

02/03/15 - 17/03/15

1 Dissertation

eb0a68e... 2015-03-17 (23 minutes ago)

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 new file: ProjectReport/2015-03-02/
ProjectReport.tex.bak

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f1e7998... 2015-03-10 (7 days ago)

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 new file: 1-Introduction/Introduction.
 tex.bak modified: 2-Theory/Theory.

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tex          new file:  2-Theory/Theory.tex.
bak          new file:  2-Theory/circleandlines2
.png         new file:  2-Theory/
circleandlines3.png          new file:  2-
Theory/circleandlines4.png          new file:
2-Theory/latticetotorus.png          new
file:  2-Theory/latticetotorus.svg
new file:  2-Theory/osangersolution.png
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          modified:  Dissertation.pdf
modified:  Dissertation.tex          new file:
Dissertation.tex.bak          modified:
title.tex

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M          1-Introduction/Introduction.tex
C089       1-Introduction/Introduction.tex 1-Introduction/
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M          2-Theory/Theory.tex
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new file: ProjectReport/2015-03-02/
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2 Code

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  anconvergence/plotan.plot    new file:
  anconvergence/run.sh         new file:
  anconvergence/template.cfg   modified:   betatest/
  plotspecificheat.plot        modified:   betatest/run
  .sh                          modified:   betatest/template.cfg
  modified:   main.cpp          modified:   param.cfg
  modified:   potts.cpp         modified:   potts.h
```

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C062    param.cfg              anconvergence/param.cfg
A       anconvergence/plotan.plot
A       anconvergence/run.sh
C052    betatest/template.cfg   anconvergence/template.
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M       betatest/plotspecificheat.plot
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M       main.cpp
M       param.cfg
M       potts.cpp
M       potts.h
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  plotspecificheat.plot        new file:   betatest/
  plotsusceptibility.plot      modified:   betatest/run
  .sh                          modified:   betatest/template.cfg
  modified:   main.cpp          modified:   param.cfg
  modified:   potts.cpp         modified:   potts.h
```

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A       betatest/plotspecificheat.plot
A       betatest/plotsusceptibility.plot
M       betatest/run.sh
M       betatest/template.cfg
M       main.cpp
```

M param.cfg
M potts.cpp
M potts.h

b96734e... 2015-03-10 (7 days ago)

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modified: betatest/run.sh renamed:
template.cfg -> betatest/template.cfg
deleted: critical/analysis.sh
deleted: critical/param.cfg
deleted: critical/plotall.plot
deleted: critical/plotenergy.plot
deleted: critical/plotmagnetisation.plot
deleted: critical/run.sh modified:
: main.cpp modified: param.cfg
modified: potts.cpp

M betatest/plotmagnetisation.plot
M betatest/run.sh
R070 template.cfg betatest/template.cfg
D critical/analysis.sh
D critical/param.cfg
D critical/plotall.plot
D critical/plotenergy.plot
D critical/plotmagnetisation.plot
D critical/run.sh
M main.cpp
M param.cfg
M potts.cpp

0d6beaf... 2015-03-05 (12 days ago)

modified: betatest/plotenergy.plot
modified: betatest/run.sh modified:
param.cfg

M betatest/plotenergy.plot
M betatest/run.sh
M param.cfg

55d2285... 2015-03-05 (12 days ago)

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Changes to be committed:      modified:   main.cpp
      modified:   param.cfg    modified:   potts.cpp
      modified:   potts.h      modified:   template.cfg
      modified:   utilityfunctions.cpp
      modified:   utilityfunctions.h
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```
M      main.cpp
M      param.cfg
M      potts.cpp
M      potts.h
M      template.cfg
M      utilityfunctions.cpp
M      utilityfunctions.h
```

3 Data and Results

3.1 Metropolis Thermodynamic Quantities

The Specific Heat Capacity was calculated using

$$C_V = \frac{1}{T^2} \left[\langle E^2 \rangle - \langle E \rangle^2 \right] \quad (1)$$

