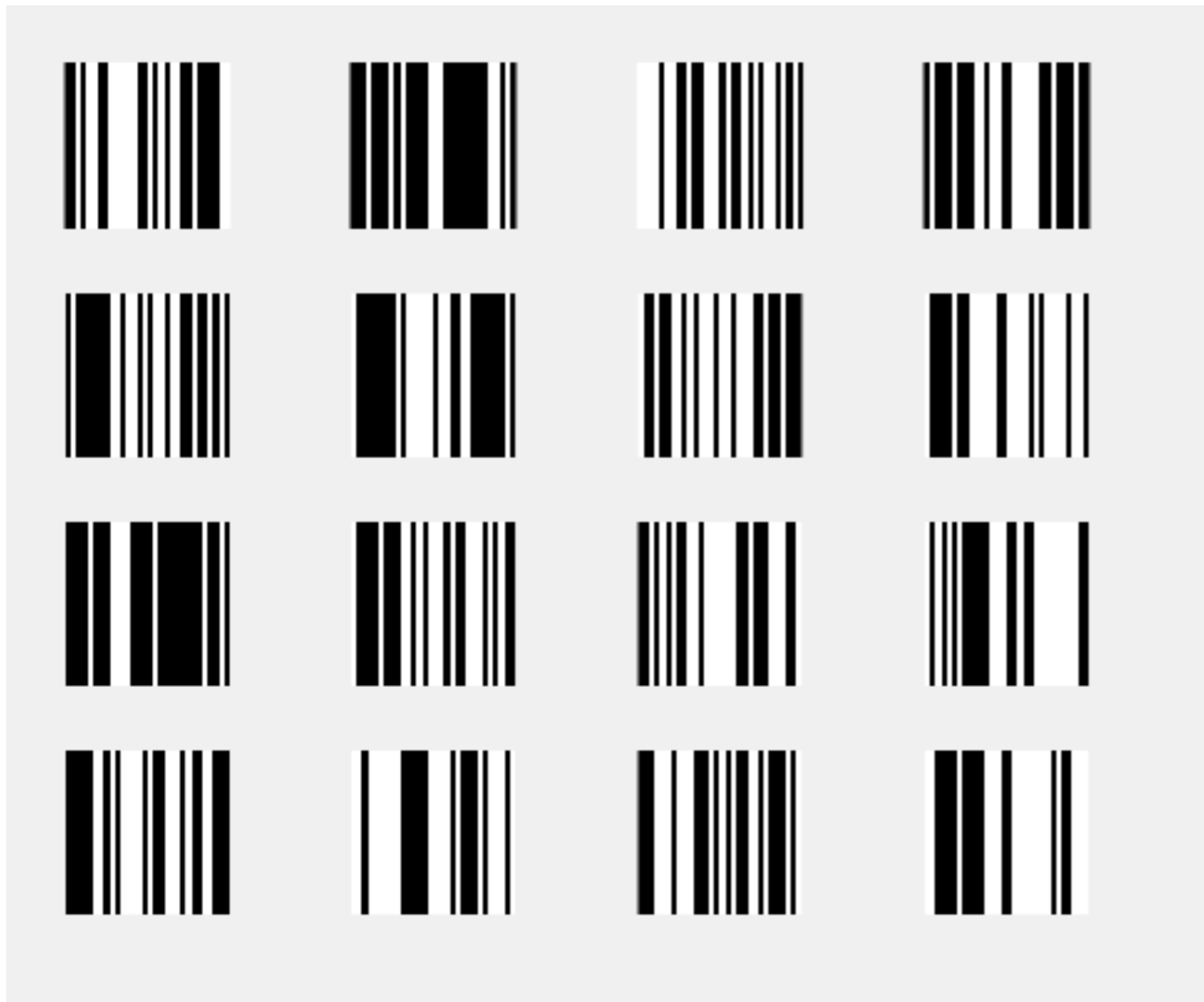
```
    end
```

```
- end
```

Search wild and mutant type sequence

```
%%  
clear dna  
letters=['a';'t';'g';'c']  
for i=1:20;  
    a=randi([1,2],1);  
  
    dna(i)=letters(a);  
end  
disp(dna)  
% mutant  
  
if dna(7:9)=='aaa'  
    disp('wild type sequence')  
else  
    disp('mutant type')  
end
```

Bar codes



```
x=zeros(30,30)
figure(10)
imshow(x,[])

%
k=1;
for k=1:16;
    for i=1:30;
        if rand()<0.5
            x(1:30,i)=1;
        else
            x(1:30,i)=0;
        end
    end
end
figure(2)
subplot(4,4,k)
imshow(x,[])
end
%%
```

For loop, if statement with and/or operator

```
%%  
% for loop and operator  
% | or  
% & and  
% ~ not  
a=1:100  
c=zeros(1,100);  
for x=1:100;  
    if a(x)<=81 & a(x)~=40  
        c(x)=a(x);  
    end  
end  
c
```

```
%%  
a=1:100  
c=zeros(1,100);  
for x=1:100;  
    if a(x)<=81 | a(x)>=92  
        c(x)=a(x);  
    end  
end  
c
```


