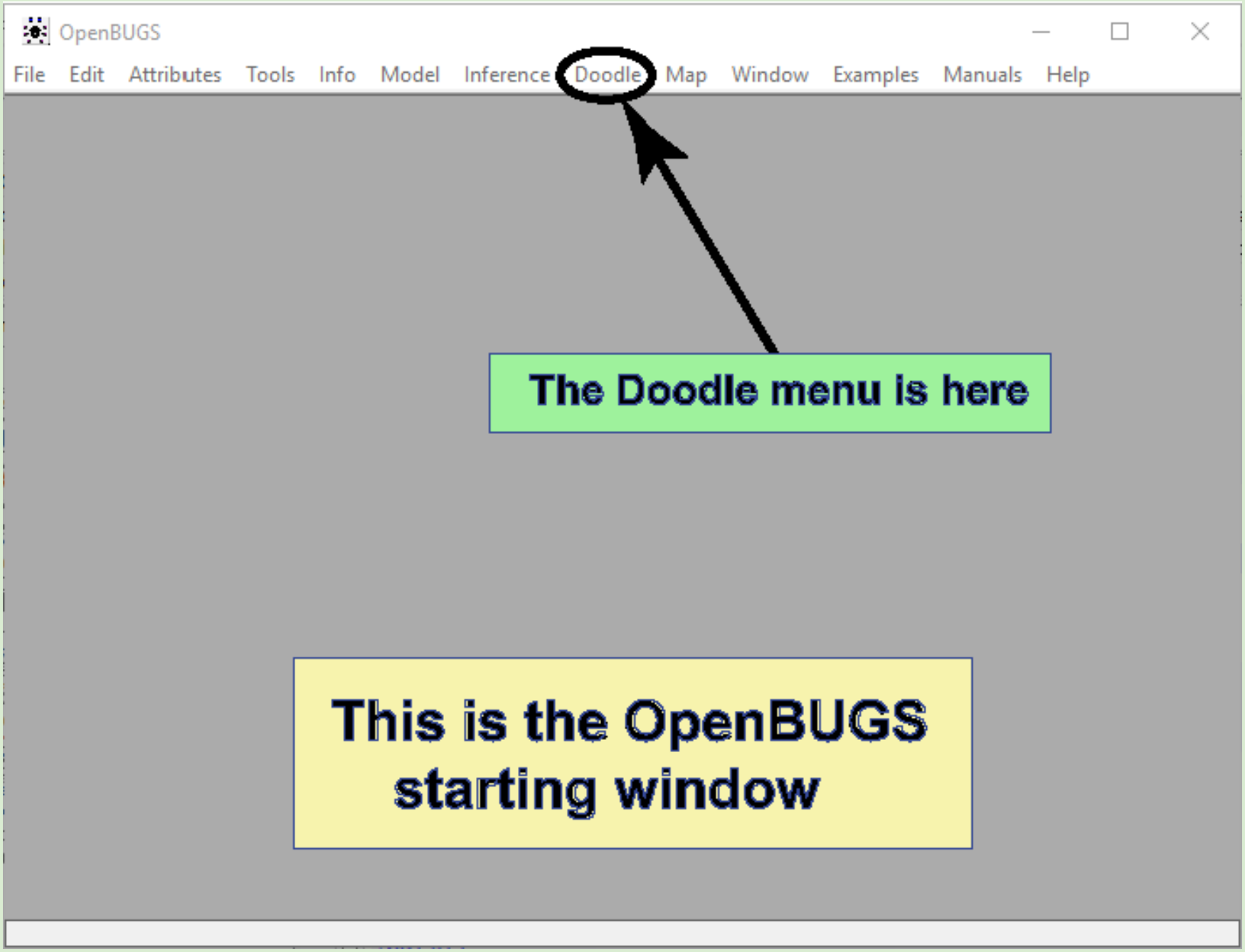
The Doodle Tool

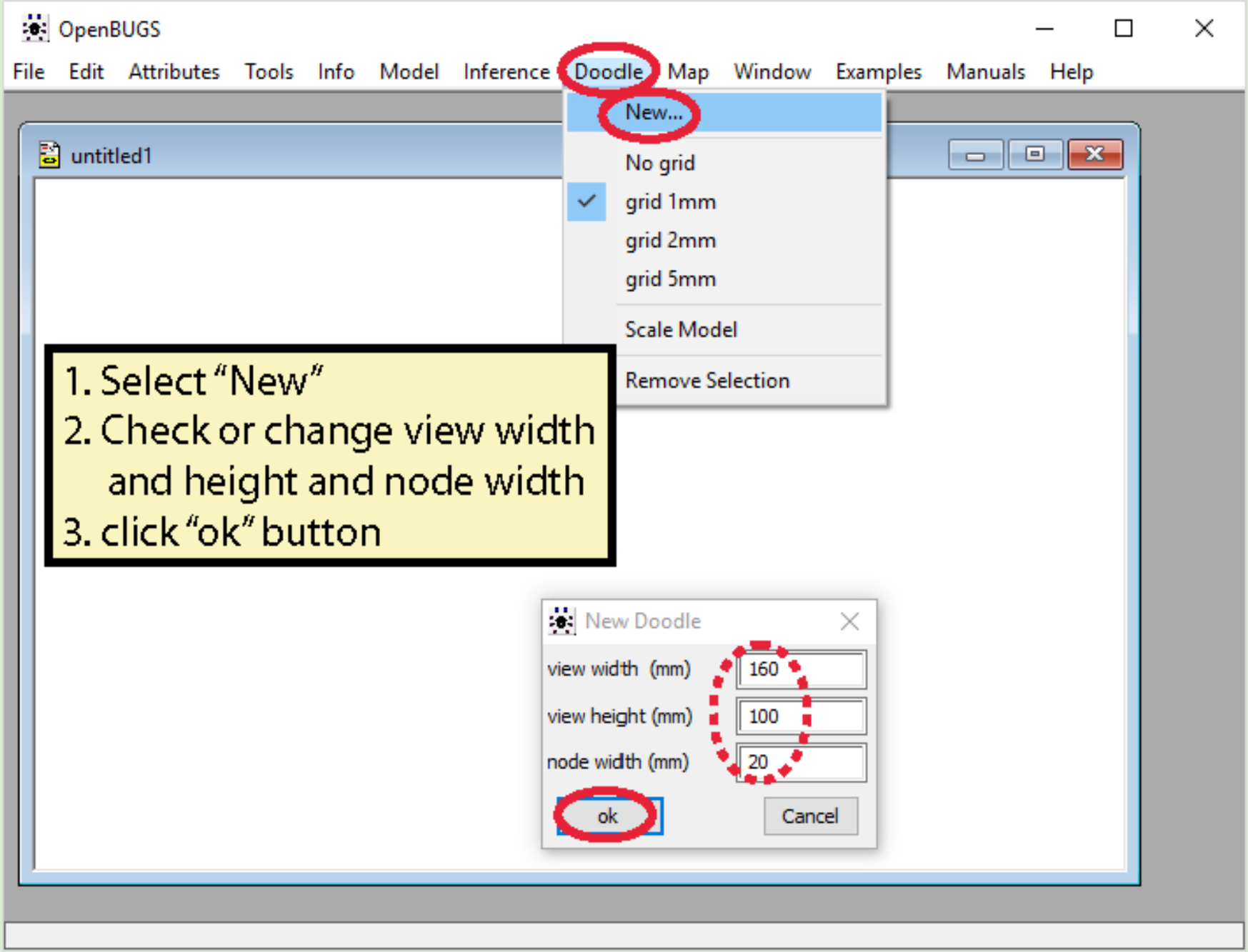
OpenBUGS

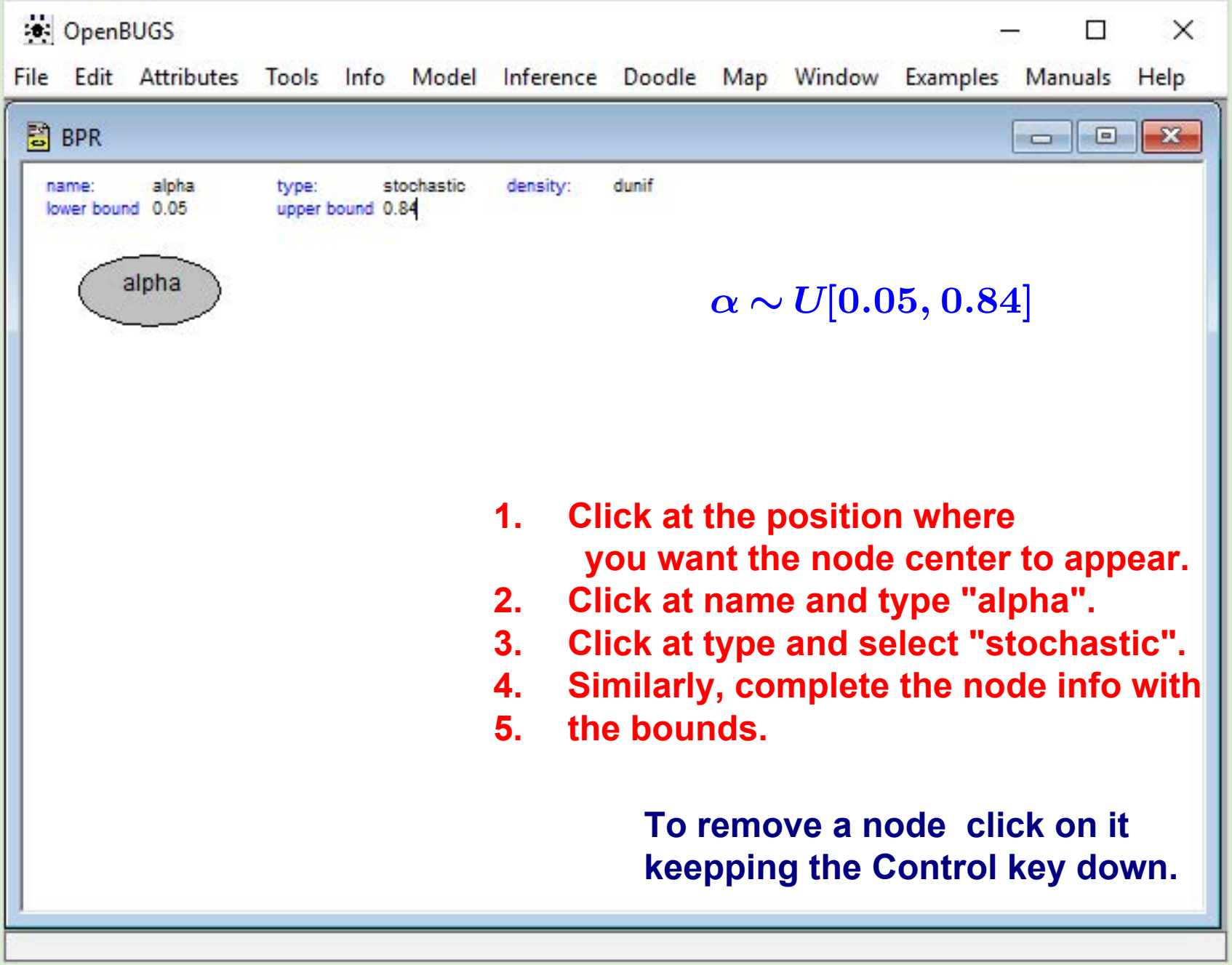
Some Hints To Work With Doodle

Some short-cuts to work with the Doodle tool are the following:

- **Create a node.** Click mouse at location and select node type and required data.
- **Select a node.** Click inside the node.
- **Delete a node.** Select node *+ control + delete*.
- **Move a node.** Select and drag node to new position
- **Create a plate.** *+ Control* + Click at its desired top-left corner
- **Select a plate.** Click at lower or right border.
- **Delete a plate.** Select plate *+ control + delete*.
- **Move a plate.** Select and drag plate. With *control* the content of the plate is moved too.
- **Resize a plate.** Change rectangle from lower-right corner.
- **Create an edge.** Select destination node and click with *control key* at node origin.
