Student name: ***Enter your name here***

Homework 5: Diffusion Limited Aggregation

Part I: This HW is an extension of the diffusion limited aggregation simulations from the computer lab. In part III of the lab, you should have realized that lowering the sticking probability *p* was not quite enough to fill all the wholes in the emerging structure. We can fix that by increasing the chance that the particle sticks where it has not only *one, but two or more neighbors*.

To do so we must first *count* the number of neighbors. *Before* the line

```
if (A(xR,y) > 0 || A(xL,y) > 0 || A(x,yU) > 0 || A(x,yD) > 0)
```

enter the line

```
n=0;
```

and then start counting the number of filled neighboring sites. This could be accomplished with four *if* statements. At the end, *n* should be increased so that it contains the number of filled neighbors site for current A(x,y) location.

Let us fix the parameter p at 0.01 for the moment. Modify your code so that the particle sticks

- with probability p if there is n=1 neighbor,
- with probability 10*p if there are n=2 neighbors,
- with probability 20*p if there are n=3 neighbors,
- with probability 30*p if there are n=4 neighbors.

With this new sticking rule, run this code for different values of *p*. Find 4 values for which the resulting images look reasonably distinct from each other. For those four *p* values, generate images with at least 20000 particles each. *Enter those images here and specify your p values*. Submit your code along with this HW.

Part II: Lets us back to our original code with a sticking probability of 100% and introduce *chemical reactions* in a very simple form. Let us assume a particle has arrived at a site with one or more neighbors. With probability q=20% the particle will now react with all neighbors or one neighbor chosen at random. You decide. In case of such a reaction, both the diffusing particle and the neighboring particle(s) simply disappear from the system. If they do not react the diffusing particle will stick as before in our original code. (One caveat: Please prevent particles in the y=1 line from reacting.)

Before writing code, answer in words:
a) To make the neighboring particle disappear, I do: _______________
b) To make the diffusing particle disappear, I do: _______________
(You way want to check your answers with out GSI before starting to write code.)

Increase the reaction probability q in steps of 5% and run your new code. At some critical value of q, something drastic will happen. *Explain what you see and explain why it occurs.*

Choose a q slightly below the critical value, *submit a nice, high-resolution image* that looks different from standard simulations with q=0%. *Please submit your code for parts I and II.*