P318 Computational Modeling
Spring 2014
Week 10 Homework
Due March 24th

This homework assignment will ask you to explore the diffusion model, examining its predictions of response times and accuracy. I want you to explore predictions of the diffusion model across a range of parameters. You will want to look at the example code and slides I used in class today as your starting point. I want you to see how different parameters effect the response time distributions predicted by the diffusion model.

For each of these problems, I am going to ask you to compare predictions when varying particular parameters. For each set of parameters, I want you to run 5000 iterations of the diffusion model. Note that this could take a couple minutes per run, depending on the speed of your computer.

When you create any graphs, please put all of the predictions on the same graph so that you can see how the predictions change with the changing parameters (pointer: "hold on" can be a useful function to call when graphing when you want multiple plots on the same graph). You may be asked to plot cdfs, pdfs, mean RTs, and/or accuracy. Make sure your code properly labels your graphs.

a) First, I want you to explore correct RTs and error RTs. In class today, I really only looked at response time distributions when you hit the "a" boundary. These are correct responses. But I want you to compare RT distributions for correct ("a" boundary) and error ("0" boundary) responses.

First, try these parameters:

```
a   = 0.200;      % upper boundary (lower boundary is 0)
z   = 0.100;      % starting point
sz  = 0.0;        % variability in starting point from trial to trial
nu  = 0.10;       % mean drift rate
eta = 0.0;        % variability in drift rate from trial to trial
Ter = 0.200;      % non-decisional time
st  = 0.0;        % variability in TR from trial to trial
s2  = .01;        % diffusion coefficient is amount of within-trial noise
```

Plot the predicted cdfs for correct RTs and error RTs on the same graph.

b) Next, try these parameters:

```
a   = 0.200;        % upper boundary (lower boundary is 0)
z   = 0.100;        % starting point
sz  = 0.0;          % variability in starting point from trial to trial
nu  = 0.10;         % mean drift rate
eta = 0.20;         % variability in drift rate from trial to trial
Ter = 0.200;        % non-decisional time
st  = 0.0;          % variability in TR from trial to trial
s2  = .01;          % diffusion coefficient is amount of within-trial noise
```

Plot the predicted cdfs for correct RTs and error RTs on a new graph.

c) Finally, try these parameters:

```
a   = 0.200;        % upper boundary (lower boundary is 0)
z   = 0.100;        % starting point
sz  = 0.09;         % variability in starting point from trial to trial
nu  = 0.10;         % mean drift rate
eta = 0.0;          % variability in drift rate from trial to trial
Ter = 0.200;        % non-decisional time
st  = 0.0;          % variability in TR from trial to trial
s2  = .01;          % diffusion coefficient is amount of within-trial noise
```

Plot the predicted cdfs for correct RTs and error RTs on a new graph.

Do you think parameter variability is important? Why? What happens to the predictions of the diffusion model when there is no parameter variability, in particular, what is the relationship between correct and error RTs?

You can check out the Ratcliff and Rouder (1998) paper for a discussion of the impact parameter variability has on correct and error response time predictions.

d) Now, I want you to explore changes in some parameters on the shape of the probability density function (pdf). You only need to examine correct RTs in this case because for the parameters you are going to use, there are very few predicted errors. For these examples, you only need to run 500 iterations per parameter set.

Use these parameters:

```
a   = 0.400;        % upper boundary (lower boundary is 0)
z   = 0.200;        % starting point
sz  = 0.05;         % variability in starting point from trial to trial
eta = 0.200;        % variability in drift rate from trial to trial
Ter = 0.200;        % non-decisional time
st  = 0.05;         % variability in TR from trial to trial
s2  = .01;          % diffusion coefficient is amount of within-trial noise
```

Find the pdf for nu=.2, nu=.3, and nu=.5. Plot all three pdfs (kernel density estimates) on the same graph.

e) Now I want you to explore the effects of the location of the decision boundaries on mean response time and accuracy.

Start with these parameters:

```
sz  = 0.01;        % variability in starting point from trial to trial
nu  = 0.10;        % mean drift rate
eta = 0.0;         % variability in drift rate from trial to trial
Ter = 0.200;       % non-decisional time
st  = 0.0;         % variability in TR from trial to trial
s2  = .01;         % diffusion coefficient is amount of within-trial noise
```

Evaluate mean correct response time and accuracy for the following values of a and z. Note that z equals ½a in all these cases. You can think of this as manipulating the speed-accuracy tradeoffs that subjects are making. In the case of a=.050 and z=.025, the person is going as fast as possible. In the case of a=.800 and z=.400, the person is stressing accuracy over speed.

a	z
.050	.025
.100	.050
.200	.100
.400	.200
.800	.400

Plot mean correct response time and accuracy as a function of the boundary size a.