- **Delete an edge.** Select destination node and click with *control key* at node origin.
- **Move Doodle.** Select “Document” from “Edit” menu and copy + paste or drag.
- **Resize Doodle.** Select Doodle by clicking and resize rectangle.


OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Window Examples Manuals Help
The Doodle menu is here
This is the OpenBUGS starting window

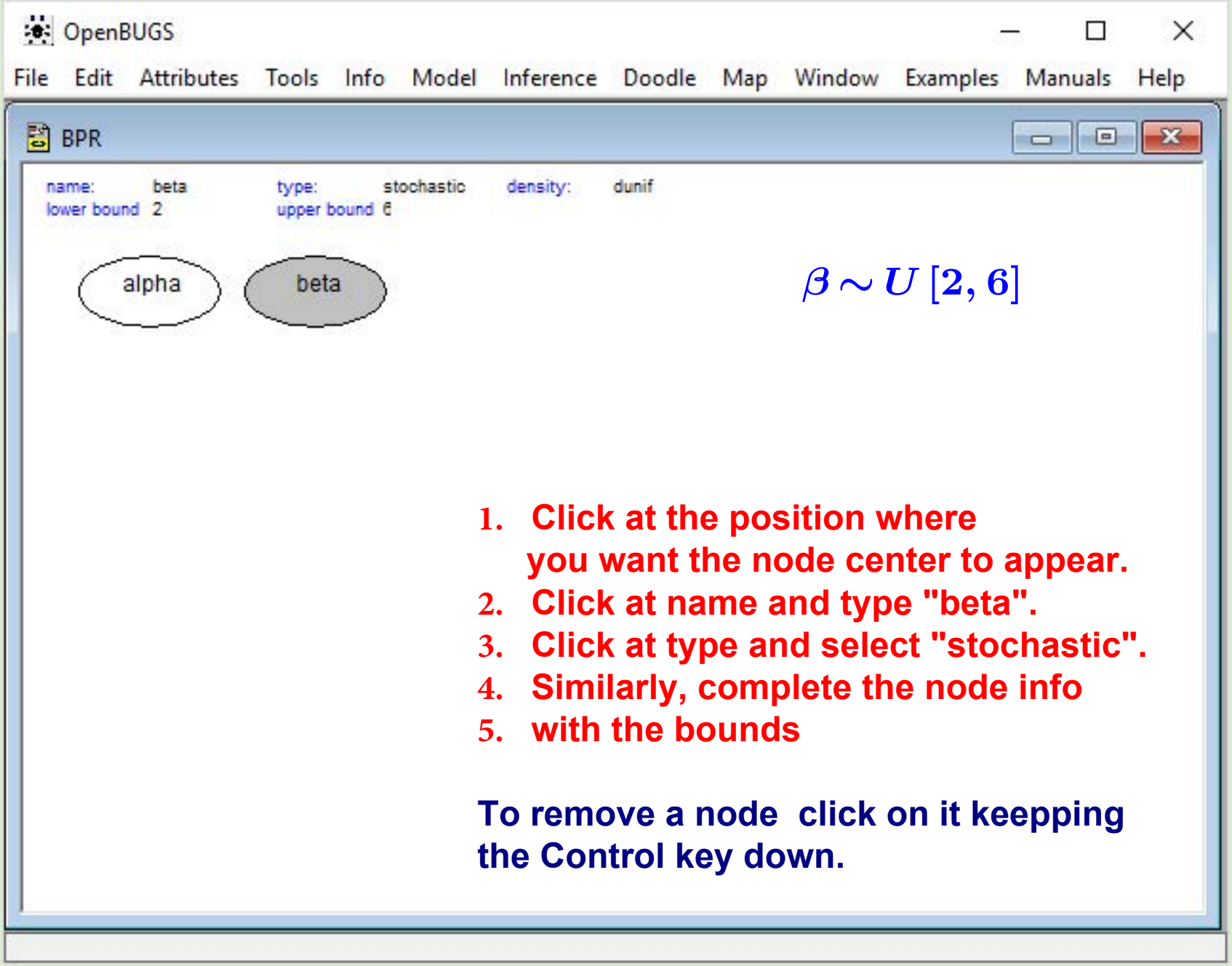

OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Window Examples Manuals Help
New...
No grid
grid 1mm
grid 2mm
grid 5mm
Scale Model
Remove Selection
untitled1
1. Select "New"
2. Check or change view width and height and node width
3. click "ok" button
New Doodle
view width (mm) 160
view height (mm) 100
node width (mm) 20
ok
Cancel



$$\alpha \sim U[0.05, 0.84]$$

1. Click at the position where you want the node center to appear.
2. Click at name and type "alpha".
3. Click at type and select "stochastic".
4. Similarly, complete the node info with
5. the bounds.