The Magnetic Susceptibility was calculated using

$$\chi = \frac{1}{T} \left[\langle M^2 \rangle - \langle M \rangle^2 \right] \quad (2)$$

3.2 q=2

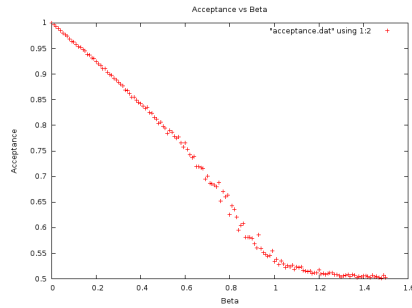
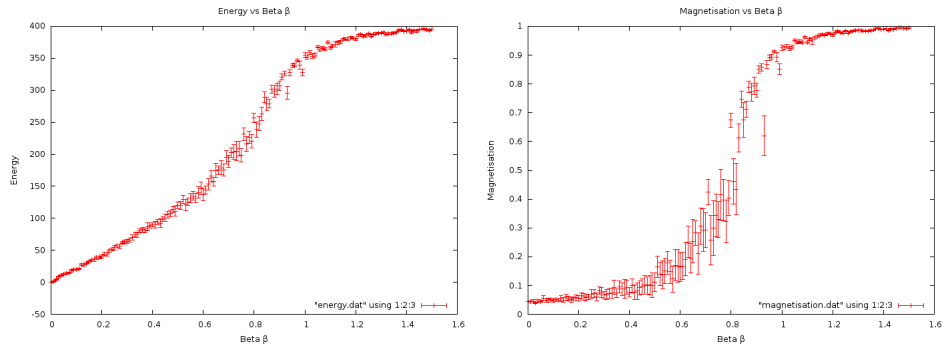
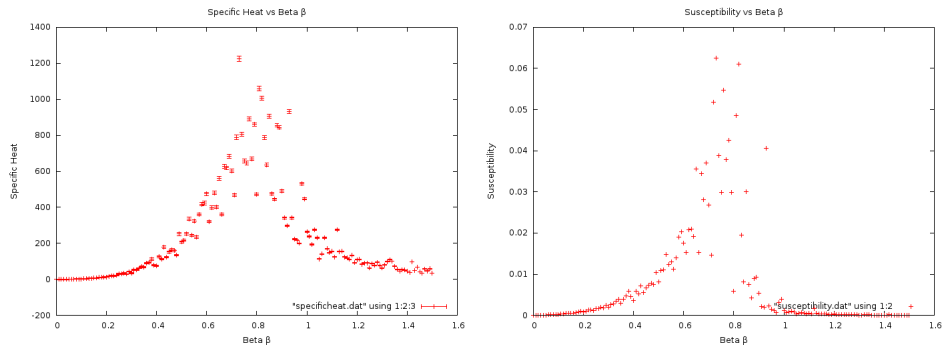


Figure 1: Acceptance for $q = 2$ on a $20 * 20$ grid



(a) Energy per Lattice Site with Errors (b) Magnetisation per Lattice Site with Errors



(a) Specific Heat of the System with Errors (b) Magnetic Susceptibility without errors

