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LAMPIRAN A

Program Utama

1. Algoritma Metropolis dengan Spin *Update* Tanpa Parameter Temperatur

```

from numpy import *
from numpy.random import *
from openpyxl import *

def initialstate(N):
    state = random(size=(N, N))
    return state

def spinflip(spin, beta):
    for i in range(N):
        for j in range(N):
            a = randint(0, N)
            b = randint(0, N)
            s = spin[a, b]
            sx1 = cos((spin[a, b] - spin[a, (b + 1) % N]) * Pi)
            sx2 = cos((spin[a, b] - spin[a, (b - 1) % N]) * Pi)
            sy1 = cos((spin[a, b] - spin[(a + 1) % N, b]) * Pi)
            sy2 = cos((spin[a, b] - spin[(a - 1) % N, b]) * Pi)
            sigma = sx1 + sx2 + sy1 + sy2
            dE = 2*sigma
            if dE < 0:
                s = random()
            elif random() < exp(-dE*beta):
                s = random()
            spin[a, b] = s
    return spin

```



```

def calcEnergy(spin):
    energy = 0
    for i in range(len(spin)):
        for j in range(len(spin)):
            Sx1 = cos((spin[i, j] - spin[i, (j + 1) % N]) * Pi)
            Sx2 = cos((spin[i, j] - spin[i, (j - 1) % N]) * Pi)
            Sy1 = cos((spin[i, j] - spin[(i + 1) % N, j]) * Pi)
            Sy2 = cos((spin[i, j] - spin[(i - 1) % N, j]) * Pi)
            Sigma = Sx1 + Sx2 + Sy1 + Sy2
            energy += -Sigma/2
    return energy

def calcMag(spin):
    mag = 0
    for i in range(len(spin)):
        for j in range(len(spin)):
            S = cos(spin[i,j]*Pi) + sin(spin[i,j]*Pi)
            mag += S
    return mag

def savefile():
    wb = Workbook()
    ws = wb.create_sheet('Hasil',0)
    title_table = ['Suhu', 'Variabel Energi', 'Magnetisasi', 'Panas Jenis']
    for title in range(0,len(title_table)):
        ws.cell(1,title+1,str(title_table[title]))
    for nilai in range(nt):
        ws.cell(nilai + 2, 1, T[nilai])
        ws.cell(nilai + 2, 2, E[nilai])
        ws.cell(nilai + 2, 3, M[nilai])
    wb.save("Nama File.xlsx") #Nama File untuk di simpan

```



```

#-----PARAMETER-----
N = 8                                #Jumlah Kisi
nt = 30                              #Jumlah Temperatur
Pi = 2*pi
spin = initialstate(N)
eqSteps = 256                        #Jumlah MC sweeps untuk
equilibration
mcSteps = 256                        #Jumlah MC sweeps untuk
calculation

T = linspace(0.53, 3.28, nt)         #Range Temperatur
E,M,C = zeros(nt), zeros(nt), zeros(nt) #Variabel Energi,
Magnetisasi, Panas Jenis
n1, n2 = 1.0/(mcSteps*N*N), 1.0/(mcSteps*mcSteps*N*N)

#-----MAIN CODE-----
for tt in range(nt):
    E1 = M1 = E2 = M2 = 0
    config = initialstate(N)
    beta = 1 / (T[tt]) #kB*T[tt]
    c = beta/(T[tt])

    for i in range(eqSteps): # equilibrate
        spinflip(config, beta) # Monte Carlo moves

    for i in range(mcSteps):
        spinflip(config, beta)
        Ene = calcEnergy(config) # calculate the energy
        Mag = calcMag(config) # calculate the magnetisation

```



```
E1 += Ene  
M1 += Mag  
M2 += Mag * Mag  
E2 += Ene * Ene
```

```
E[tt] = n1 * E1  
M[tt] = n1 * M1  
C[tt] = (n1 * E2 - n2 * E1 * E1) * c
```

```
savefile()
```