If with break statement

```
%%  
for i=1:100;  
    disp(i)  
    if i==50;  
        break  
    end  
end  
end
```

```
194 %o %o  
195 % Break statement can be used to get out of loops  
196 % if some set of conditions has been satisfied.  
197 - y=50;  
198 - x=0;  
199 - for i=1:100;  
200 -     if i~=50; % not equal  
201 -         disp(x.^2);  
202 -         x=x+1  
203 -     else  
204 -         i  
205 -         break;  
206 -     end  
207 -  
208 - end  
209 - i  
210 - x  
211  
212
```

```
%% grading
```

```
examscores=randi([30,100],1,100)
```

```
% A B C D F
```

```
%|
```

```
for i=1:100;
```

```
    grade{i,2}=examscores(1,i)
```

```
    if examscores(1,i)>90
```

```
        grade{i,1}='A'
```

```
    else if examscores(1,i)>80
```

```
        grade{i,1}='B'
```

```
    else if examscores(1,i)>70
```

```
        grade{i,1}='C'
```

```
        else if examscores(1,i)>50
```

```
            grade{i,1}='D'
```

```
    else if examscores(1,i)<=50
```

```
        grade{i,1}='F'
```

```
    end
```

```
    end
```

```
end
```

```
end
```

```
end
```

```
end
```

