1a. Particle 1: v(i;d) = w\*v(i;d) + r1\*(x\*(i;d) – x(i;d)) + 0.5 \* (x(d) – x(i;d))= 2 \* (2,2) + 0.5\*((5,5 – 5,5)) + 0.5\*((5,5) – (5,5)) = (4,4)

Thus, particle 1’s new position is (9,9).

Particle 2: v(i;d) = w\*v(i;d) + r1\*(x\*(i;d) – x(i;d)) + 0.5 \* (x(d) – x(i;d))= 2 \* (3,3) + 0.5 \* (7,3 – 8,3) + 0.5 \* ((5,5) – (8,3)) = (6,6) + (-0.5,0) + (-1.5,-1) = (4,5)

Thus, particle 2’s new position is (12,8).

Particle 3: v(i;d) = w\*v(i;d) + r1\*(x\*(i;d) – x(i;d)) + 0.5 \* (x(d) – x(i;d))= 2 \* (4,4) + 0.5 \* ((5,6) – (7,5)) + ((5,5) – (7,5)) = (8,8) + (-1,0.5) + (-2,0) = (5,8.5)

Thus, particle 3’s new position is (12,13,5).

1b. Particle 1: v(i;d) = w\*v(i;d) + r1\*(x\*(i;d) – x(i;d)) + 0.5 \* (x(d) – x(i;d))= 0.1 \* (2,2) + 0.5\*((5,5 – 5,5)) + 0.5\*((5,5) – (5,5)) = (0.2,0.2)

Thus, particle 1’s new position is (5.2,5.2).

Particle 2: v(i;d) = w\*v(i;d) + r1\*(x\*(i;d) – x(i;d)) + 0.5 \* (x(d) – x(i;d))= 0.1 \* (3,3) + 0.5 \* (7,3 – 8,3) + 0.5 \* ((5,5) – (8,3)) = (0.3,0.3) + (-0.5,0) + (-1.5, 1) = (-1.7,1.3)

Thus, particle 2’s new position is (6.3,4.3).

Particle 3: v(i;d) = w\*v(i;d) + r1\*(x\*(i;d) – x(i;d)) + 0.5 \* (x(d) – x(i;d))= 0.1 \* (4,4) + 0.5 \* ((5,6) – (6,7)) + ((5,5) – (6,7)) = (0.4,0.4) + (-0.5,-0.5) + (-0.5,-1) = (-0.6,1.9)

Thus, particle 3’s new position is (5.4,8.9).

1c. The parameter *w* seems to simulate friction/acceleration for the individual particles.

1d. The swarm will make optimize faster but be more imprecise.

2. The particle will find the solution, but very slowly and inefficiently compared to other values of *w*.

3. Regular K-means seems to generally produce better results, since depending on the weight parameters our implementation of PSO seems to either concentrate all the centroids at the exact same spot for each particle, or drive them as far away from the center of the search space as possible. Thus, PSO fails in this case to create an adequate clustering for both datasets.

A possible reason for this is the way that the “global best” position is calculated, namely as the average point between the centroids for the clustering with the best known global fitness.