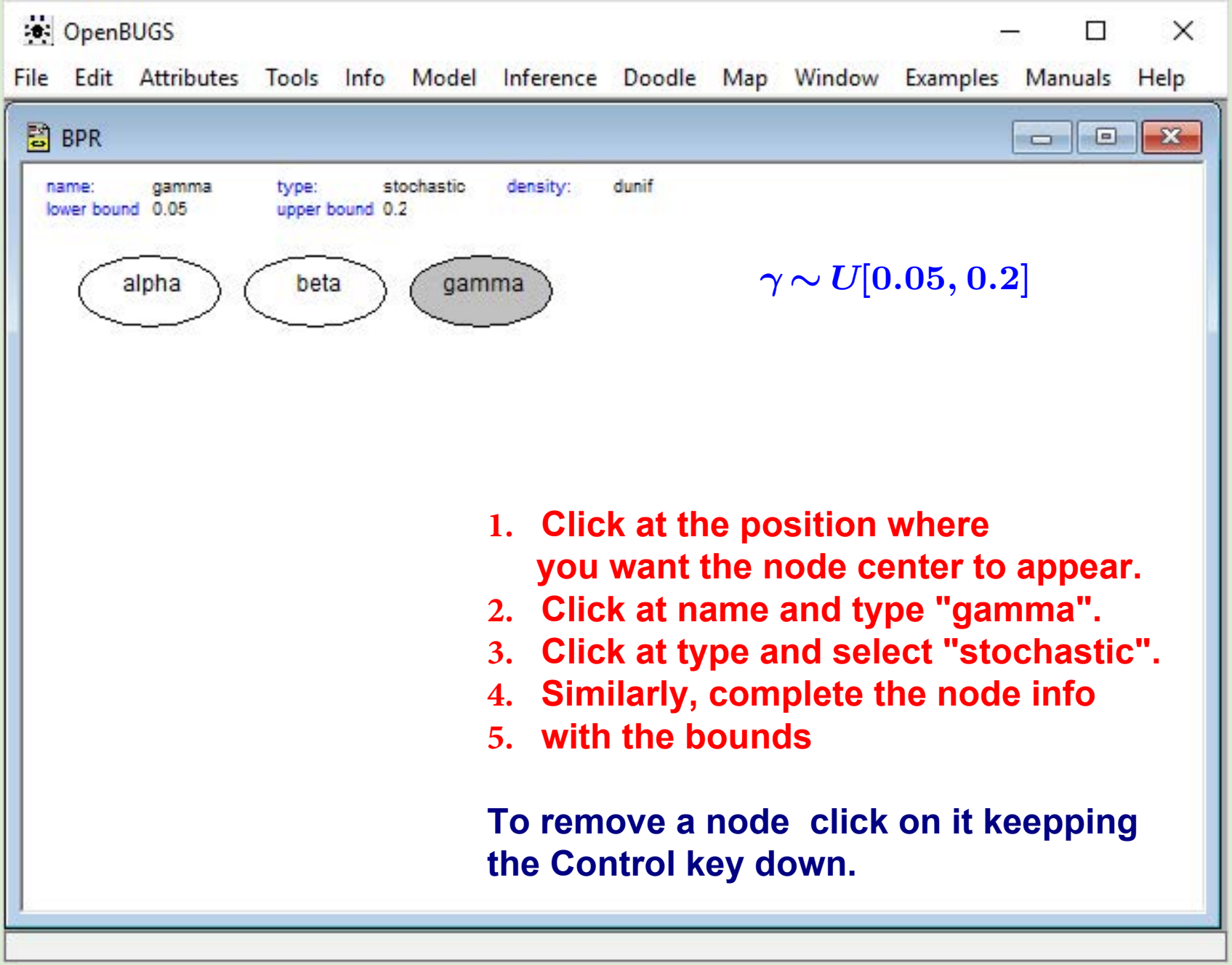
To remove a node click on it keepping the Control key down.



$$\beta \sim U\,[2, 6]$$

1. Click at the position where you want the node center to appear.
2. Click at name and type "beta".
3. Click at type and select "stochastic".
4. Similarly, complete the node info
5. with the bounds

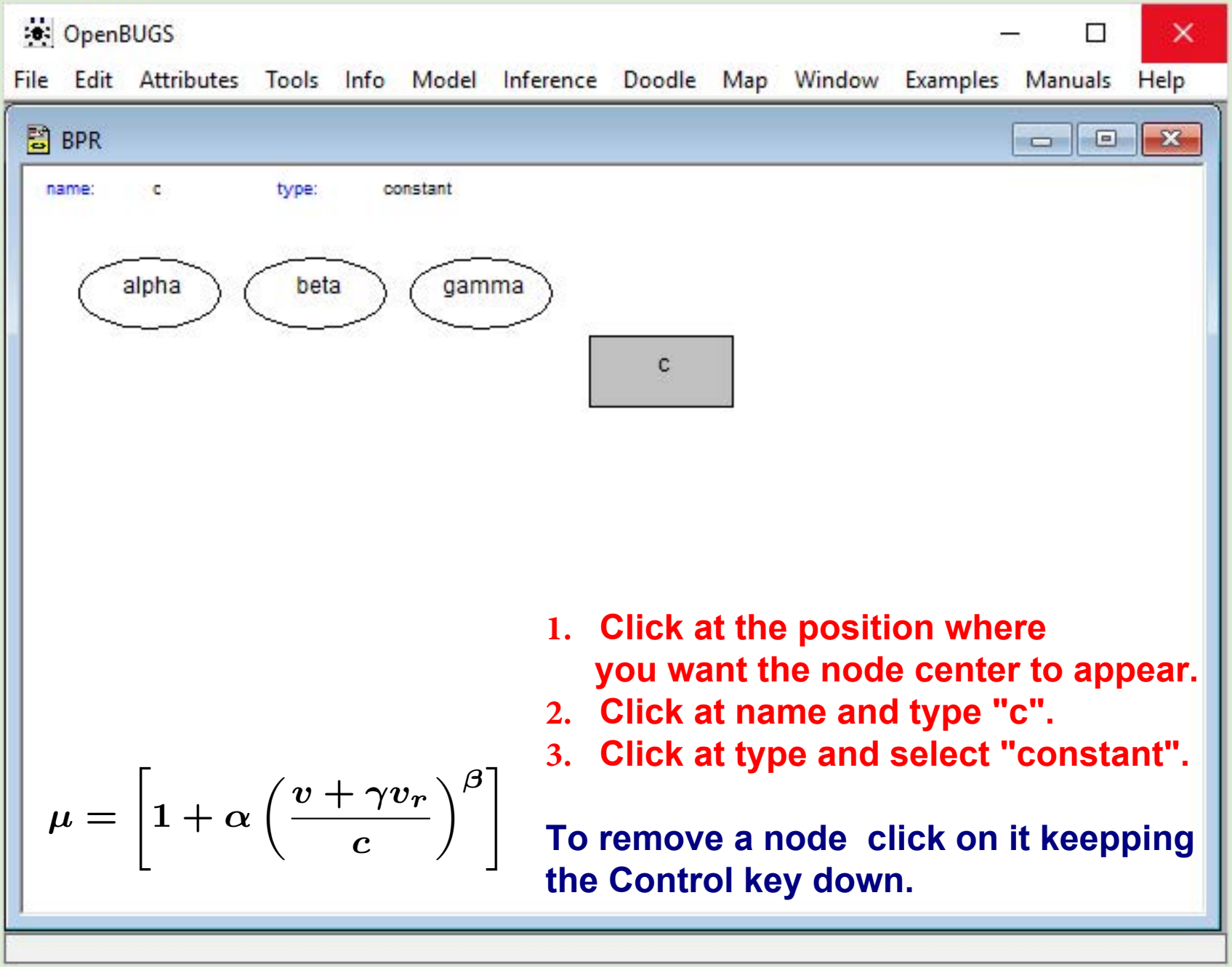
To remove a node click on it keepping the Control key down.