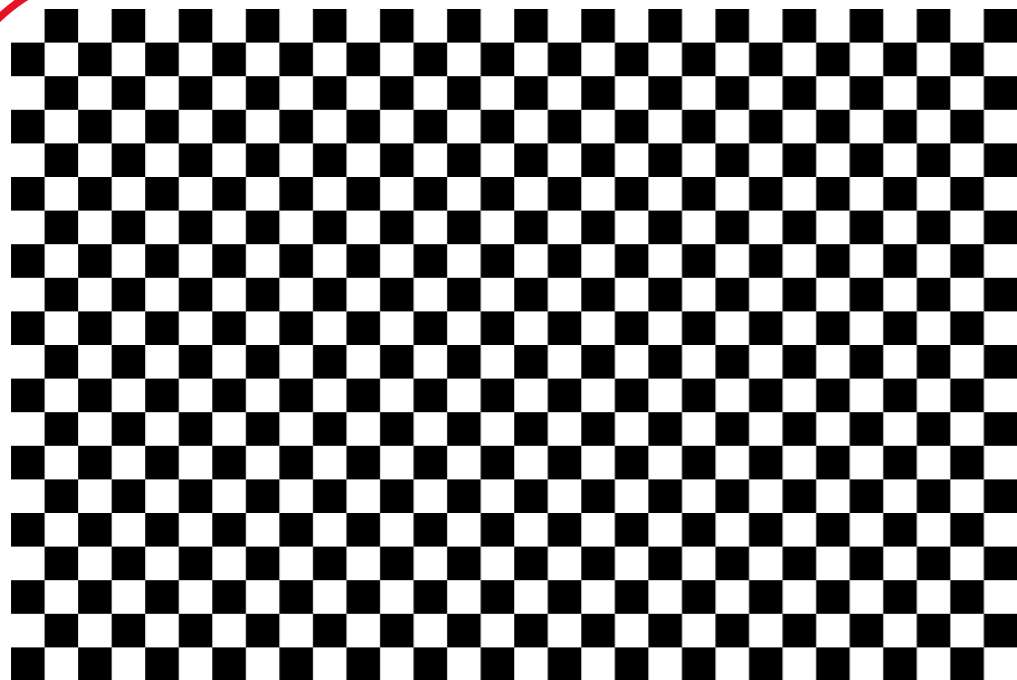
```
%%
```

For loops with if statements

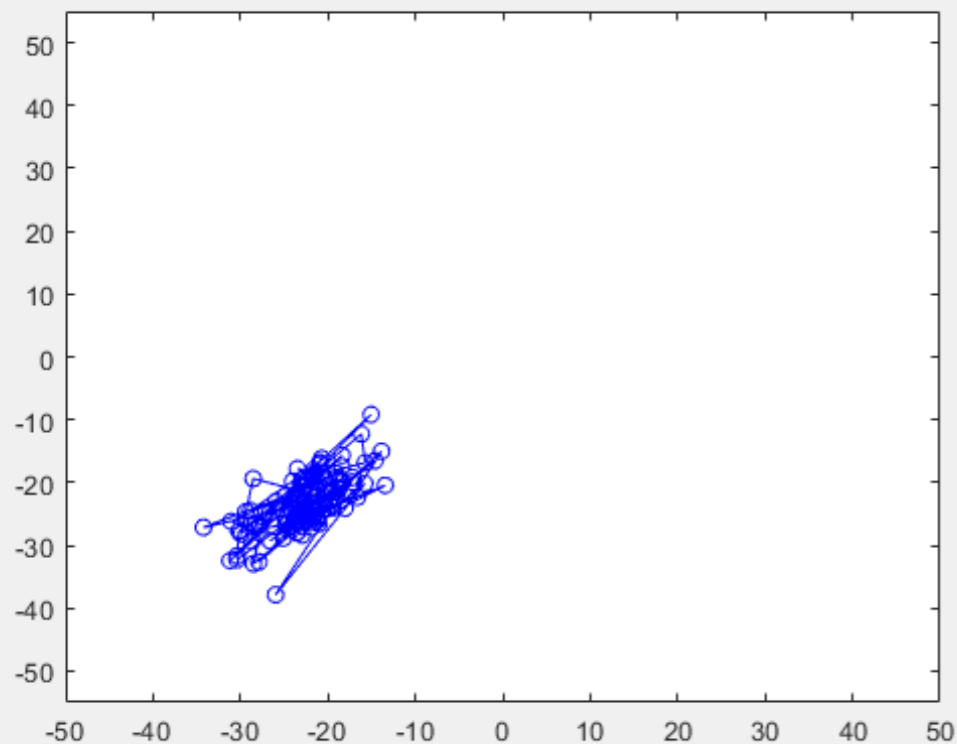
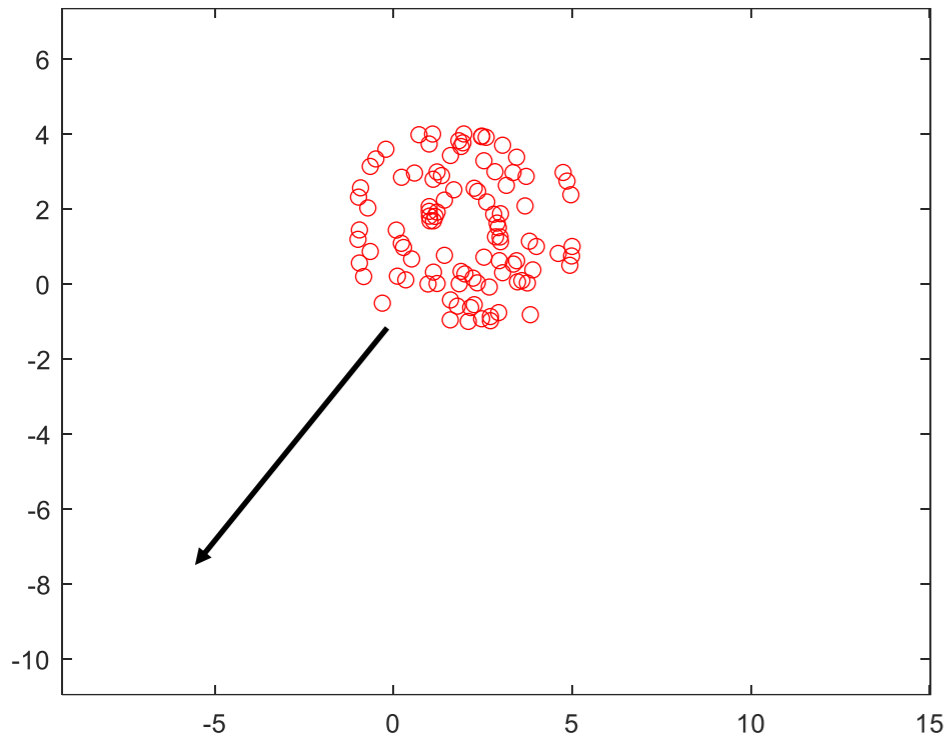


```
for k=1:30:  
    if mod(k,2)~=1; % if k is a odd number  
        ab(1:10,1+(10*(k-1)):10+(10*(k-1)))=0;  
        % black squares  
    else % if k is an even number  
        ab(1:10,1+(10*(k-1)):10+(10*(k-1)))=1;  
        % white squares  
    end
```

```
end  
figure(1)  
imshow(ab,[],'initialmagnification',600)
```



Crawling objects over the plane



```
xa
figure(3)
plot(xa,1*ya,'-ro')
axis([-50 50 -55 55])
pause(0.2)

for i=1:100
    for j=1:10
        xr(j)=randi([1+(10*(j-1)),10*j])
        xa(xr(j)) = xa(xr(j))-rand
        ya(xr(j)) = ya(xr(j))-rand
    end
end

figure(3)
plot(xa,1*ya,'-bo')
axis([-50 50 -55 55])
pause(0.005)

end
```