2. Algoritma Metropolis dengan Spin *Update* Parameter Temperatur Syarat Penerimaan 0,6

```

from numpy import *
from numpy.random import *
from openpyxl import *
import matplotlib.pyplot as plt

def initialstate(N):
    state = random(size=(N, N))
    return state

def spinflip(spin, beta):
    for tt in range(nt):
        for i in range(N):
            for j in range(N):
                a = randint(0, N)
                b = randint(0, N)
                s = spin[a, b]
                sx1 = cos((spin[a, b] - spin[a, (b + 1) % N]) * Pi)
                sx2 = cos((spin[a, b] - spin[a, (b - 1) % N]) * Pi)
                sy1 = cos((spin[a, b] - spin[(a + 1) % N, b]) * Pi)
                sy2 = cos((spin[a, b] - spin[(a - 1) % N, b]) * Pi)
                sigma = sx1 + sx2 + sy1 + sy2
                dE = 2 * sigma
                R = rand()
                if R > 0.4:                                     #Probabilitas Flip Spin
                    if T[tt] < 1.0:
                        if dE < 0:
                            s = random() * 0.55
                        elif random() < exp(-dE * beta):
                            s = random() * 0.55

```



```

spin[a, b] = s
elif 1.0 < T[tt] < 1.2:
    if dE < 0:
        s = random() * 0.6
    elif random() < exp(-dE * beta):
        s = random() * 0.6
    spin[a, b] = s
elif 1.2 < T[tt] < 1.4:
    if dE < 0:
        s = random() * 0.65
    elif random() < exp(-dE * beta):
        s = random() * 0.65
    spin[a, b] = s
elif 1.4 < T[tt] < 1.6:
    if dE < 0:
        s = random() * 0.7
    elif random() < exp(-dE * beta):
        s = random() * 0.7
    spin[a, b] = s
elif 1.6 < T[tt] < 1.8:
    if dE < 0:
        s = random() * 0.75
    elif random() < exp(-dE * beta):
        s = random() * 0.75
    spin[a, b] = s
elif 1.8 < T[tt] < 2.0:
    if dE < 0:
        s = random() * 0.8
    elif random() < exp(-dE * beta):
        s = random() * 0.8
    spin[a, b] = s

```




```

elif T[tt] > 2.0:
    if dE < 0:
        s = random()
    elif random() < exp(-dE * beta):
        s = random()
    spin[a, b] = s
return spin

def calcEnergy(spin):
    energy = 0
    for i in range(len(spin)):
        for j in range(len(spin)):
            Sx1 = cos((spin[i, j] - spin[i, (j + 1) % N]) * Pi)
            Sx2 = cos((spin[i, j] - spin[i, (j - 1) % N]) * Pi)
            Sy1 = cos((spin[i, j] - spin[(i + 1) % N, j]) * Pi)
            Sy2 = cos((spin[i, j] - spin[(i - 1) % N, j]) * Pi)
            Sigma = Sx1 + Sx2 + Sy1 + Sy2
            energy += -Sigma/2
    return energy

def calcMag(spin):
    mag = 0
    for i in range(len(spin)):
        for j in range(len(spin)):
            S = cos(spin[i,j]*Pi) + sin(spin[i,j]*Pi)
            mag += S
    return mag

```

```

def savefile():
    wb = Workbook()
    ws = wb.create_sheet('Hasil',0)