$\gamma \sim U[0.05, 0.2]$

1. Click at the position where you want the node center to appear.
2. Click at name and type "gamma".
3. Click at type and select "stochastic".
4. Similarly, complete the node info
5. with the bounds

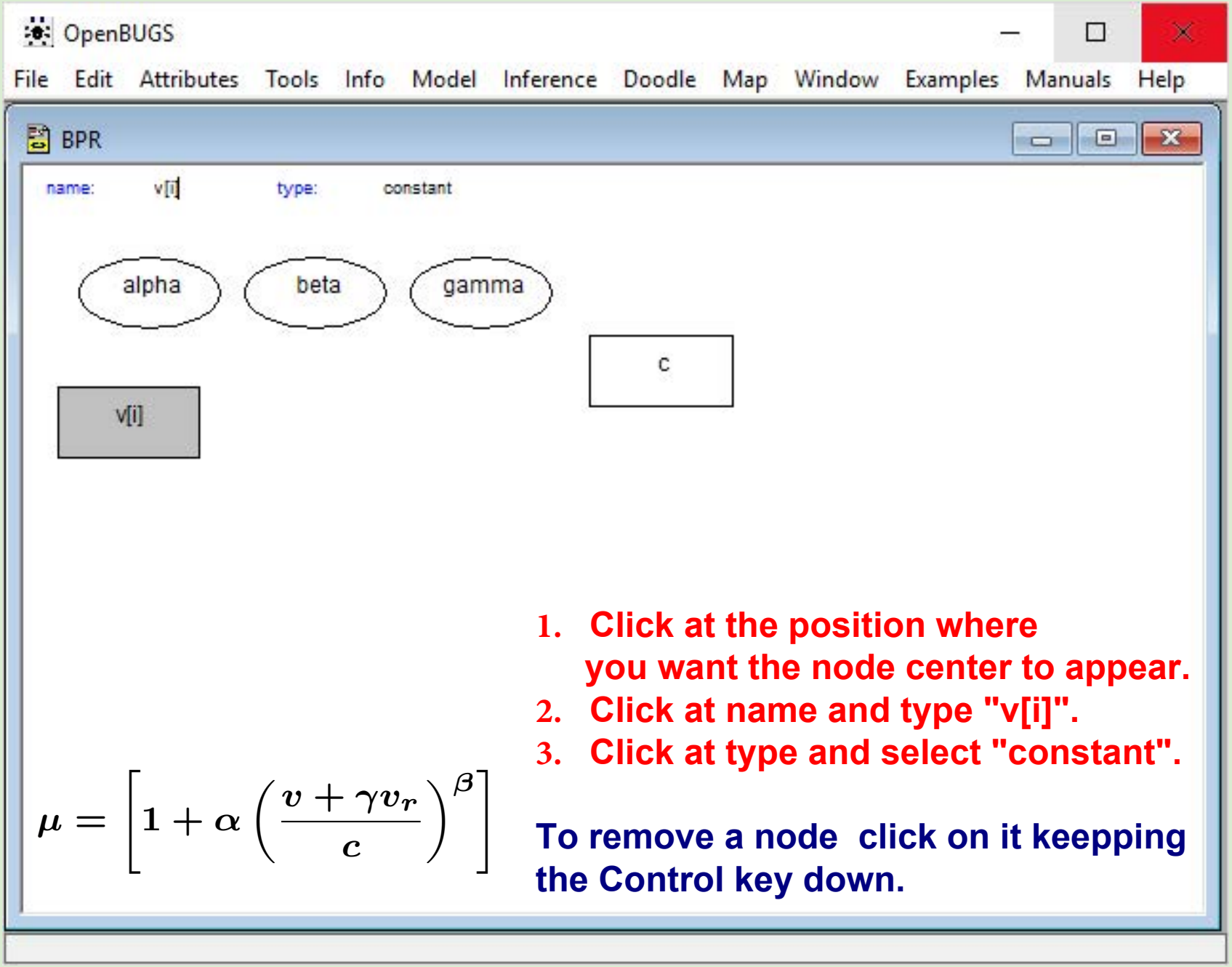
To remove a node click on it keepping the Control key down.



1. Click at the position where you want the node center to appear.
2. Click at name and type "c".
3. Click at type and select "constant".

$$\mu = \left[1 + \alpha \left(\frac{v + \gamma v_r}{c}\right)^{\beta}\right]$$

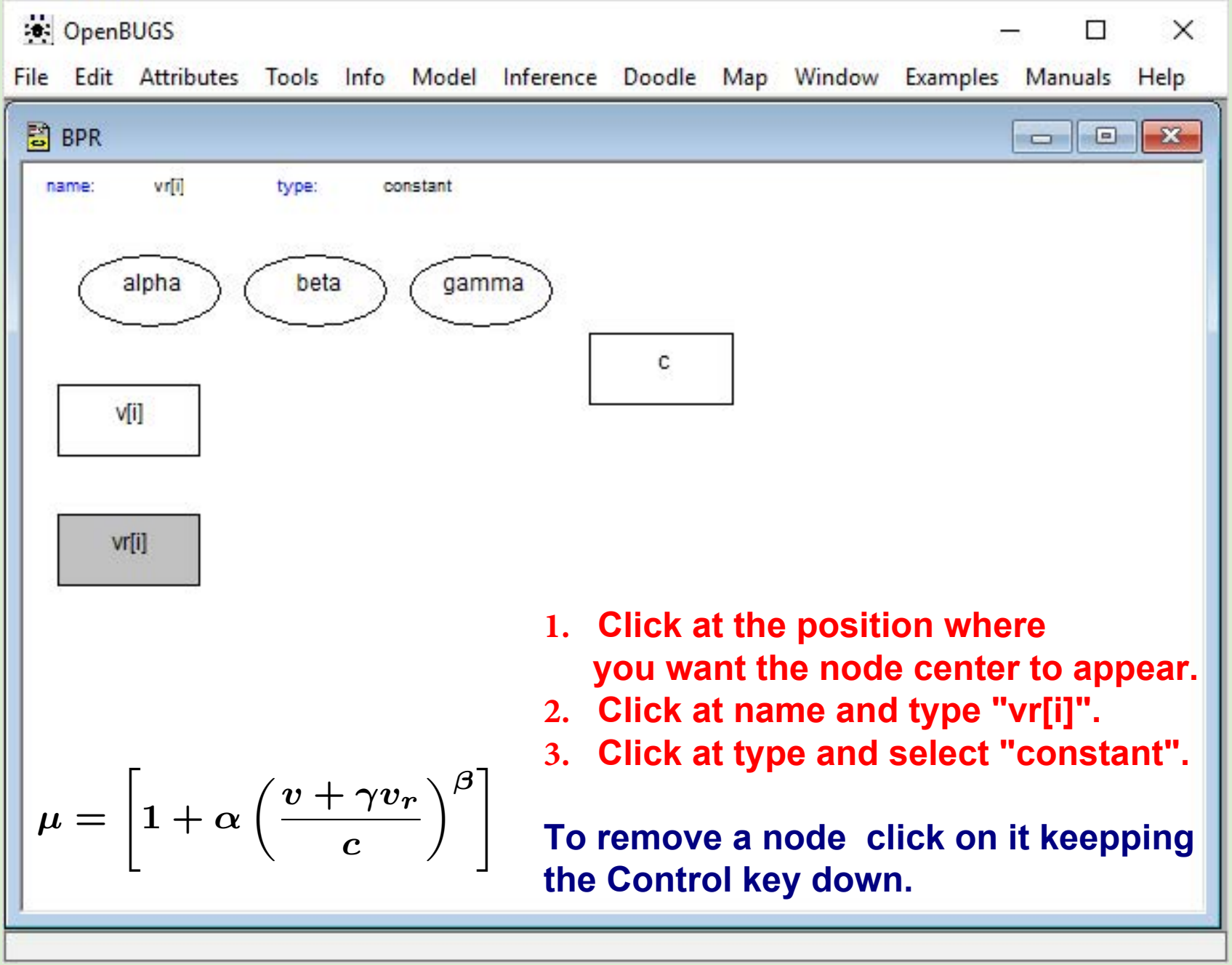
To remove a node click on it keepping the Control key down.