A genome sequence with for loop

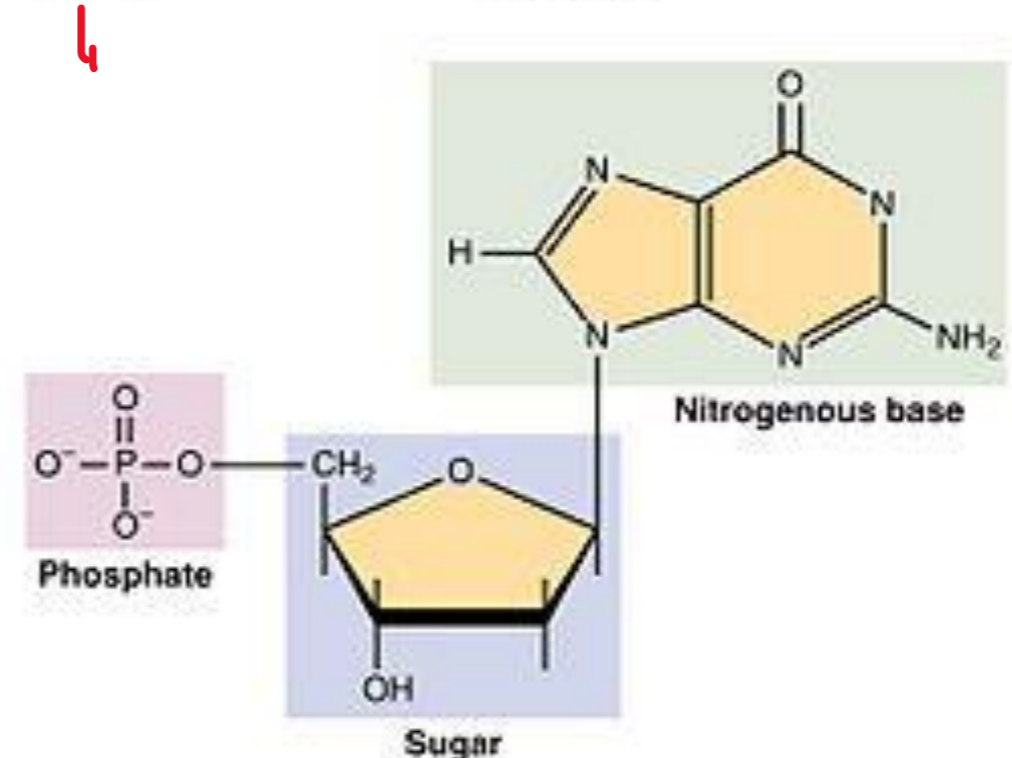
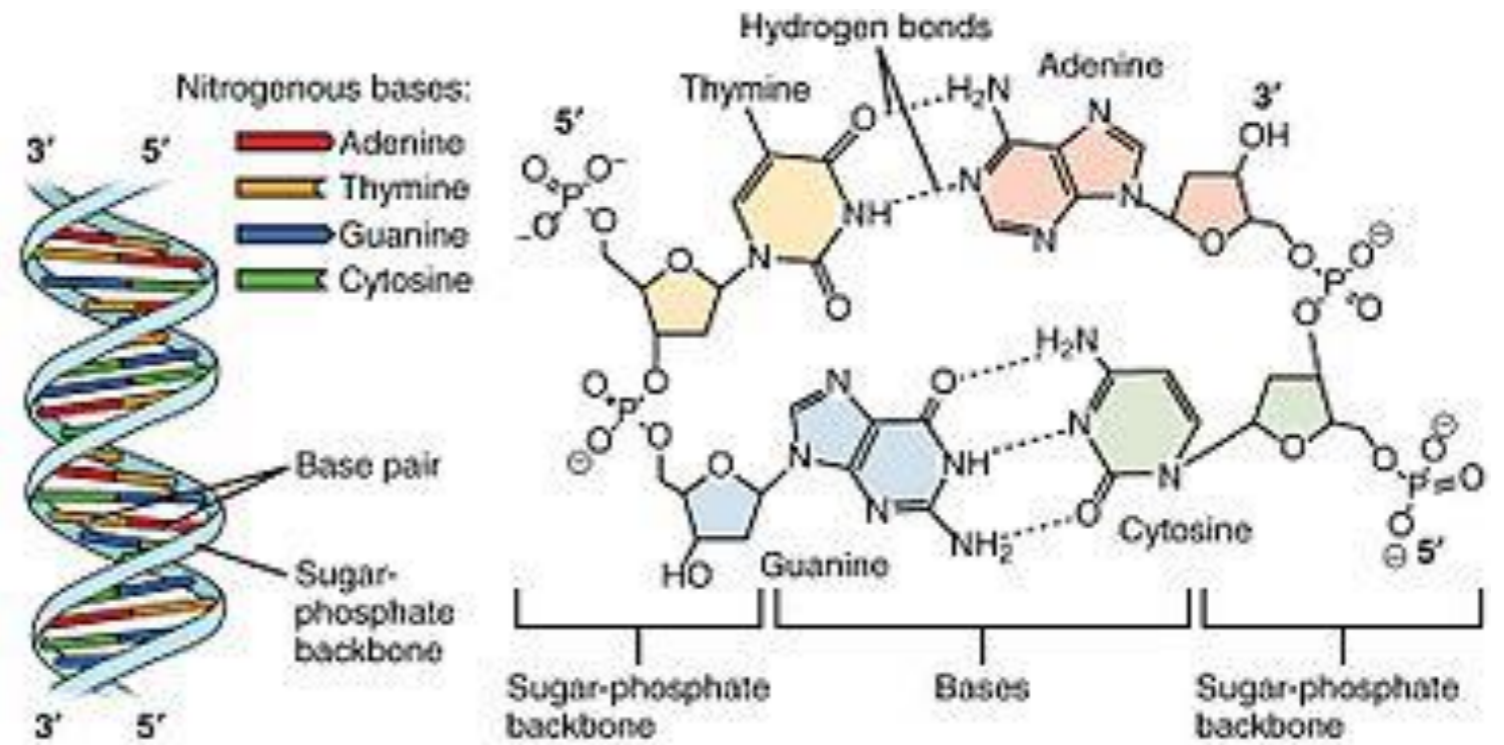
We need 4 letters

```
letters=['A';'T';'G';'C']
```

```
for i=1:10000;  
    a=randi([1,4],1);
```

```
    geneB(i)=letters(a);
```

```
end
```

