

fMath152 at the University of Tennessee, Knoxville - Chat for March 28, 2016 with the course instructor, Louis Gross.

I will be online starting at about 8:30PM and will be happy to answer questions regarding any aspect of the course, assignments, etc. though for this evening I suspect that questions will be mostly about Chapter 23 and 24 and the latest Matlab Project. You can type in this document to ask questions.

When you ask a question, please do not use your name because this document will be saved and publicly posted after we close it. I will be on-line at least until 9:30PM but will stay on longer if there are still questions. Note that I do not know the identity of anyone posting questions - each participant shows up as "Anonymous" animal.

I am now online - Lou

I was wondering what is the point of the matlab projects. This is not a computer programming class, and the majority of the class barely made it through the last exam... Seems as if our time would be better used elsewhere, instead of trying to comprehend a program that many have never seen before and which we've received very little instruction. Especially considering it is such a significant portion of our grades.

Fascinating - you may recall that one of the specific objectives of this class is to help attendees become able to think quantitatively about the world, in this case through the lens of biology. Just about every area of the world is touched by computers and coding is the language in which we express our problems in computer language. Matlab is one of the standard tools of quantitative science, but more than Matlab specifically, the objective is assist you to think logically about a sequence of operations. I could also refer you to a host of reports (some are mentioned at the beginning of this course sequence) that encourage more computational thinking on the part of undergraduates in biology. This course is designed to be aligned with these reports that have been composed by the world's experts on the future of biology.

Hello! I hope you enjoyed your extra-long weekend. I am wondering if we need to print out any of the other graphs besides the 3D graph? Also, where do we get the 't' (z) factors for the final aspect of this project? Finally, when the 3D graph has been created, how do we interpret the different colors, for example is the dark the blue the closer to the actual area? Or is it vice-versa? Thanks so much!

Regarding the graphs, as I said in class, each of you should include at least one of the 3-d plots that you look at for the last part of the problem and describe what you learned from not just that plot but from also the various rotations that you did to the graph in 3-D. Regarding the other

questions I am not sure what you mean by the 't' z factors. You can calculate the optimal t values for each of the choices of M and c and these values are placed in the z matrix. So the z-value is the optimal t you found in the earlier sections for the various M and c values (remember I said not to include the c=0 case). So the z-matrix is 5 x 5 not 6 x 5.

Regarding colors, Matlab chooses an automated set of these (you can change them if you want by using various parameters for the Matlab function surface - use help in Matlab if you want to see these options). I am not sure what you mean by "actual area" - the colors are used in Matlab to assist in visualizing the 3-d surface - there isn't an "area" measure.

I was wondering, when I am doing the matlab project for question #6 when we have to create the OptimalForaging.m file, I am for some reason unable to complete creating the surface because MatLab is saying that I have an error in the value of property ZData and that the Array is the wrong shape or size. However my matrix I came up with for z is 6x5 (6 rows, 5 columns, with columns corresponding to M value and rows corresponding to c value) so I am not sure what i am doing wrong. Can you help me?

This may be because you are having values for the c=0 case that mess up the matrix. - try doing it first with a "dummy" matrix for z and see what it looks like - so create a matrix that is 5 x 5 and for example is just filled with 1 everywhere. Then do the surface call in the OptimalForaging.m code and see if you get a flat surface.

Hi, I have made my graph of the derivative function for the first parts of the project but am unsure on what to label the axes. Because of this, I am having trouble understanding the biological significance of my graph. Also, I am having trouble interpreting the 3D graph, it is difficult for me to interpret the values corresponding to certain points on the graph. Thank you

First, for the first parts of this, the graph is a graph of the derivative of foraging rate as a function of time in a patch (t), for any particular value of M and c. So this graph crosses the horizontal axis when the derivative = 0. The value of t where it crosses is the optimal value of t - this is assuming you have the graph correct and that it is indeed a maximum and not a minimum. Remember that a maximum occurs at a point if the function is increasing to the left of that point (derivative is positive) and decreasing to the right of the point (derivative is negative). Regarding the 3-D graph, this is showing how the optimal time to leave a patch depends upon the parameters M and c. So for a fixed c value, as you increase M you are increasing the time it takes to move between two patches. This decreases the food intake rate and one of objectives is for you to investigate how this affects the optimal time to leave a patch.

So I got to the point where you input the points in the matrix "z" and when I run the program, it says "Warning: Error creating or updating Surface
Error in value of property ZData Array is wrong shape or size" even though I removed the c=0
*** Update: I tried doing the "dummy" matrix and I'm still receiving the same error message.

OK - I have a guess here but just to check - you have the vectors M and C given as in the Optimal Foraging.m code except that c doesn't have the zero in it. Now does your matrix z show up on the window on the right as having 5 rows and 5 columns? If not then I suspect you have not entered the matrix z correctly

Do you mean the workspace or the command window? Oh it's 5x5 in both windows

OK so the matrix z is showing as 5 x 5 and the M is showing as having 5 entries and c as having 5 entries and then you type `surface(c,M,z)` and still get an error?