1. Click at the position where you want the node center to appear.
2. Click at name and type "v[i]".
3. Click at type and select "constant".

$$\mu = \left[1 + \alpha \left(\frac{v + \gamma v_r}{c}\right)^{\beta}\right]$$

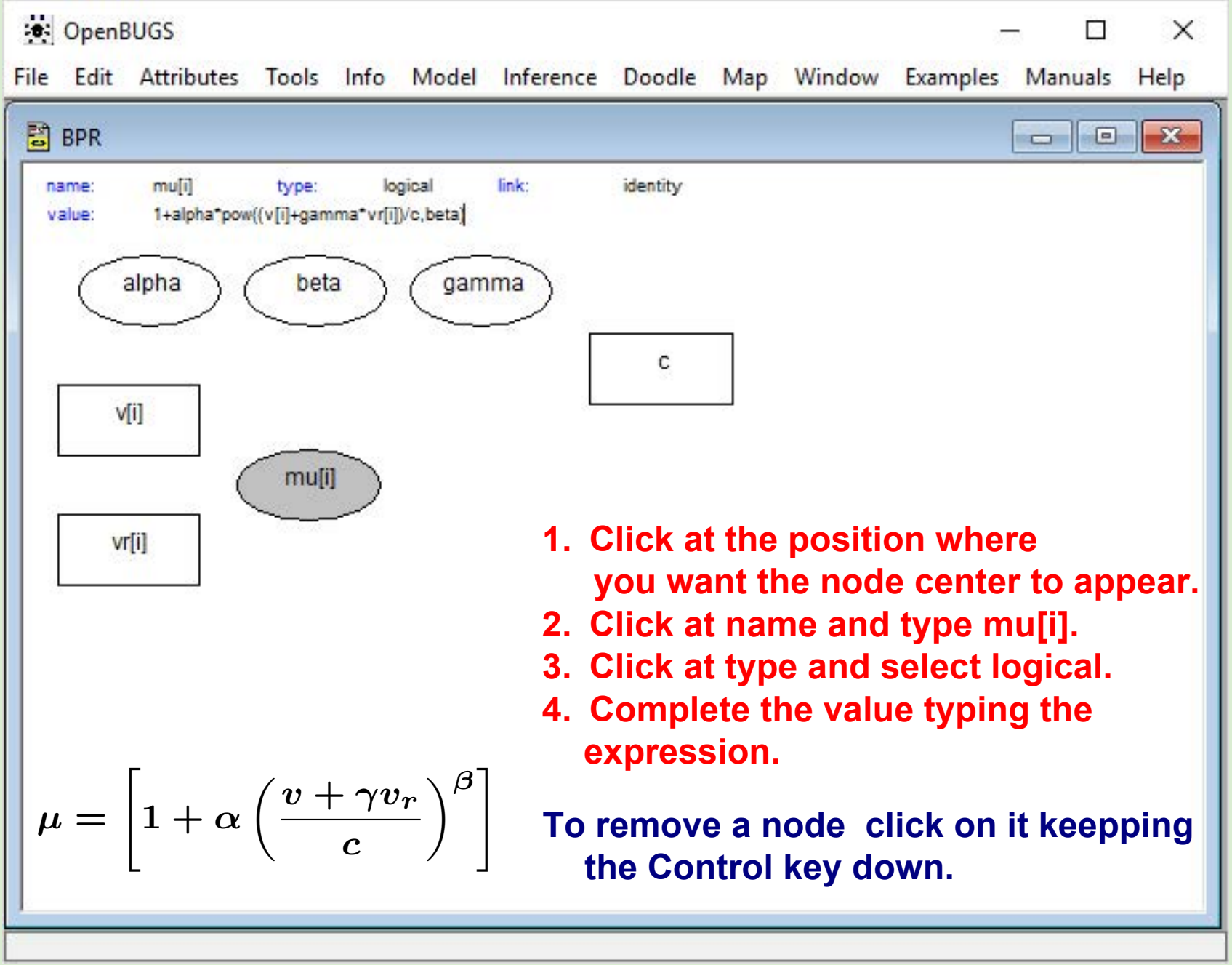
To remove a node click on it keepping the Control key down.



1. Click at the position where you want the node center to appear.
2. Click at name and type "vr[i]".
3. Click at type and select "constant".

$$\mu = \left[1 + \alpha \left(\frac{v + \gamma v_r}{c}\right)^{\beta}\right]$$

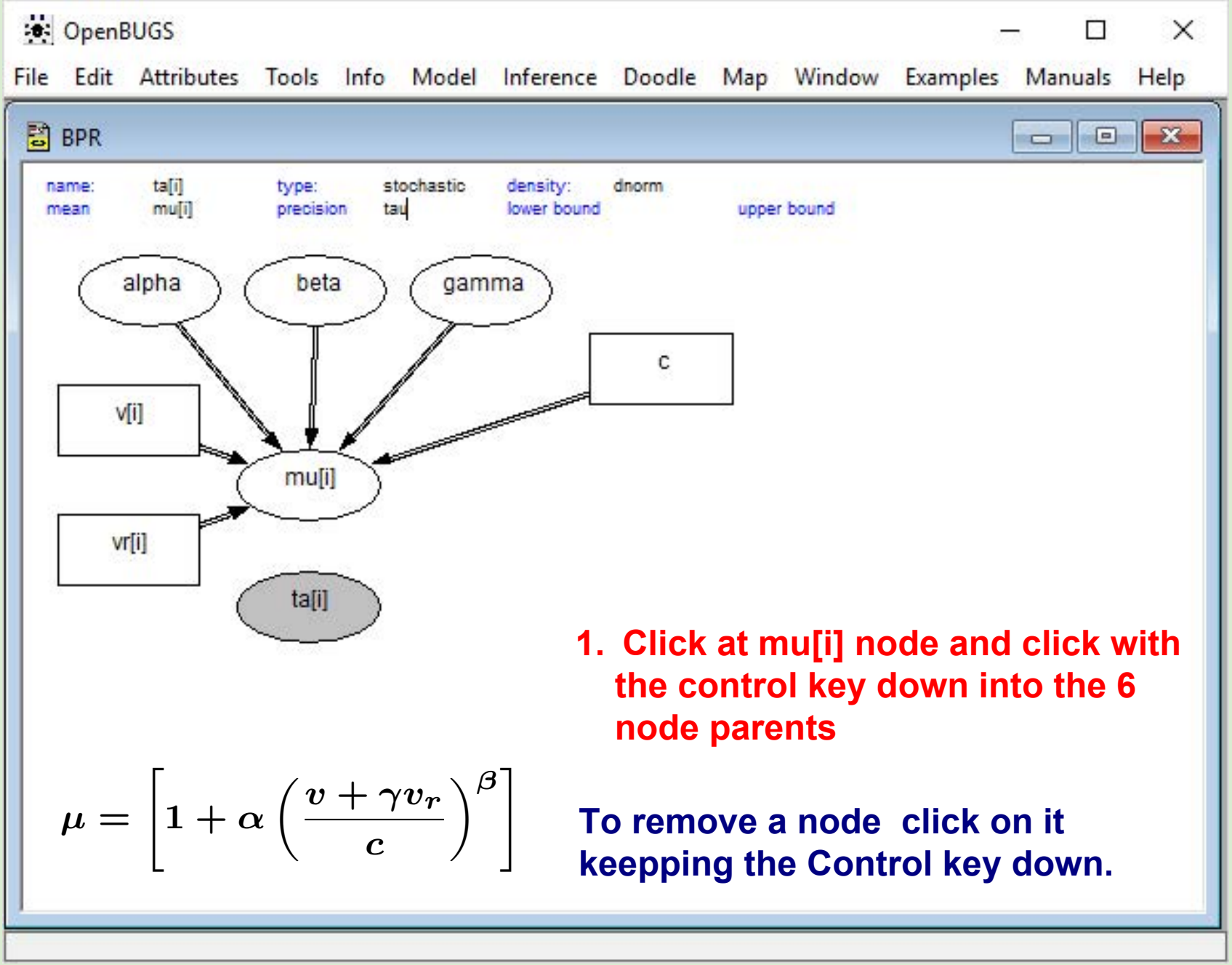
To remove a node click on it keepping the Control key down.



$$\mu = \left[1 + \alpha \left(\frac{v + \gamma v_r}{c}\right)^{\beta}\right]$$

1. Click at the position where you want the node center to appear.
2. Click at name and type mu[i].
3. Click at type and select logical.
4. Complete the value typing the expression.