```



```

title_table = ['Suhu', 'Variabel Energi', 'Magnetisasi', 'Panas Jenis']
for title in range(0,len(title_table)):
    ws.cell(1,title+1,str(title_table[title]))
for nilai in range(nt):
    ws.cell(nilai + 2, 1, T[nilai])
    ws.cell(nilai + 2, 2, E[nilai])
    ws.cell(nilai + 2, 3, M[nilai])
wb.save("Nama File.xlsx")           #Nama File untuk di simpan

#-----PARAMETER-----
N = 8                               #Jumlah Kisi
nt = 30                             #Jumlah Termperatur
Pi = 2*pi
spin = initialstate(N)
eqSteps = 256                       #Jumlah MC sweeps untuk
equilibration
mcSteps = 256                       #Jumlah MC sweeps untuk
calculation

T = linspace(0.53, 3.28, nt)        #Range Temperatur
E,M,C = zeros(nt), zeros(nt), zeros(nt)  #Variabel Energi,
Magnetisasi, Panas Jenis
n1, n2 = 1.0/(mcSteps*N*N), 1.0/(mcSteps*mcSteps*N*N)

#-----MAIN CODE-----
for tt in range(nt):
    E1 = M1 = E2 = M2 = 0
    config = initialstate(N)
    beta = 1 / (T[tt])  #(kB*T[tt])
    c = beta/(T[tt])

```



```
for i in range(eqSteps): # equilibrate
    spinflip(config, beta) # Monte Carlo moves

for i in range(mcSteps):
    spinflip(config, beta)
    Ene = calcEnergy(config) # calculate the energy
    Mag = calcMag(config) # calculate the magnetisation

    E1 += Ene
    M1 += Mag
    M2 += Mag * Mag
    E2 += Ene * Ene

E[tt] = n1 * E1
M[tt] = n1 * M1
C[tt] = (n1 * E2 - n2 * E1 * E1) * c

savefile()
```



LAMPIRAN B

Data Pengukuran Untuk 8 Sampel

1. Algoritma Metropolis Spin *Update* Tanpa Parameter Temperatur
Untuk Kisi $L = 8$

| Suhu | Energi | Magnetisasi | Panas Jenis |
|----------|--------------|-------------|-------------|
| 0,53 | -1,438451373 | 0,411621012 | 0,331258803 |
| 0,624828 | -1,465487899 | 0,403066502 | 0,131099868 |
| 0,719655 | -1,532929508 | 0,335456105 | 0,116975185 |
| 0,814483 | -1,580176091 | 0,539987209 | 0,089405857 |
| 0,90931 | -1,6055154 | 0,677333831 | 0,096022728 |
| 1,004138 | -1,62809705 | 0,732925999 | 0,201973961 |
| 1,098966 | -1,618764787 | 0,650040247 | 0,282150664 |
| 1,193793 | -1,605700339 | 0,519684781 | 0,23545872 |
| 1,288621 | -1,483579292 | 0,515153534 | 0,655950475 |
| 1,383448 | -1,400139554 | 0,384512389 | 0,926866628 |
| 1,478276 | -1,31784045 | 0,418779671 | 1,136603814 |
| 1,573103 | -0,976984274 | 0,25063908 | 0,978744015 |
| 1,667931 | -0,92349429 | 0,205457476 | 0,971221053 |
| 1,762759 | -0,790398421 | 0,090427593 | 0,680261683 |
| 1,857586 | -0,72714731 | 0,112771751 | 0,563772115 |
| 1,952414 | -0,682620116 | 0,149248714 | 0,529771008 |
| 2,047241 | -0,616213486 | 0,062984165 | 0,398414086 |
| 2,142069 | -0,595351381 | 0,027607028 | 0,360049916 |
| 2,236897 | -0,550145196 | 0,075143007 | 0,336381219 |
| 2,331724 | -0,522199484 | 0,01696182 | 0,282931802 |
| | -0,493874897 | 0,040727698 | 0,276188053 |
| | -0,46111978 | 0,024485276 | 0,227014877 |
| | -0,444606677 | 0,024698314 | 0,188137323 |



| | | | |
|----------|--------------|-------------|-------------|
| 2,711034 | -0,433487831 | 0,022448775 | 0,196714974 |
| 2,805862 | -0,410694645 | 0,028567002 | 0,181202463 |
| 2,90069 | -0,405810007 | 0,021841956 | 0,18243559 |
| 2,995517 | -0,381506631 | 0,035000917 | 0,176532732 |
| 3,090345 | -0,378508867 | 0,016796824 | 0,134928193 |
| 3,185172 | -0,352076679 | 0,019088075 | 0,139120318 |
| 3,28 | -0,339776055 | 0,009483243 | 0,121972179 |