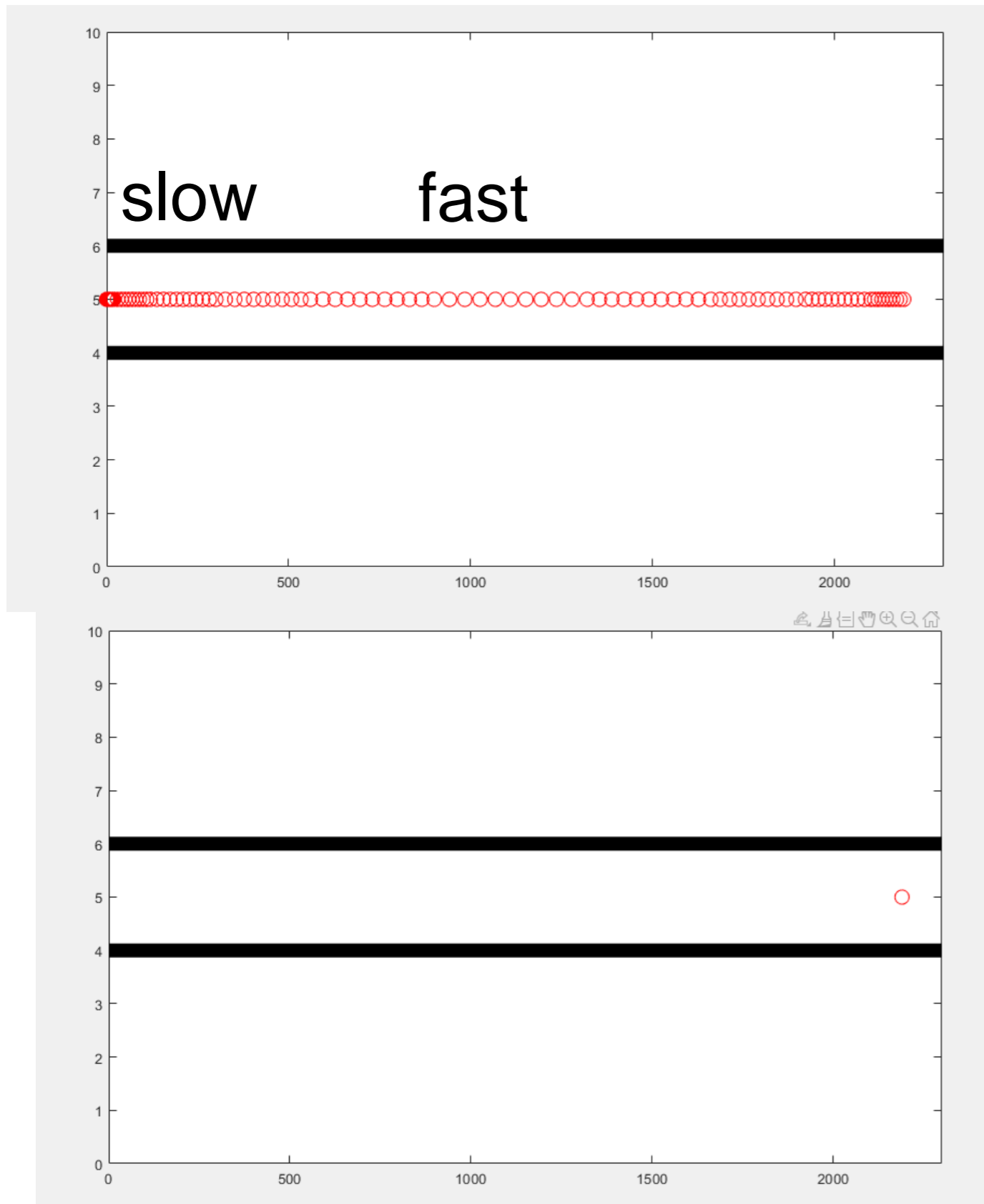


Finding a sequence in the gene

```
%%  
gene='tgacagtgatcagcatgtcagtta'  
count=0  
pos=[]  
k=1  
for i=1:3:22  
    if gene(1,i:i+2)=='cag'  
        count=count+1  
        pos(k,1)=i  
        k=k+1  
    end  
end  
%%
```



Linear movement model with matlab

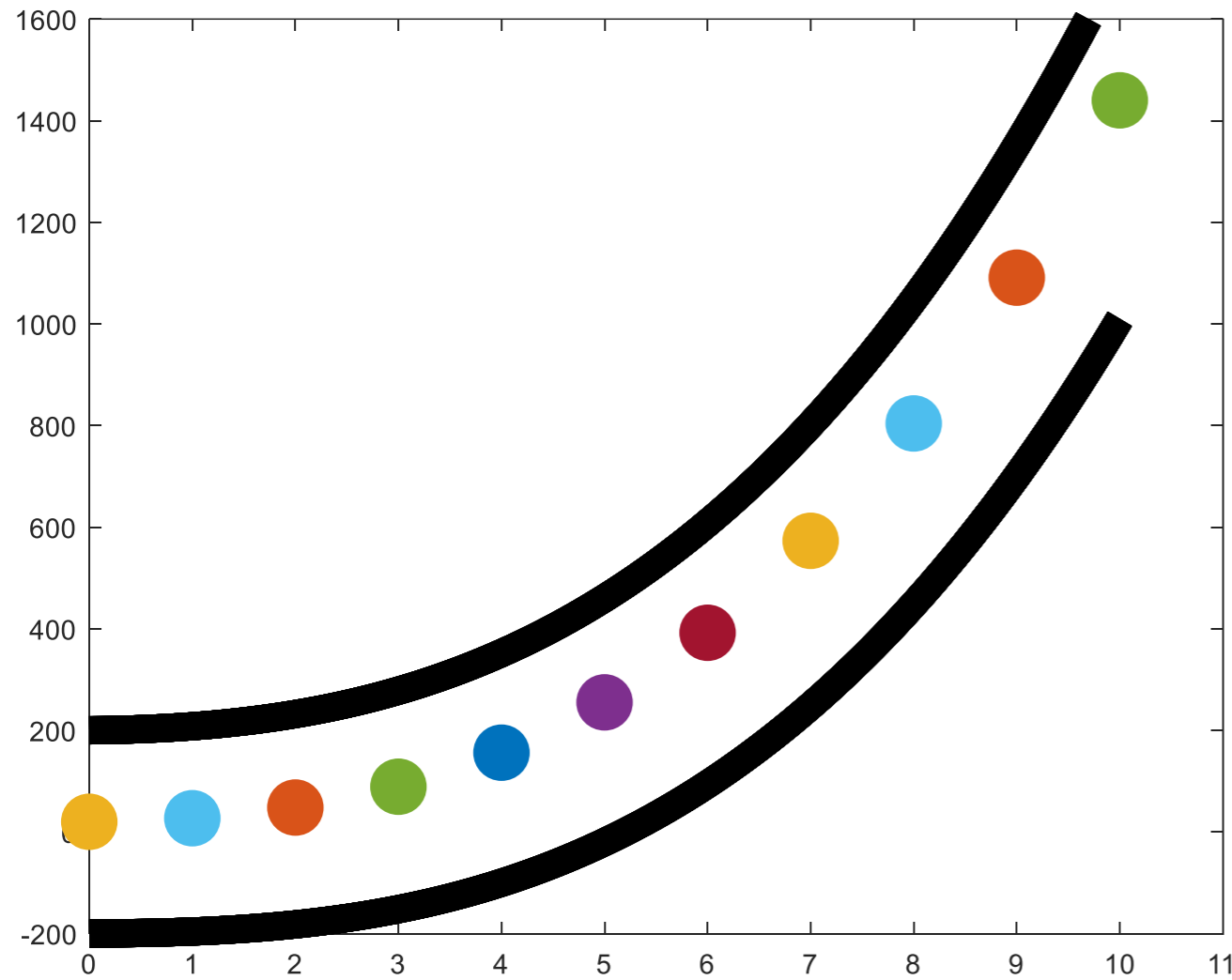


```
% movement model
clear x
t=2
k=2
x(1,1)=0
for j=1:10
for i=1:10
x(k,1)=x(k-1,1)+t % speed section
% increase with units of t
k=k+1
end
if j>5 % section where you increase speed
t=t-8
else % section where you increase speed
t=t+8
end
end
```