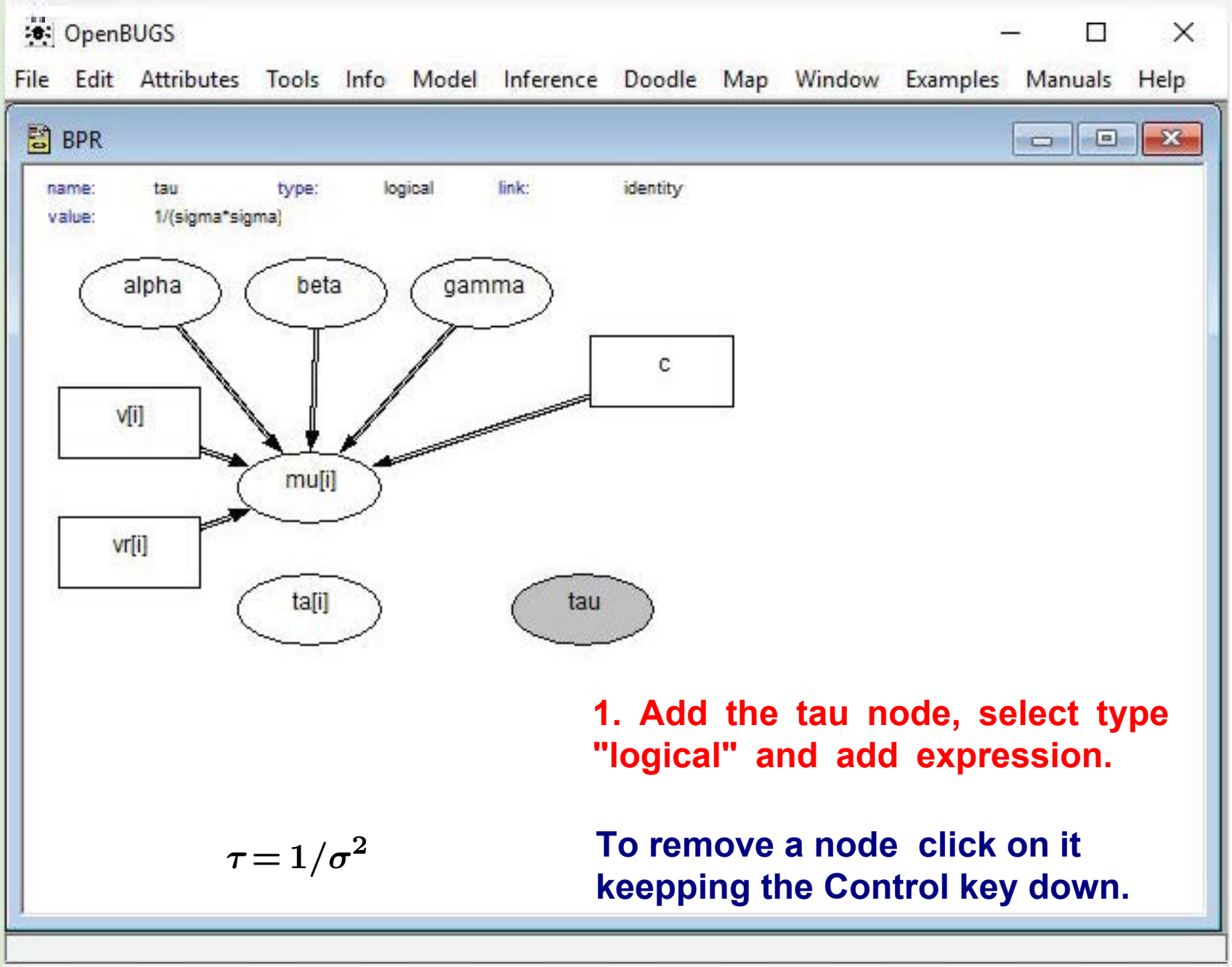
To remove a node click on it keepping the Control key down.



1. Click at mu[i] node and click with the control key down into the 6 node parents

$$\mu = \left[1 + \alpha \left(\frac{v + \gamma v_r}{c}\right)^{\beta}\right]$$

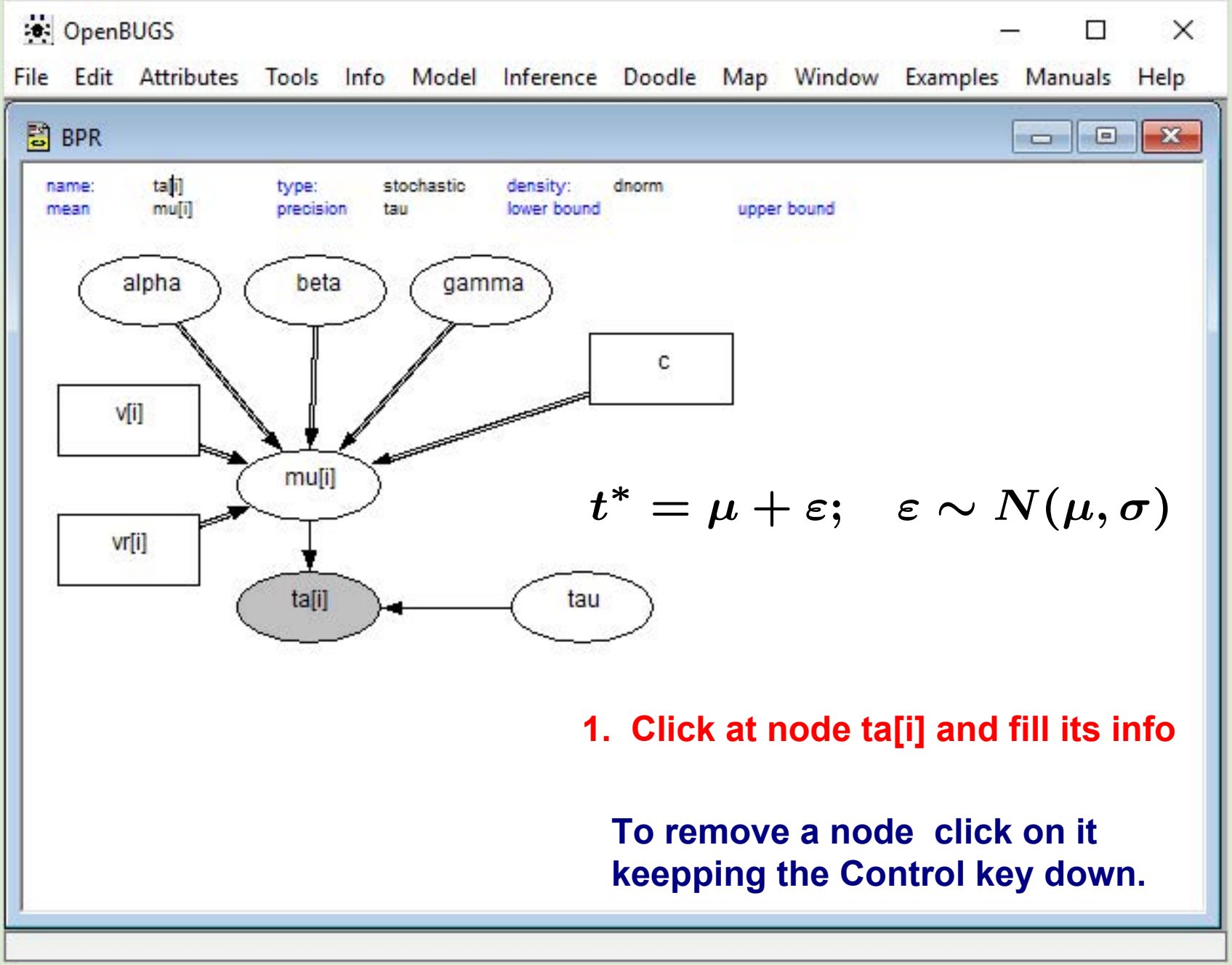
To remove a node click on it keepping the Control key down.



