Assignment 2 project report

For this programme, the aim was to create code that could map biological fallout from a bomb detonated on top of a building. To do this, 5000 individual ‘particles’ were moved on a 300x300 raster grid using parameters to replicate wind movement and the gradual descent of particles due to gravity. The final representation showed a heat map of where the individual particles had hit the ground.

The first step in creating this model was to create the environment by reading in the raster coordinates from the raster.txt file. Every coordinate had a value of 0 apart from the (50,150) cell which had a value of 30 and represented the original location of the bomb. Once the environment had been created, the agents (bomb particles) were created and all 5000 were set to the location of the bomb. At this point the bomb, the environment and the particles were all in place to be moved.

To create the movement of the particles a second python file, agentframework.py, was created so the function did not need to be written out in full on the main file. The ‘move’ function set out the directions of movement and, using the random module, the chances of each particle moving in each direction. Variables were set up at the top of the page to represent the chances of movement in each direction so that a user could change the wind and descent patterns at their own discretion without needing to rewrite any code. A second function, land, was created to add 1 to each raster cell when the z value (altitude) for each particle was at 0. The two functions, move and land, were added to the main run in the main file. To prevent movement once each particle had reached the ground the argument; while agent[i].z > 0:, was used for all the agents. The ‘environment’ was printed in the console to be viewed by the user. To create the heatmap the matplotlib.pyplot module was used and the environment was represented as a plot. Finally, an empty .txt file (Results.txt) in the repository was used to write the results of each run as it happened. The results are rewritten after every run but with a small modification the results of each run could be saved in the file.

The process of writing this code took place in the order written above. Before starting any new section of code the previous section would have to be completed. For example, the agents were not created until the environment was working. The initial finished code had fewer features and many of the variables were defined as they were needed rather than by name at the top of the page. For instance, in the move function, the chances of movement in each direction were defined at each line they were needed. If left like this, the model would be very difficult to alter and each parameter would have to be found individually. Instead, the starting position of the bomb, wind direction and descent rate can all be dictated easily by the user. The final code is simple and should be user friendly.

There were relatively few issues when writing the code. However, some issues occurred when trying to plot the heatmap. Initially points representing the landing location of each particle were plotted and the use of other modules were attempted to convert these points into a heatmap. However, once the realisation that the ‘land’ function could be used to alter the environment was made, plotting the environment instead of the points became a much more obvious solution. At first when this was achieved the heatmap was very faint making it difficult to see the patterns. This was because the initial value given to the bomb location was 255 which was much higher than the cells where particles were landing. To fix this the value of this cell was changed to 30 in the original raster.txt file. Once this was done the final heatmap was far clearer and the patterns could be viewed more easily.

The only other small issue was in converting the final environment values into a text file. Initial attempts were made in a way suitable for strings but not for lists. However, this was fixed with online searches and some trial and error. The decision to save only the recent run was made due to the length of the raster list. However, in the line: “with open('Results.txt','w') as f:” (line 65), changing the w to an a would mean for each run the environment would be saved one after the other.

Sources of information used to help complete this model were predominantly stackoverflow and some introductory pages on using certain aspects of python, for example GeeksforGeeks was used to help write a list rather than a string into the Results.txt file. These websites were useful for troubleshooting and helped to understand newer ideas which had not previously been seen.

This model set out to map bomb particles after an explosion. The final code is simple and, with the ability to change parameters easily, is highly usable. There are not many alterations that would be made to it to improve the current code.