Untuk Kisi L = 12

| Suhu | Energi | Magnetisasi | Panas Jenis |
|-------------|--------------|-------------|-------------|
| 0,53 | -1,374616094 | 0,226117302 | 0,236549222 |
| 0,624827586 | -1,460396959 | 0,380034615 | 0,224222234 |
| 0,719655172 | -1,520224222 | 0,226676683 | 0,143455963 |
| 0,814482759 | -1,572502181 | 0,453944929 | 0,222728634 |
| 0,909310345 | -1,557087092 | 0,393676256 | 0,178162284 |
| 1,004137931 | -1,625620923 | 0,415770672 | 0,224456172 |
| 1,098965517 | -1,555161908 | 0,220743724 | 0,386527391 |
| 1,193793103 | -1,569407832 | 0,451200424 | 0,417699074 |
| 1,28862069 | -1,43085793 | 0,377082341 | 0,54129608 |
| 1,383448276 | -1,357657446 | 0,321098304 | 1,054964718 |
| 1,478275862 | -1,137231513 | 0,471703117 | 0,942357146 |
| 1,573103448 | -0,999417797 | 0,109104256 | 1,023622254 |
| 1,667931034 | -0,870237233 | 0,082252377 | 0,699518035 |
| 1,762758621 | -0,793709441 | 0,088153502 | 0,657656799 |
| 1,857586207 | -0,705575757 | 0,029169509 | 0,510444135 |
| 1,952413793 | -0,660484842 | 0,026332838 | 0,408810046 |
| 2,047241379 | -0,632555344 | 0,042156019 | 0,393289528 |
| 2,142072413 | -0,591221271 | 0,033626231 | 0,350385174 |
| 2,236903448 | -0,536459383 | 0,019615765 | 0,292653371 |
| 2,331734483 | -0,520090513 | 0,019906724 | 0,311029811 |



| | | | |
|-------------|--------------|-------------|-------------|
| 2,426551724 | -0,512599668 | 0,023952203 | 0,240440399 |
| 2,52137931 | -0,470812146 | 0,008467162 | 0,22431051 |
| 2,616206897 | -0,442571048 | 0,009705797 | 0,202360425 |
| 2,711034483 | -0,42330549 | 0,009332855 | 0,188402416 |
| 2,805862069 | -0,403503837 | 0,02332826 | 0,182716522 |
| 2,900689655 | -0,396582221 | 0,006307366 | 0,172091211 |
| 2,995517241 | -0,37590334 | 0,007352974 | 0,140159826 |
| 3,090344828 | -0,365867676 | 0,01065573 | 0,121664488 |
| 3,185172414 | -0,352445532 | 0,023783977 | 0,126761198 |
| 3,28 | -0,340495541 | 0,013743512 | 0,114253574 |

Untuk Kisi L = 14

| Suhu | Energi | Magnetisasi | Panas Jenis |
|-------------|--------------|-------------|-------------|
| 0,53 | -1,393211405 | 0,189984432 | 0,27836028 |
| 0,624827586 | -1,456631371 | 0,285936489 | 0,250545871 |
| 0,719655172 | -1,474854989 | 0,094370007 | 0,21434801 |
| 0,814482759 | -1,497935593 | 0,287917821 | 0,221589498 |
| 0,909310345 | -1,545787175 | 0,348490107 | 0,528995046 |
| 1,004137931 | -1,559180026 | 0,437487141 | 0,243285727 |
| 1,098965517 | -1,490342594 | 0,158531686 | 0,423837735 |
| 1,193793103 | -1,470771557 | 0,226314033 | 0,532203564 |
| 1,28862069 | -1,407925917 | 0,425816537 | 0,550599068 |
| 1,383448276 | -1,374240735 | 0,328430494 | 1,023504955 |
| 1,478275862 | -1,112953646 | 0,373813907 | 1,458770612 |
| 1,573103448 | -0,985379016 | 0,180473021 | 0,899315719 |
| 1,667931034 | -0,882483528 | 0,131143292 | 0,674266011 |
| 1,762758621 | -0,790908361 | 0,063596347 | 0,759826489 |
| 207 | -0,748503777 | 0,078500133 | 0,701627009 |
| 793 | -0,676296027 | 0,064462863 | 0,495141047 |
| 379 | -0,620628946 | 0,0364682 | 0,398069013 |