1. Add the tau node, select type "logical" and add expression.

$$\tau = 1/\sigma^2$$

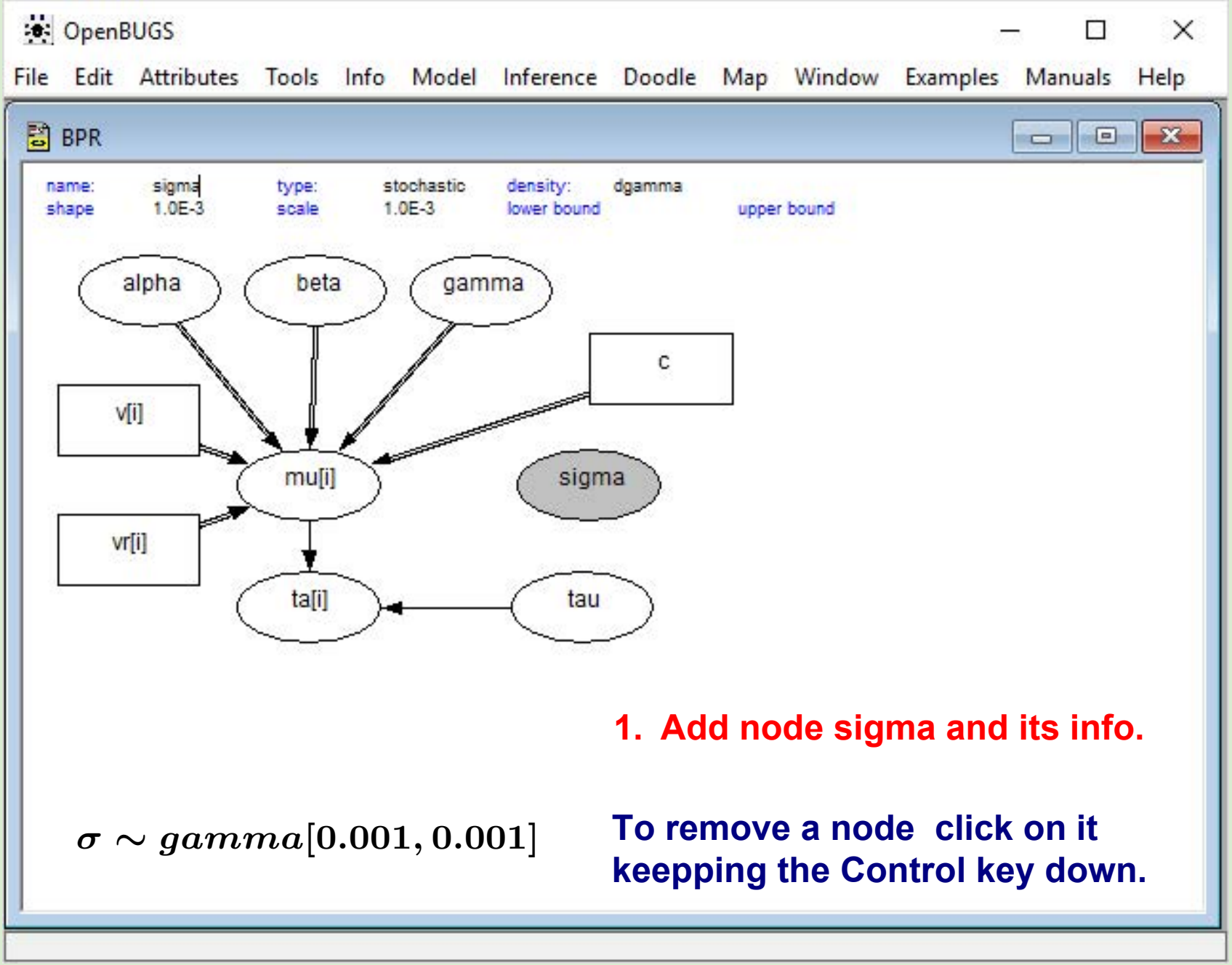
To remove a node click on it keepping the Control key down.



$$t^* = \mu + \varepsilon; \quad \varepsilon \sim N(\mu, \sigma)$$

1. Click at node ta[i] and fill its info

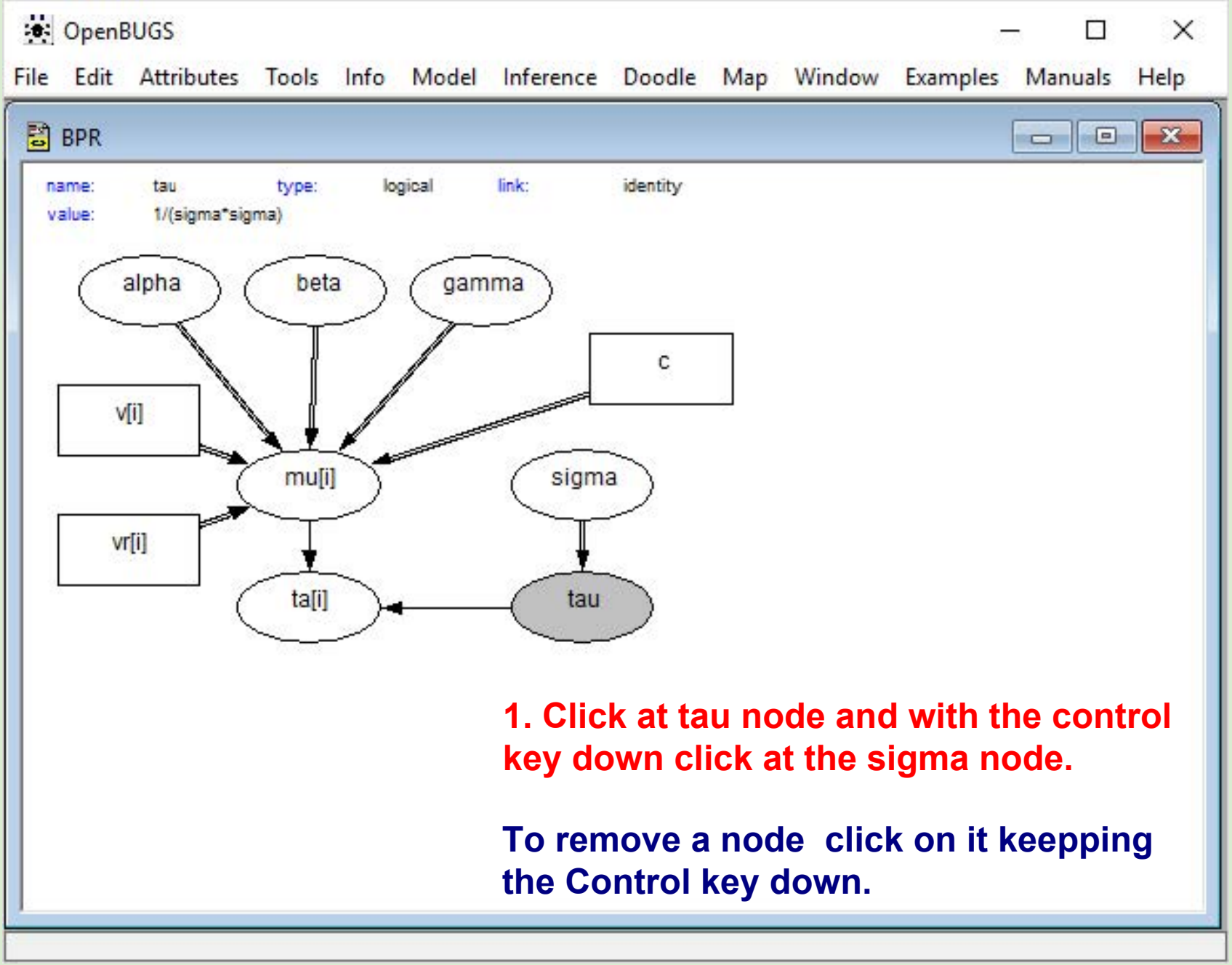
To remove a node click on it keepping the Control key down.