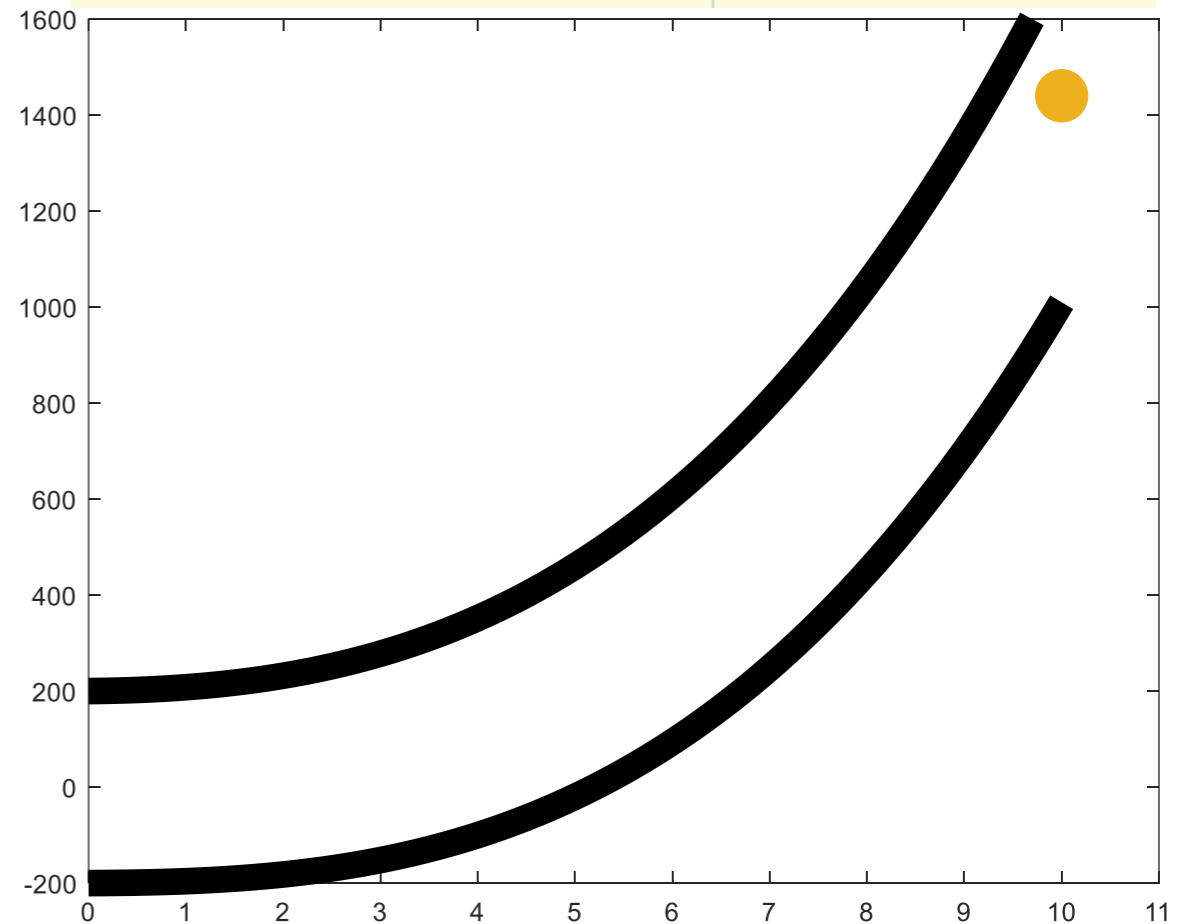
```
road=6+zeros(1,2300)
road1=4+zeros(1,2300)
figure(1)
for i=1:100
plot(x(i,1),5,'or','markersize',10)
hold off
```

```
figure(1)
for i=1:100
plot(x(i,1),5,'or','markersize',10)
hold on
axis([0 2300 0 10])
pause(0.05)
plot(1:2300,road,'-k','linewidth',10)
hold on
plot(1:2300,road1,'-k','linewidth',10)
hold on
axis([0 2300 0 10])
end
plot(x(i,1),5,'or','markersize',10)
```