| | | | |
|-------------|--------------|-------------|-------------|
| 2,142068966 | -0,58894959 | 0,037492768 | 0,360816065 |
| 2,236896552 | -0,549917792 | 0,030527323 | 0,273597677 |
| 2,331724138 | -0,52548838 | 0,025075804 | 0,264148537 |
| 2,426551724 | -0,499130578 | 0,025537902 | 0,247639107 |
| 2,52137931 | -0,467173628 | 0,019673876 | 0,214889901 |
| 2,616206897 | -0,445730333 | 0,027714672 | 0,192364071 |
| 2,711034483 | -0,435240778 | 0,007944532 | 0,209122644 |
| 2,805862069 | -0,405629429 | 0,016176665 | 0,156397578 |
| 2,900689655 | -0,392609264 | 0,019829726 | 0,15851846 |
| 2,995517241 | -0,374398791 | 0,013581076 | 0,137909993 |
| 3,090344828 | -0,369190476 | 0,010013692 | 0,137997038 |
| 3,185172414 | -0,352747324 | 0,013960191 | 0,128864415 |
| 3,28 | -0,342121975 | 0,00833036 | 0,124057849 |

Untuk Kisi L = 16

| Suhu | Energi | Magnetisasi | Panas Jenis |
|-------------|--------------|-------------|-------------|
| 0,53 | -1,402507884 | 0,156007717 | 0,152172433 |
| 0,624827586 | -1,422434541 | 0,215833904 | 0,295004381 |
| 0,719655172 | -1,494021798 | 0,233127297 | 0,264962784 |
| 0,814482759 | -1,508861897 | 0,163081829 | 0,130940014 |
| 0,909310345 | -1,581052916 | 0,3087512 | 0,310039273 |
| 1,004137931 | -1,544235758 | 0,339606518 | 0,389522427 |
| 1,098965517 | -1,500369852 | 0,304906982 | 0,31919709 |
| 1,193793103 | -1,542875187 | 0,495816682 | 0,519242539 |
| 1,28862069 | -1,348654517 | 0,246571271 | 0,586694907 |
| 1,383448276 | -1,303756513 | 0,359449348 | 0,830004112 |
| 1,478275862 | -1,17710114 | 0,357535487 | 0,987221048 |
| 1,573104448 | -1,023294045 | 0,26935096 | 1,150317652 |
| 1,667933034 | -0,889942163 | 0,069960962 | 0,819936181 |
| 1,762761621 | -0,784306178 | 0,054779592 | 0,551349361 |



