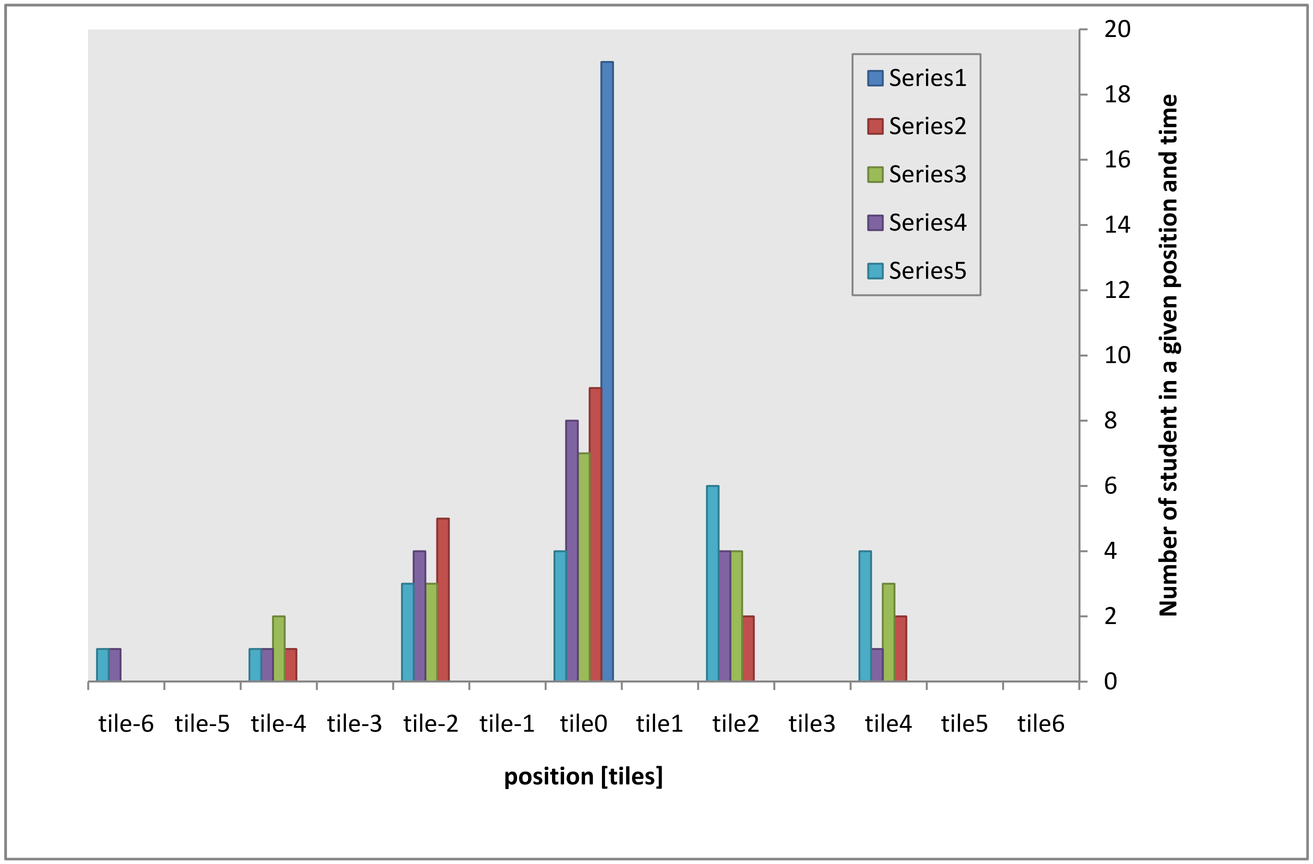
Simulation 3: diffusion

Homework part a (once you have the worksheet with all the data):