Yes, and the M values and the c values are what I used to get the numbers in my z matrix.

What happens if you just type `surface(z)`

OKay it didn't work at first but a graph just showed up, but I'm not sure if it's the right one.

It will not be the correct one because you need to identify the values on the axis for the surface graph to give the correct answer - I was just concerned that the surface function was not installed on your Matlab implementation - since you see a graph, it is installed. What happens now if you type `surface(c,M,z)`

The error sign showed up again and a graph does not show up.

Hi, I am working on the project right now and I cannot figure out how to find the zeros on Matlab. I have tried multiple times to play with the codes but it seems like it is always an error somewhere. And now that I went to eat and came back to my computer, I tried to click run to remake the graph so i could add labels and now it is not working. So I never got to find the critical point with my graph.

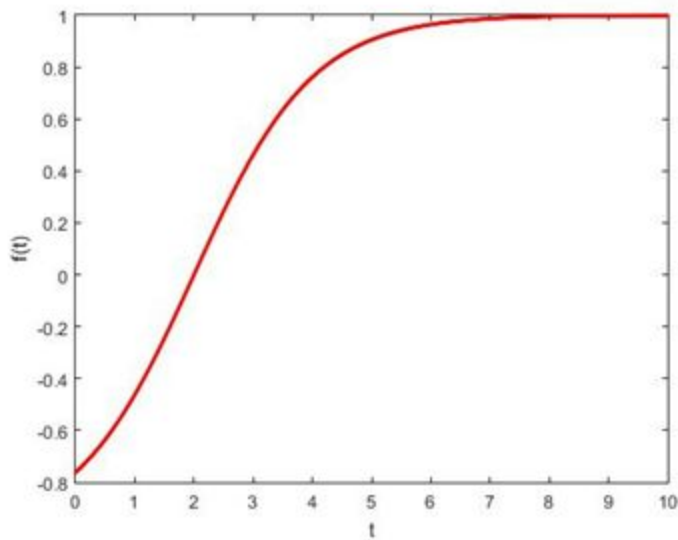
OK - first, when you look at the graph does it give you a function that starts above zero and then crosses zero somewhere? That is what the derivative should do for the first case in part 2 of the project

No, my graph started at zero and now I can't make another one because something happened to my code

I'm not sure I know what you mean by something happened to your code. You can always restart Matlab to get a clean workspace and start again. I presume you have saved your work of course - always save your work in a separate file.

I don't know what happened, it was working fine then I came back to my computer and now it wont run anything and keeps saying that there is an error. Is that graph right?

If you mean the graph below - it is not a graph of the derivative for this project - I am not sure but it looks like you are plotting the feeding rate normalized in some way - if so, the optimal time is where the slope of this is a maximum (the t value that gives the highest feeding rate)



Hello, so I've been having trouble with the first part of the matlab project. I cannot code for the derivative of the function, it keeps telling me that I have errors and therefore I cannot produce any graphs at all. I was wondering if you could help with finding the derivative or what equation are we required to use specifically?

To find the derivative ignore the K in equation 20.7, use the quotient rule and then define this as your function - fix a particular value of c and M and graph it as a function of t. For the first case in the project (in part 2 of the project with M=10 and c =4 you should get a graph that starts above zero and crosses zero and then stays below zero. The place where it crosses zero is the optimal time to leave the patch for those values of M and c.

I am stuck on #4, I know I have to use for loops but I'm not sure what to type. Could you please explain?

You want a loop that has

0

for i = 1:5

For j = 1:5

m1=M[i];

c1=c[j];

tt=fzero(yourfunction, 1)

Save the tt value

```
end  
End
```

In the above your function is the derivative function in which you have placed m1 in for M value and c1 in for the c value. Note that the above is only one way to use the for loops - it is assigning i and j to be the indexes of the values in the M and c vectors.

When I am looking at my graphs in numbers 2 and 4, the code you provided to find where the function is equal to zero doesn't line up with where my graphs are crossing. (`tt=fzero(func,1.5)`). Could you explain this? For example -not actual data- if my graph looked as if it crossed the X axis at .88, I thought I would use this as a critical point. But when I use the code `tt=fzero(func,1.5)` I get .088 or something of the sorts. If I am looking at the wrong part of the graph to find the local max, just let me know that instead. Basically the graph isn't lining up with the tt values I get. Thanks!

I'm not sure what is wrong - the `fzero` function should show where the function crosses the axis and it should look like this in the graph. I suggest trying a simple function and seeing what happens there

Here's an example

```
fun1=@(t) t^2-10  
fzero(fun1,1)  
fplot(fun1,[0,8])
```

If you try that you should see that the value where it crosses zero is the same as the `fzero` value.

Using red to try and get your attention back to this above, to be more specific, when $M=10$, the `tt` value comes to .0xxx, but when I use $M=1$ my value moves from .0xxx to .xxx without the 0.

Ok - not sure what the c value is but assuming it is one of the values in the project .

OK - so I will give you the answer for the $c=4$, $M=10$ case - it should be $t = .9506$

If you are not getting this for the value, there is something not working correctly in your code.