| | | | |
|-------------|--------------|-------------|-------------|
| 1,857586207 | -0,735977449 | 0,099137053 | 0,552092405 |
| 1,952413793 | -0,671573856 | 0,023674562 | 0,396777276 |
| 2,047241379 | -0,610535173 | 0,027828709 | 0,454257687 |
| 2,142068966 | -0,593146846 | 0,025220458 | 0,34391217 |
| 2,236896552 | -0,552688808 | 0,016050634 | 0,334009396 |
| 2,331724138 | -0,518546778 | 0,005981162 | 0,274701191 |
| 2,426551724 | -0,496838096 | 0,031413363 | 0,245004537 |
| 2,52137931 | -0,472662182 | 0,011251214 | 0,224483243 |
| 2,616206897 | -0,440396355 | 0,013201021 | 0,202530896 |
| 2,711034483 | -0,427733077 | 0,014134754 | 0,170926932 |
| 2,805862069 | -0,405859035 | 0,008805396 | 0,168322416 |
| 2,900689655 | -0,39935101 | 0,017184965 | 0,148047184 |
| 2,995517241 | -0,377876471 | 0,004118478 | 0,141268155 |
| 3,090344828 | -0,358452794 | 0,008827109 | 0,147135531 |
| 3,185172414 | -0,353188436 | 0,013289334 | 0,124206868 |
| 3,28 | -0,339305924 | 0,008502412 | 0,117693629 |



2. Algoritma Metropolis Spin *Update* Parameter Temperatur Dengan Syarat

Penerimaan 0,6

Untuk Kisi $L = 8$

| Suhu | Energi | Magnetisasi | Panas Jenis |
|-------------|--------------|-------------|-------------|
| 0,53 | -1,615100072 | 0,297500172 | 0,236721425 |
| 0,624827586 | -1,671263474 | 0,132587093 | 0,079041228 |
| 0,719655172 | -1,769483122 | 0,254575592 | 0,055300196 |
| 0,814482759 | -1,757882377 | 0,303162597 | 0,107541901 |
| 0,909310345 | -1,733846084 | 0,368801775 | 0,178583836 |
| 1,004137931 | -1,727080145 | 0,19499435 | 0,175431035 |
| 1,098965517 | -1,694839157 | 0,408023538 | 0,257056276 |
| 1,193793103 | -1,646128974 | 0,342802971 | 0,367838233 |
| 1,28862069 | -1,566550707 | 0,166982518 | 0,498713285 |
| 1,383448276 | -1,506886406 | 0,181540954 | 0,613803982 |
| 1,478275862 | -1,414538136 | 0,305758818 | 0,697947053 |
| 1,573103448 | -1,309672954 | 0,234243936 | 0,806074109 |
| 1,667931034 | -1,198675157 | 0,197918771 | 0,879142822 |
| 1,762758621 | -1,117725882 | 0,21177097 | 0,830351362 |
| 1,857586207 | -0,998486517 | 0,183409913 | 0,83548281 |
| 1,952413793 | -0,897376569 | 0,141502648 | 0,755865177 |
| 2,047241379 | -0,823399705 | 0,128976163 | 0,638249941 |
| 2,142068966 | -0,735280455 | 0,122430105 | 0,565815381 |
| 2,236896552 | -0,663228746 | 0,110132583 | 0,495819621 |
| 2,331724138 | -0,612299671 | 0,077231159 | 0,405678515 |
| 2,426551724 | -0,558675974 | 0,070959961 | 0,334626292 |
| 2,52137931 | -0,522562091 | 0,066427913 | 0,311368132 |
| 2,616206897 | -0,484988851 | 0,068487816 | 0,256041577 |
| 2,711034483 | -0,458492053 | 0,048886884 | 0,202943254 |
| 2,805862069 | -0,44454633 | 0,059582031 | 0,2067579 |
| 2,900690655 | -0,420924411 | 0,042184172 | 0,190969508 |



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|-------------|--------------|-------------|-------------|
| 2,995517241 | -0,391882555 | 0,038056973 | 0,162087344 |
| 3,090344828 | -0,37795748 | 0,035466433 | 0,142194638 |
| 3,185172414 | -0,360157211 | 0,039794973 | 0,130741864 |
| 3,28 | -0,354301094 | 0,030620426 | 0,135335519 |