1. Plot the student concentration as function of time for t=0,4,8,12,16. (10pts).



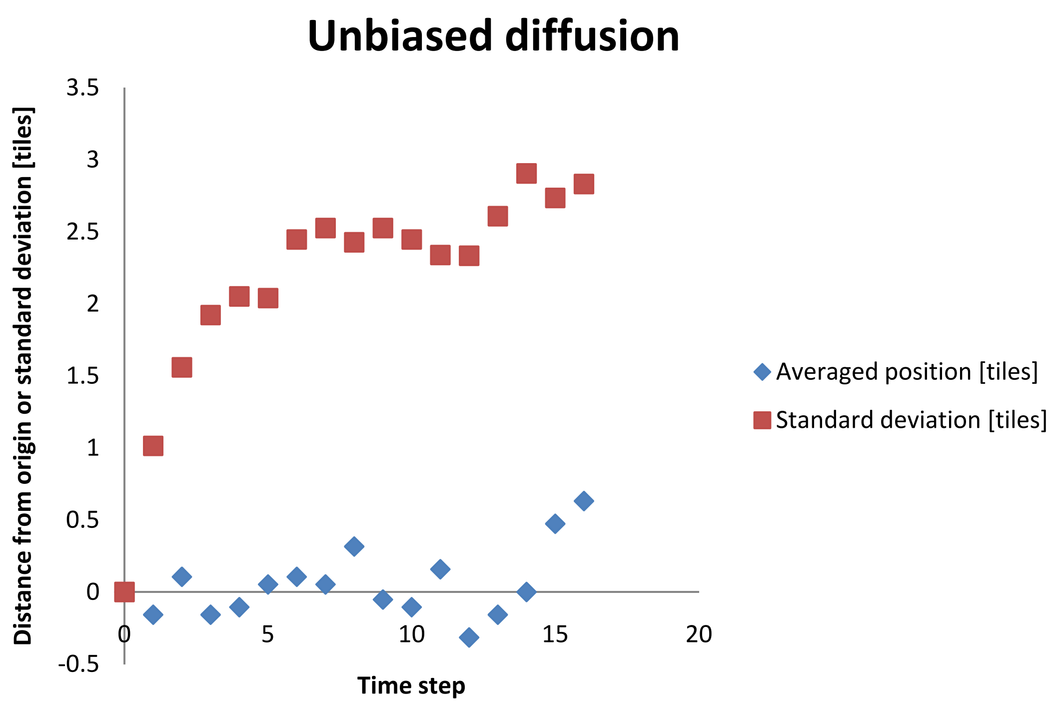
Simulation 3: diffusion

2. How did the mean student position change as function of time (10pts)?

Hardly at all. It oscillates around tile-0 (see figure below).

3. How did the standard deviation around the mean change as function of time? (10pts) What units does it have (10pts)?

It increased as function of time (see figure below). Initial increase faster.
It has the same units as the mean, e.g. length or tile number.



Simulation 3: diffusion

Assuming a time-step of 20sec and a step-length of 25cm, estimate from dimensional analysis the diffusion coefficient of the students in the corridor ($[D]=m^2/s$). (10pts)

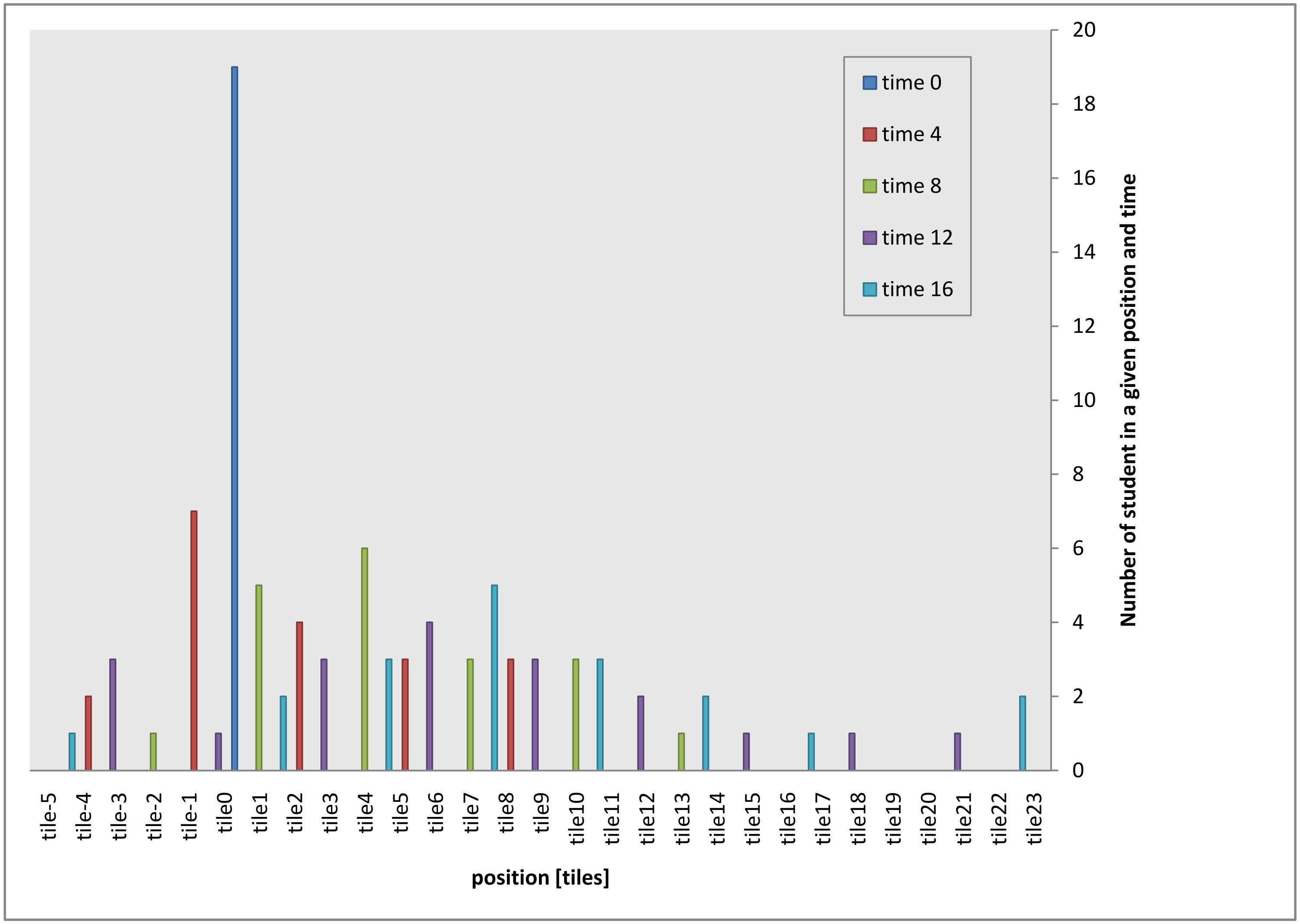
Since the average distance moved per time step is one tile,