I am still using $c=4$ as in number 2. I've collaborated with multiple people over text and everyone is getting $M=10$ to have the value of .0xxx and is not lining up with the graph. Thanks for the

answer. Doesn't really help with the rest of the project if I can't figure out what's wrong in my code. And it's more than just my code

OK - let's go through this step by step

First you need to define the function - the easiest way to do this is using just what I put in the sample code

Myfunction = @(t,c,m) In here you put the derivative formula

Then set the m and c values

```
m=10.;;  
c =4.;
```

Then set up the function to graph as a function of t

```
funct=@(t) Myfunction(t,c,m)
```

Then plot it over some range - I'll use 0 to 10

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

And compare this with the root obtained from

```
fzero(funct,1.5)
```

And this value should be the value where the graph crosses the x- axis.Thi

So the only thing I could have messed up on here is my derivative formula. Can you do a step by step on that? After that I understand the rest of the project.

Does anyone know how to get the surface graph to work?

^RT

The derivative is derivative of $(1 - \exp(-c*t))/(t+m)$

So this is the quotient rule you apply - this is in the text on page 360 Note that m and c are constants - you are just treating the t in this equation like the x in the formula for the quotient rule. Note that I have not included the K - it is a constant.

Then when you take the derivative you place this in the formula above

Thank you, I'll do what I can.

Is there a specific section within the textbook where we can reference how to insert matrices or other commands?

Section 7.3 has basic matrix skills

So im kind of freaking out about this project. I feel comfortable on how to do all the math in this chapter, but when it comes to using Matlab i am completely lost. I cant even figure out graphing on matlab.

So I suggest that you collaborate with someone who has a better graph of Matlab than you do then. I gave a reasonably easy way to do the graphs in the small help file I put on The website. - all you really need to do with that file for the first parts of the project is replace the function I put in as myfunction in this code with the derivative you calculate and make sure you replace the a and b in that dummy code with the M and the c values from the project.

Earlier I asked about why when I am answering number 6 that the surface function wasnt working so you told me to create a 5x5 dummy matrix with all 1s and for some reason it is still not working.

```
>> M = [1 5 10 15 20]; c = [0, 2, 4, 6, 8, 10]; z = [1 1 1 1 1; 1 1 1 1 1; 1 1 1 1 1; 1 1 1 1 1; 1 1 1 1 1]
z =
     1     1     1     1     1
     1     1     1     1     1
     1     1     1     1     1
     1     1     1     1     1
     1     1     1     1     1

>> ssurface(c,M,z); xlabel('c'); ylabel('M')
Undefined function or variable 'ssurface'.

>> surface(c,M,z); xlabel('c'); ylabel('M')
Warning: Error creating or updating Surface
Error in value of property ZData
Array is wrong shape or size
```

It is not working because you have a matrix c which includes 0 so Matlab thinks that c is length 6 but the z matrix is 5 x 5. So just remove the 0 from the c vector.

Hi, looking at my graphs they are all decreasing from left to right, this makes sense because the food supply within a patch is decreasing, I'm pretty sure my formula is correct. Looking at the critical points, they are minimums, not maximums. So what could I be doing wrong?

I don't see the problem - assuming you are graphing the derivatives and the graph decreases as you go from left to right and the graph crosses zero, this means the value where it crosses zero is the maximum because the function graphed is the derivative.

Okay, is that how I would explain that I know there is a maximum there? Because the graph is of the derivative?

Yes the graph is the derivative - that is what you are graphing (I hope).

Alright, thank you very much!

Do I have #4 setup correctly?

```
myfunction=@(t,m,c) (c*exp(-c*t)*(t+m))-(1-exp(-c*t));
```

```
m = [1 5 10 15 20];
```

```
c = [2 4 6 8 10];
```

```
for i = 1:5
```

```
    for j = 1:5
```

```
        m = m(i);
```

```
        c = c(j);
```

```
        tt = fzero(myfunction,1)
```

```
    end
```

```
end
```

This project was assigned several weeks ago - it is still due tomorrow.

In the above there are some errors because you are setting m = to one of the entries in m - this will mess up Matlab

Try

```
M = [1 5 10 15 20];
```

```
C = [2 4 6 8 10];
```

```
for i = 1:5
```

```
    for j = 1:5
```

```
        m = M(i);
```

```
        c = C(j);
```

```
        tt = fzero(myfunction,1)
```



```
% In here you need to save the tt value as something for the i and j value
% for example setting z(i,j)=tt
    end
end
```

It's saying that there are not enough input arguments.

Right - I see why it gives you that now - it is because Matlab doesn't realize that you want to treat myfunction just as a function of t - so as I did in the example above you need to define a function of just t within the loop

```
for i = 1:5
    for j = 1:5
        m = M(i);
        c = C(j);
        funct=@(t) myfunction(t,c,m)
        tt = fzero(funct,1)
    % In here you need to save the tt value as something for the i and j value
    % for example setting z(i,j)=tt
        end
    end
```

It works now, thanks so much!

OK - I've essentially done the project now (or at least most of it) above. I'm signing off. - Lou

Thank you!!