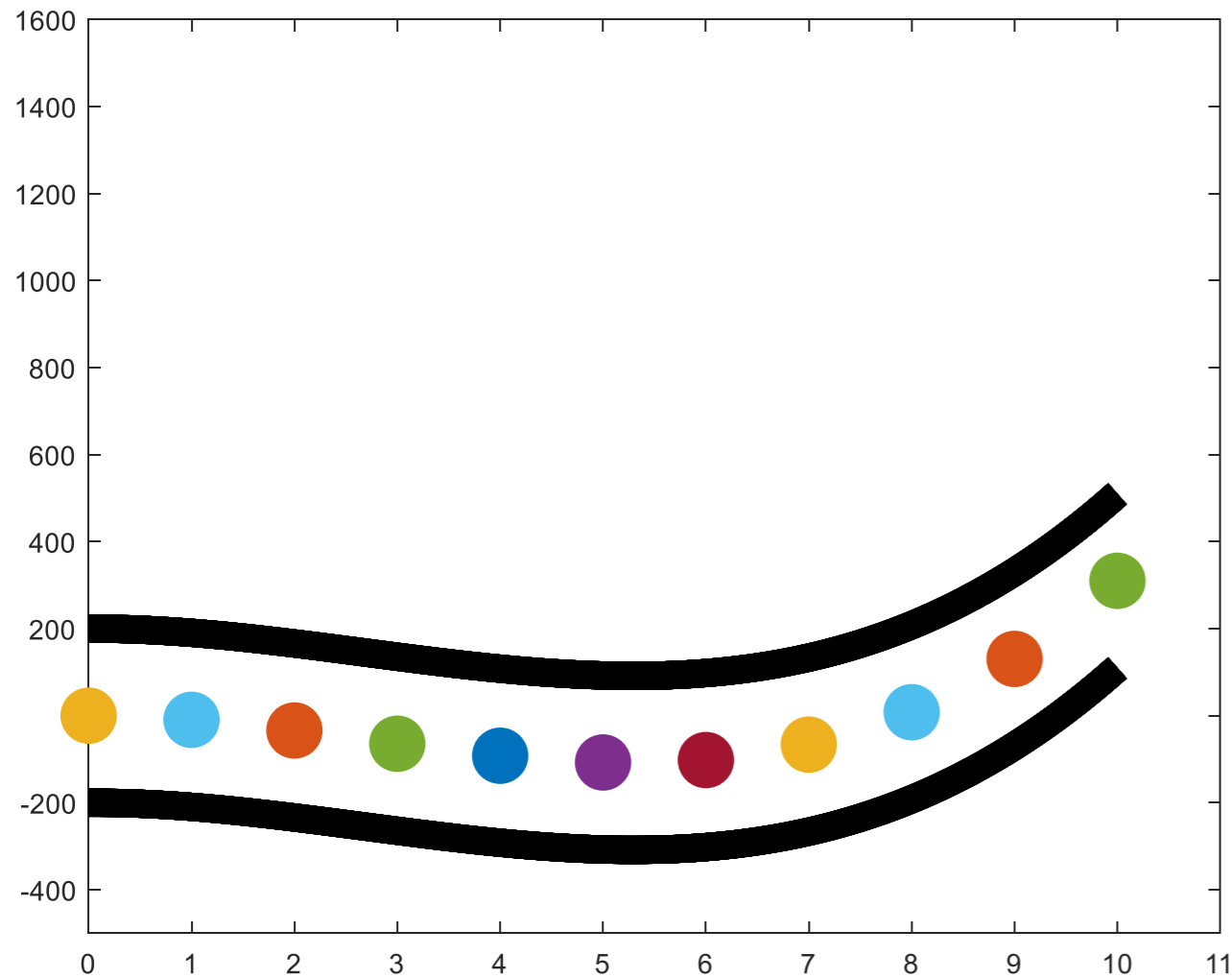
Nonlinear movement model with matlab: Polynomial function with high orders



```
%%  
% non linear model  
x=0:0.1:10  
  
y=x.^3+4*x.^2+2*x.^1+20  
y1=x.^3+5*x.^2+2*x.^1+200  
y2=x.^3+2*x.^2+1*x.^1-200  
figure(1)  
for i=1:10:101  
    plot(x,y1,'-k','markersize',10,'linewidth',10)  
    hold on  
    plot(x,y2,'-k','markersize',10,'linewidth',10)  
    hold on  
    plot(x(1,i),y(1,i),'o','markersize',10,'linewidth',10)  
    hold off  
    axis([ 0 11 -200 1600])  
  
    pause(0.01)  
  
end
```