$[D] \sim (25cm)^2/20s \sim 0.003m^2/s$

Simulation 4: biased diffusion

Homework part b (once you have the worksheet with all the data):

1. Plot the student concentration as function of time for t=0,4,8,12,16. (10pts)



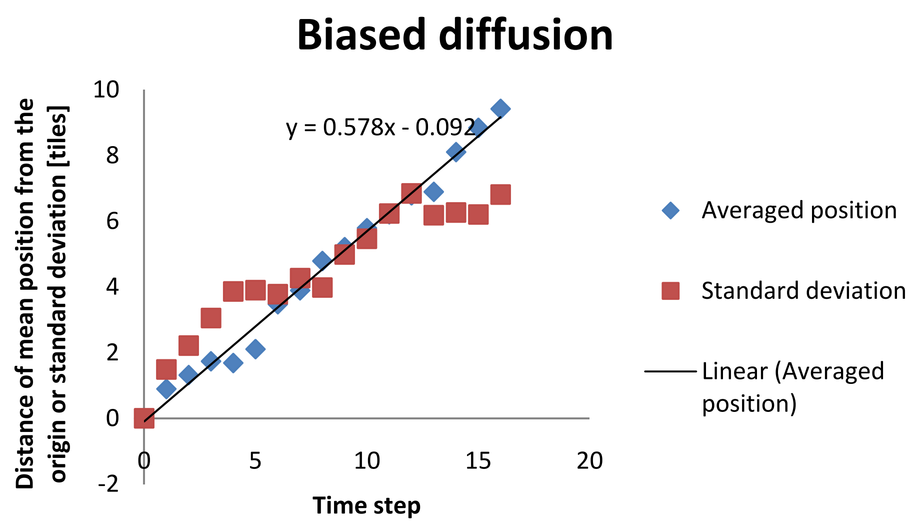
Simulation 4: biased diffusion

2. How did the mean position changed as function of time? (10pts)

As the graph shows, the mean position drifted as function of time to the right.

3. How did the standard deviation around the mean change as function of time (10pts)? What units does it have (10pts)?

As the graph below shows the standard deviation increases as function of time (initially faster). Its units are the same as those of the mean, e.g. tiles.



Simulation 4: biased diffusion

4. Assuming a time-step of 20sec and a step-length of 25cm, estimate from dimensional analysis the diffusion coefficient of the students in the corridor ($[D]=m^2/s$). Using part 1, what is the mean drift speed of the mean position (the rate by which the position of the mean drifts $[v]=m/s$)? (5 + 5pts)

Since the average distance moved per time step is 1.5 tiles ((2+1)/2), $[D] \sim (1.5 \times 25cm)^2/20s \sim 0.007m^2/s$

The drift can be calculated by fitting a line to the mean position in the previous graph. It is 0.58tiles/20sec ~ 0.029tiles/s ~ 0.007cm/sec