Untuk Kisi L = 12

| Suhu | Energi | Magnetisasi | Panas Jenis |
|----------|--------------|-------------|-------------|
| 0,53 | -1,611421826 | 0,242884878 | 0,056505191 |
| 0,624828 | -1,687630196 | 0,19266344 | 0,089942108 |
| 0,719655 | -1,737996876 | 0,185098078 | 0,087865595 |
| 0,814483 | -1,762356017 | 0,425001013 | 0,106205441 |
| 0,90931 | -1,747822036 | 0,195020715 | 0,159674393 |
| 1,004138 | -1,723764638 | 0,263155678 | 0,206542837 |
| 1,098966 | -1,663858464 | 0,18348024 | 0,311068175 |
| 1,193793 | -1,622452248 | 0,251833101 | 0,377272697 |
| 1,288621 | -1,570790045 | 0,216635335 | 0,45773263 |
| 1,383448 | -1,484342456 | 0,178012624 | 0,646428461 |
| 1,478276 | -1,397040991 | 0,266890079 | 0,786001359 |
| 1,573103 | -1,305086842 | 0,247683021 | 0,870467444 |
| 1,667931 | -1,20457146 | 0,224604955 | 0,825755616 |
| 1,762759 | -1,106600725 | 0,180716183 | 0,939278647 |
| 1,857586 | -0,987147925 | 0,166629724 | 0,857923711 |
| 1,952414 | -0,885518874 | 0,154721641 | 0,735003607 |
| 2,047241 | -0,807731287 | 0,133329536 | 0,674525298 |
| 2,142069 | -0,736377958 | 0,122100457 | 0,566679703 |
| 2,236897 | -0,678197604 | 0,101633499 | 0,479646413 |
| 2,331724 | -0,621917408 | 0,093525391 | 0,386360848 |
| | -0,566899126 | 0,084258925 | 0,35104984 |
| | -0,532879478 | 0,07205285 | 0,302890411 |
| | -0,495493283 | 0,069753636 | 0,275228441 |



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|----------|--------------|-------------|-------------|
| 2,711034 | -0,464779107 | 0,061248258 | 0,220500186 |
| 2,805862 | -0,438028246 | 0,046849383 | 0,188818787 |
| 2,90069 | -0,414656368 | 0,044040457 | 0,173534718 |
| 2,995517 | -0,391600349 | 0,041639373 | 0,157515457 |
| 3,090345 | -0,379170831 | 0,036930411 | 0,15336769 |
| 3,185172 | -0,362353616 | 0,031768524 | 0,128390508 |
| 3,28 | -0,352937308 | 0,03106252 | 0,120330755 |

Untuk Kisi L = 14

| Suhu | Energi | Magnetisasi | Panas Jenis |
|-------------|--------------|-------------|-------------|
| 0,53 | -1,604671837 | 0,141904738 | 0,223060364 |
| 0,624827586 | -1,694424535 | 0,388908399 | 0,051652689 |
| 0,719655172 | -1,728160614 | 0,219058286 | 0,087421923 |
| 0,814482759 | -1,763737486 | 0,264765163 | 0,082482906 |
| 0,909310345 | -1,741023679 | 0,263639963 | 0,176714345 |
| 1,004137931 | -1,711144583 | 0,200155863 | 0,225181374 |
| 1,098965517 | -1,670509816 | 0,333783338 | 0,324664804 |
| 1,193793103 | -1,62292213 | 0,179758319 | 0,420439278 |
| 1,28862069 | -1,560824135 | 0,243228664 | 0,530731139 |
| 1,383448276 | -1,49474341 | 0,282487645 | 0,626054386 |
| 1,478275862 | -1,402807673 | 0,288106043 | 0,756538963 |
| 1,573103448 | -1,304168862 | 0,252437678 | 0,785015743 |
| 1,667931034 | -1,206471191 | 0,209436162 | 0,795876778 |
| 1,762758621 | -1,087225893 | 0,171203997 | 0,850414898 |
| 1,857586207 | -0,995341096 | 0,171233606 | 0,80413902 |
| 1,952413793 | -0,891222506 | 0,141036014 | 0,736382607 |
| 2,047241379 | -0,816545996 | 0,132012877 | 0,691549446 |
| 2,142072966 | -0,745275182 | 0,120532235 | 0,575990959 |
| 2,236904552 | -0,673190622 | 0,104222128 | 0,49224067 |
| 2,331736138 | -0,61706321 | 0,090999004 | 0,406909157 |