Nonlinear movement model with matlab: Polynomial function with high orders

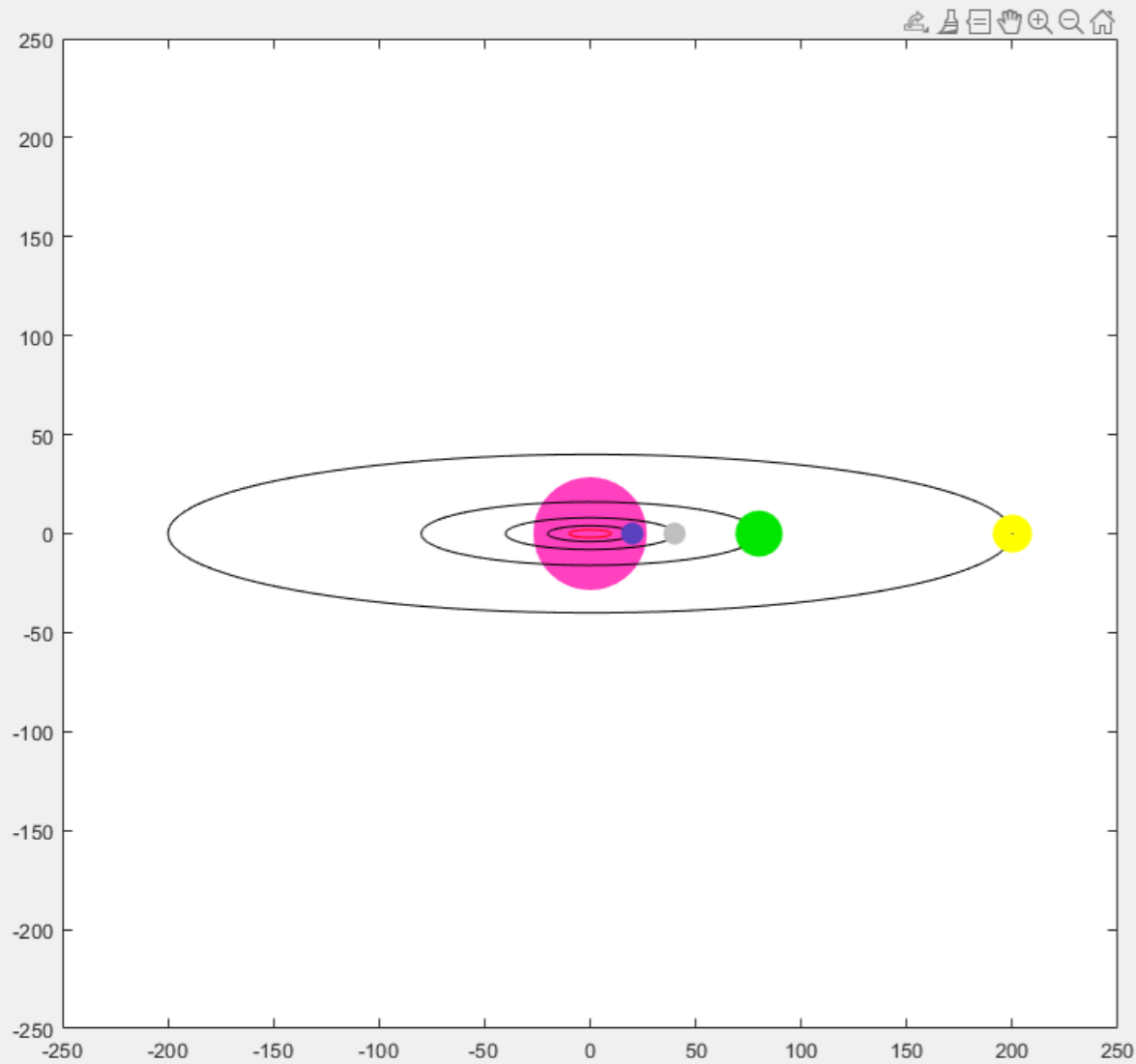


```
% non linear model
x=0:0.1:10

y=1.5*x.^3-12*x.^2+1*x.^1+0
y1=1.5*x.^3-12*x.^2+1*x.^1+200
y2=1.5*x.^3-12*x.^2+1*x.^1-200
figure(1)
for i=1:10:101
    plot(x,y1,'-k','markersize',10,'linewidth',10)
    hold on
    plot(x,y2,'-k','markersize',10,'linewidth',10)
    hold on
    plot(x(1,i),y(1,i),'o','markersize',10,'linewidth',10)
    hold on
    axis([ 0 11 -500 1600])

    pause(0.01)
end
```

Exercise: Planets rotating along the orbit



```
%%  
figure (1)  
for i=1:100  
    plot(a,b,'marker','.', 'MarkerSize',80,'Color',[1,0.25,0.75]) % sun  
    hold on  
    plot(k,l,'-r')  
    hold on  
    plot(k(1,i)+a,l(1,i)+b)  
    hold on  
    plot(2*k,2*l,'-k')  
    plot((2*k(1,101-i))+a,(2*l(1,101-i))+b,'marker','.', 'MarkerSize',30,'Color',[0.35,0.25,0.75])  
    hold on  
    plot(4*k,4*l,'-k')  
    plot((4*k(1,101-i))+a,(4*l(1,101-i))+b,'marker','.', 'MarkerSize',30,'Color',[0.75,0.75,0.75])  
    hold on  
    plot(8*k,8*l,'-k')  
    plot((8*k(1,101-i))+4*a,(8*l(1,101-i))+4*b,'marker','.', 'MarkerSize',50,'Color',[0.75,0.75,0.75])  
    axis([-150 150 -150 150])  
  
    hold on  
    plot(16*k,16*l,'-k')  
    plot((16*k(1,101-i))+5*a,(16*l(1,101-i))+5*b,'marker','.', 'MarkerSize',30,'Color',[1,0.75,0.75])  
    axis([-200 200 -200 200])  
end
```

Have a nice week.

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