3.3 $q=4$

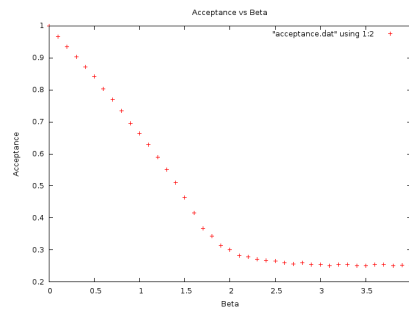
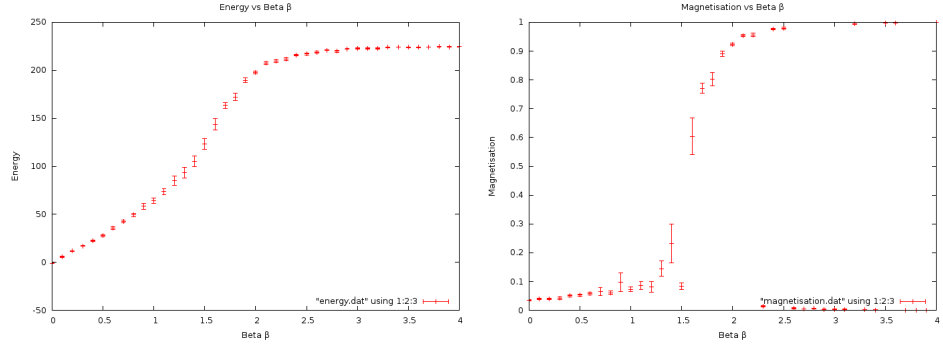
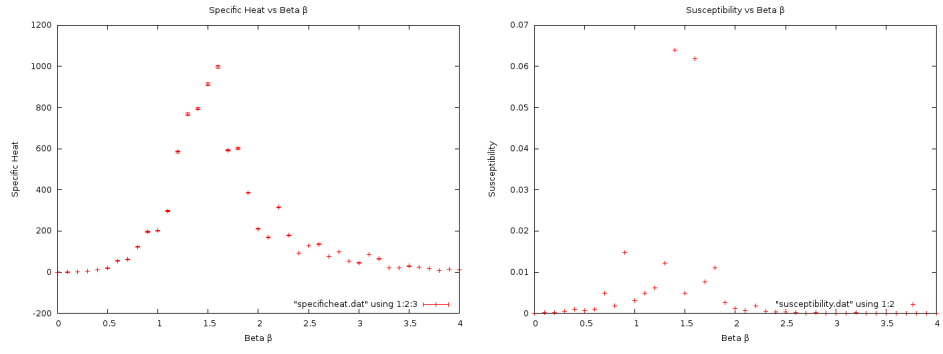


Figure 4: Acceptance for $q = 2$ on a $20 * 20$ grid



(a) Energy per Lattice Site with Errors (b) Magnetisation per Lattice Site with Errors



(a) Specific Heat of the System with Errors (b) Magnetic Susceptibility without errors

3.4 $q=10$

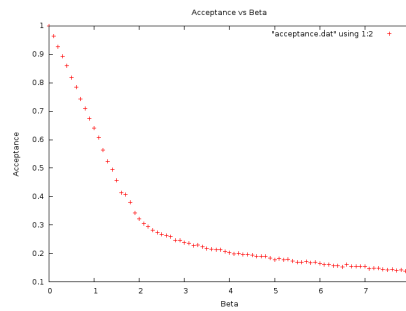
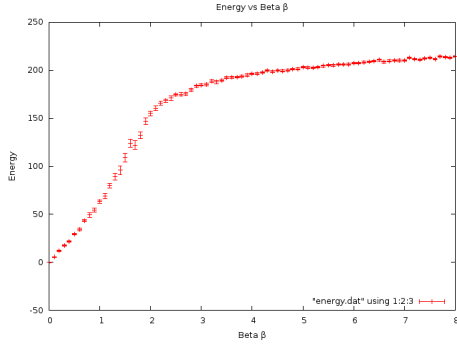
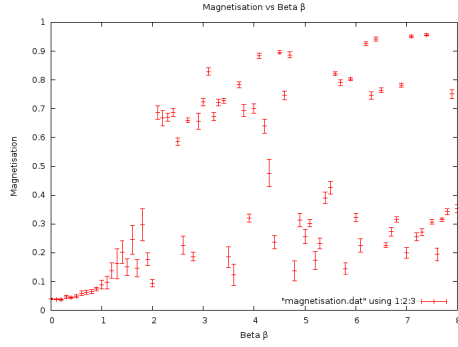


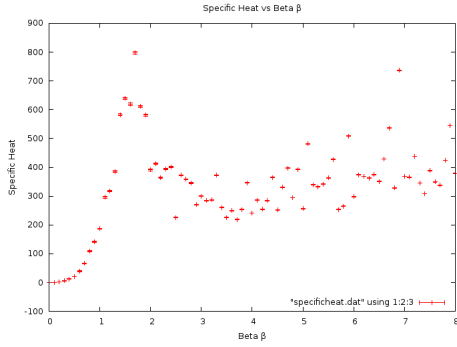
Figure 7: Acceptance for $q = 2$ on a 20×20 grid