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|-------------|--------------|-------------|-------------|
| 2,426551724 | -0,564257957 | 0,081900559 | 0,34771413 |
| 2,52137931 | -0,521165335 | 0,07134391 | 0,288805123 |
| 2,616206897 | -0,495240737 | 0,059765896 | 0,259618693 |
| 2,711034483 | -0,461445253 | 0,061090213 | 0,240333415 |
| 2,805862069 | -0,438310896 | 0,048513457 | 0,196508587 |
| 2,900689655 | -0,417510581 | 0,046104923 | 0,172480189 |
| 2,995517241 | -0,396095864 | 0,041064096 | 0,151812074 |
| 3,090344828 | -0,379517967 | 0,035385725 | 0,141290909 |
| 3,185172414 | -0,357893432 | 0,028704909 | 0,122919186 |
| 3,28 | -0,349169945 | 0,027618269 | 0,130642429 |

Untuk Kisi L = 16

| Suhu | Energi | Magnetisasi | Panas Jenis |
|-------------|--------------|-------------|-------------|
| 0,53 | -1,601060341 | 0,210835973 | 0,078396142 |
| 0,624827586 | -1,684130896 | 0,279460665 | 0,182399963 |
| 0,719655172 | -1,743786276 | 0,100731207 | 0,106448858 |
| 0,814482759 | -1,751798814 | 0,402112866 | 0,097121987 |
| 0,909310345 | -1,742708864 | 0,232042046 | 0,176315303 |
| 1,004137931 | -1,711047304 | 0,178991278 | 0,178964113 |
| 1,098965517 | -1,680174895 | 0,259027276 | 0,260177407 |
| 1,193793103 | -1,628239378 | 0,368903477 | 0,42519623 |
| 1,28862069 | -1,565881313 | 0,292817011 | 0,50941915 |
| 1,383448276 | -1,49034413 | 0,272991514 | 0,632739897 |
| 1,478275862 | -1,401784764 | 0,246123142 | 0,845320804 |
| 1,573103448 | -1,310825609 | 0,220791769 | 0,853373588 |
| 1,667931034 | -1,200238812 | 0,213116849 | 0,957768446 |
| 1,762758621 | -1,099386534 | 0,170355792 | 0,88641248 |
| 207 | -1,000486933 | 0,172541146 | 0,808121564 |
| 793 | -0,901946028 | 0,152605306 | 0,754444752 |
| 379 | -0,815282743 | 0,139884576 | 0,635798199 |



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|-------------|--------------|-------------|-------------|
| 2,142068966 | -0,738044151 | 0,128895325 | 0,556674587 |
| 2,236896552 | -0,679429453 | 0,10428645 | 0,49341664 |
| 2,331724138 | -0,615818834 | 0,0975109 | 0,423871726 |
| 2,426551724 | -0,561803391 | 0,077960508 | 0,336986237 |
| 2,52137931 | -0,528657414 | 0,07464007 | 0,302359202 |
| 2,616206897 | -0,488019888 | 0,063501346 | 0,240276393 |
| 2,711034483 | -0,469549919 | 0,060548535 | 0,226257599 |
| 2,805862069 | -0,435231251 | 0,050924815 | 0,194182509 |
| 2,900689655 | -0,417145788 | 0,043764463 | 0,172177791 |
| 2,995517241 | -0,394963964 | 0,037516146 | 0,155758898 |
| 3,090344828 | -0,379040725 | 0,033287465 | 0,145425858 |
| 3,185172414 | -0,358682456 | 0,031558701 | 0,137967532 |
| 3,28 | -0,348922501 | 0,028657761 | 0,12634577 |

