MATH 5485 – Introduction to Numerical Methods I

Fall 2013

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Lab Project: Bridge Construction

Additional Notes

1 Color Plots in Matlab (for Task 5)

To start with, this is how one can plot a red line in Matlab

```
>> plot([0,1],[0,1],'Color',[1,0,0]);
```

The color of the line is given by three numbers, each number between 0 and 1, that give the red, green, and blue component.

Let us first generate randomly a bunch of line coordinates and plot them:

```
x = rand(2,10)

x =

  Columns 1 through 7

    0.5308    0.9340    0.5688    0.0119    0.1622    0.3112    0.1656
    0.7792    0.1299    0.4694    0.3371    0.7943    0.5285    0.6020

  Columns 8 through 10

    0.2630    0.6892    0.4505
    0.6541    0.7482    0.0838

>> y = rand(2,10);
>> plot(x,y)
```

Now make the task harder: we randomly generate their "elongations" that will be color-coded (small are blue and large are red).

```
>> e = abs(randn(1,10))

e =

  Columns 1 through 7

    2.0518    0.3538    0.8236    1.5771    0.5080    0.2820    0.0335

  Columns 8 through 10

    1.3337    1.1275    0.3502
```

Our next task is generate the actual colors based on `e`. This is done by the following function:

```
>> cmap = colormap;
```

The variable cmap now contains, usually, 64 (but sometimes less or more) triples of numbers.

Next, we do an actual by running the following script:

```
hold on;
for i=1:10
    plot(x(:,i), y(:,i), 'Color', ...
    cmap(round(e(i)/max(e)*(size(cmap,1)-1)+1),:));
end
set(gca, 'CLim', [0 max(e)]); colorbar;
hold off;
```

Notes:

- Here "..." means that the command is carried over to the next line.

- `round(e(i)/max(e)*(size(cmap,1)-1)+1)` is the formula that maps a number `e(i)` from a range $[0, \max(e)]$ to the range of integer numbers from 1 to `size(cmap,1)` (that is, it is the number of different color triples in `cmap`).

- `set(gca, 'CLim', [0 max(e)]);` sets the limits for the colorbar (from 0 to `max(e)`)

- `colorbar;` Actually adds the color bar to the graph

You should get something like this:
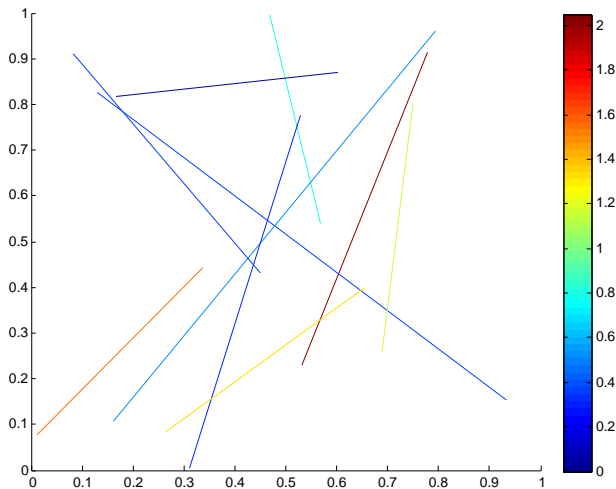
2 Adding Text Labels to Graphs (for Task 7)

You may want to add labels of nodes of your bridge to better see what trusses to enforce. This can be done by using `text`:

```
>> x = rand(1,10);
>> y = rand(1,10);
>> for i=1:10
text(x(i), y(i), int2str(i));
end;
```

Here `int2str(i)` generates a string from an integer `i` and `text` places the string at the given coordinates on the graph.

3 Submission of the Project

The project should be submitted using *Google Drive* (former *Google Docs*) through your UMN account. For that,

(1) Name the files by your student number (i.e., UMN ID). For instance: `9876543.pdf`, `9876543.nodes`, `9876543.trusses`. (You can also rename the files after uploading.)

(2) log in to `http://docs.umn.edu/`,

(3) upload your files (ideally, in the PDF format for your report and `.nodes` and `.trusses` format for your bridge), and

(4) share it with my UMN account (`ashapeev@umn.edu`). Please do not send me an email notification upon sharing the files (this will save me from about a 100 emails in my mailbox).