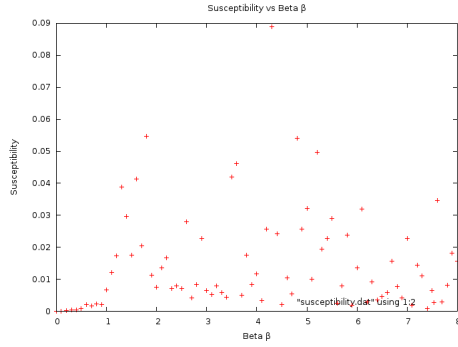
(a) Energy per Lattice Site with Errors



(b) Magnetisation per Lattice Site with Errors



(a) Specific Heat of the System with Errors



(b) Magnetic Susceptibility without errors

At higher and higher q we get some interesting artefacts after the phase transition, behaviours that look like energy level splitting and multiple minor phase transitions.

Because the Error of the Magnetic Susceptibility becomes significantly larger than the data itself around β_c it was not shown in this plot as to show the behaviour.

Behaviour is as expected when coupling is $J = 1/2$ to match the Ising Model. However when changing to the Antiferromagnetic case $J = -0.5$ the simulation becomes erratic. Further investigation will be required to identify the source of the problem.

3.5 a_n Convergence

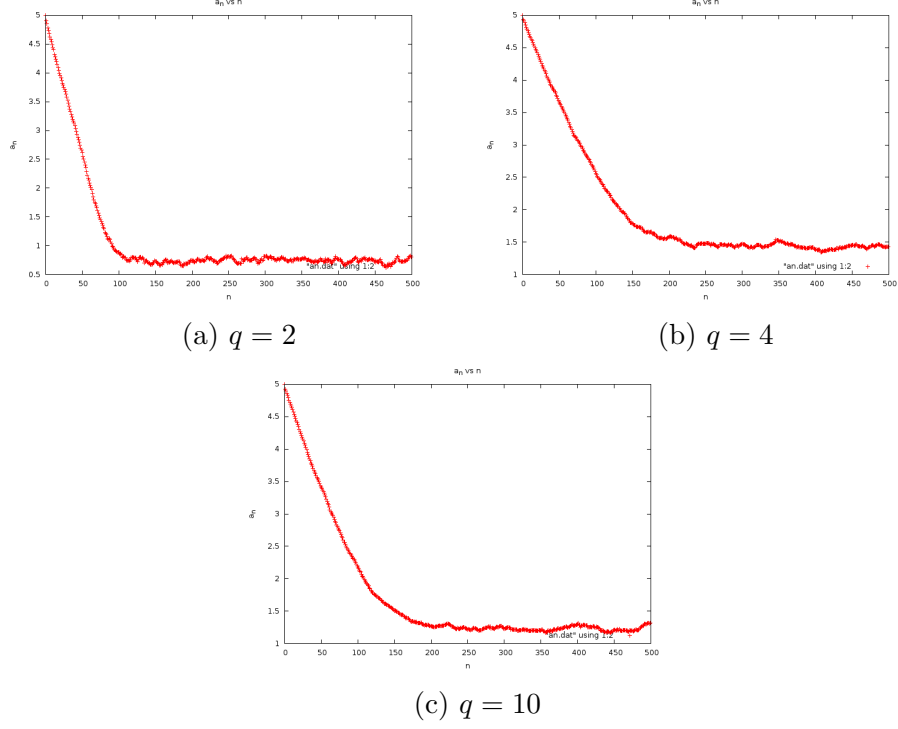


Figure 10: Target Energy: -100.0 , Energy Band Width: 15.0

Taking the energies calculated from the Metropolis at various β and using those as a target to drive the configuration into to calculate a_n . I intend to prove that the two different values are indeed compatible.