PH-M31 Assignment Question 4

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1. Question 4 - Run the serial code and the MPI code (the latter with two processes, locally) and show that they reproduce the same results.

(See Graphs sub-directory in attached zip file)

A script was created to run the program over varying values of beta for both the serial and MPI code on 2 processes. From the Kramers-Wannier Duality of the Square Ising model we know that a phase transition should occur at approximately $\beta_c = 0.44$, so for this reason the script samples many more values around $\beta = 0.35$ to 0.5 range as this is the region where the interesting physics is expected to occur, we expect to see m=0 until approximately β=0.44 and then the phase transition should occur so the magnetisation should rapidly, but continuously jump to m=1.

The script takes in the range of β values from the file beta.list and will run the program at each value of beta and then outputs the results for energy and magnetisation into individual files, these results were then collated and plotted on simultaneous graphs whcih will allow us to compare the agreement between the results between the serial and MPI code, and alos the expected values.

The Magnetisation and Energy values for both the serial and MPI code were plotted on the same graph to allow for easy comparison.

The plots for Magnetisation against β for both the serial and MPI code agree very well and within errors, however there is a small deviation near low values for β values. The results also agree well with the predicted shape from the study of phase transitions and agree with the result from the Kramers-Wannier Duality as the phase transition does indeed occur in the area around =0.44

The plots of Energy against β for both the serial and MPI code also agree very well.