1. Add node sigma and its info.

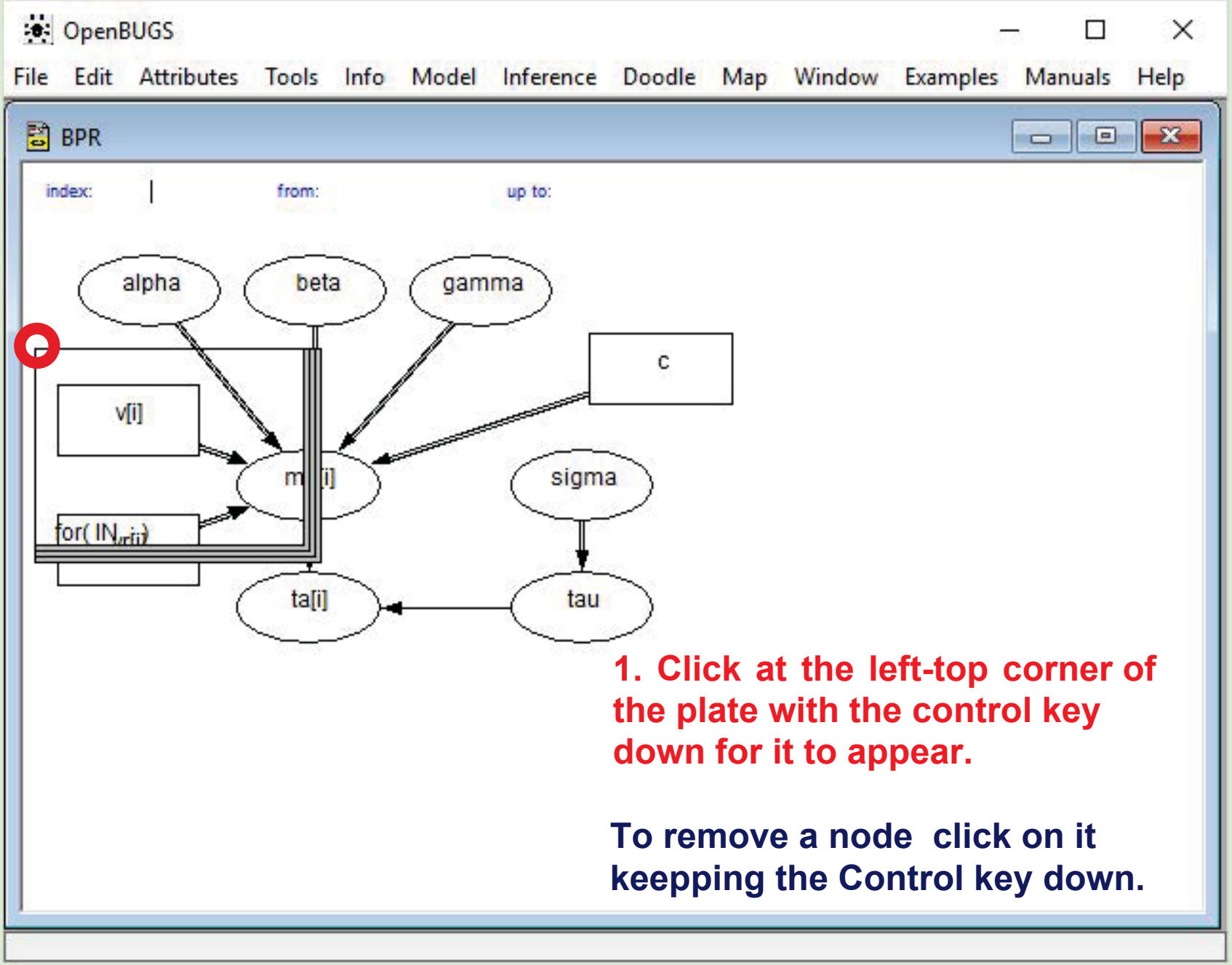
$$\sigma \sim gamma[0.001, 0.001]$$

To remove a node click on it keepping the Control key down.



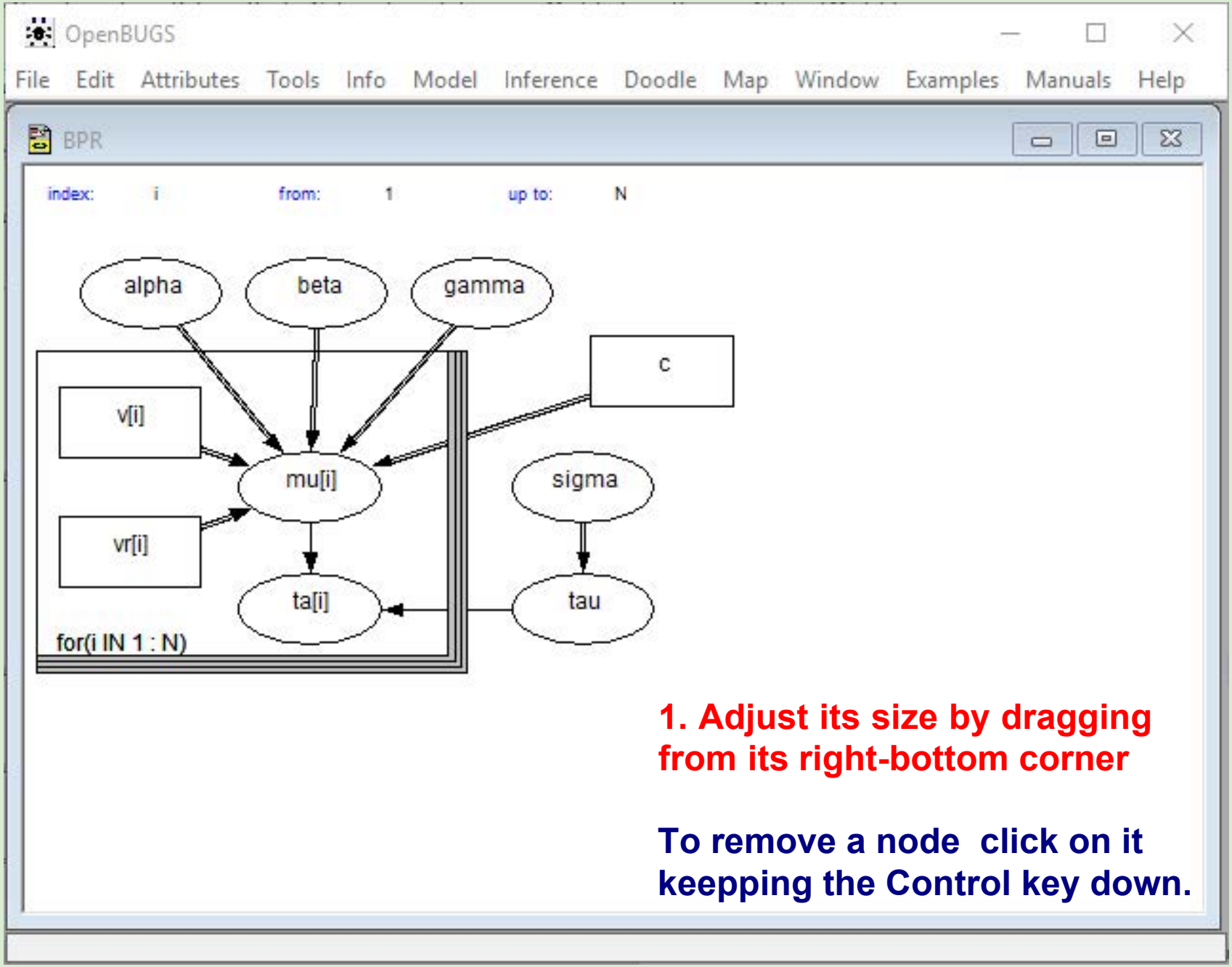
1. Click at tau node and with the control key down click at the sigma node.

To remove a node click on it keepping the Control key down.



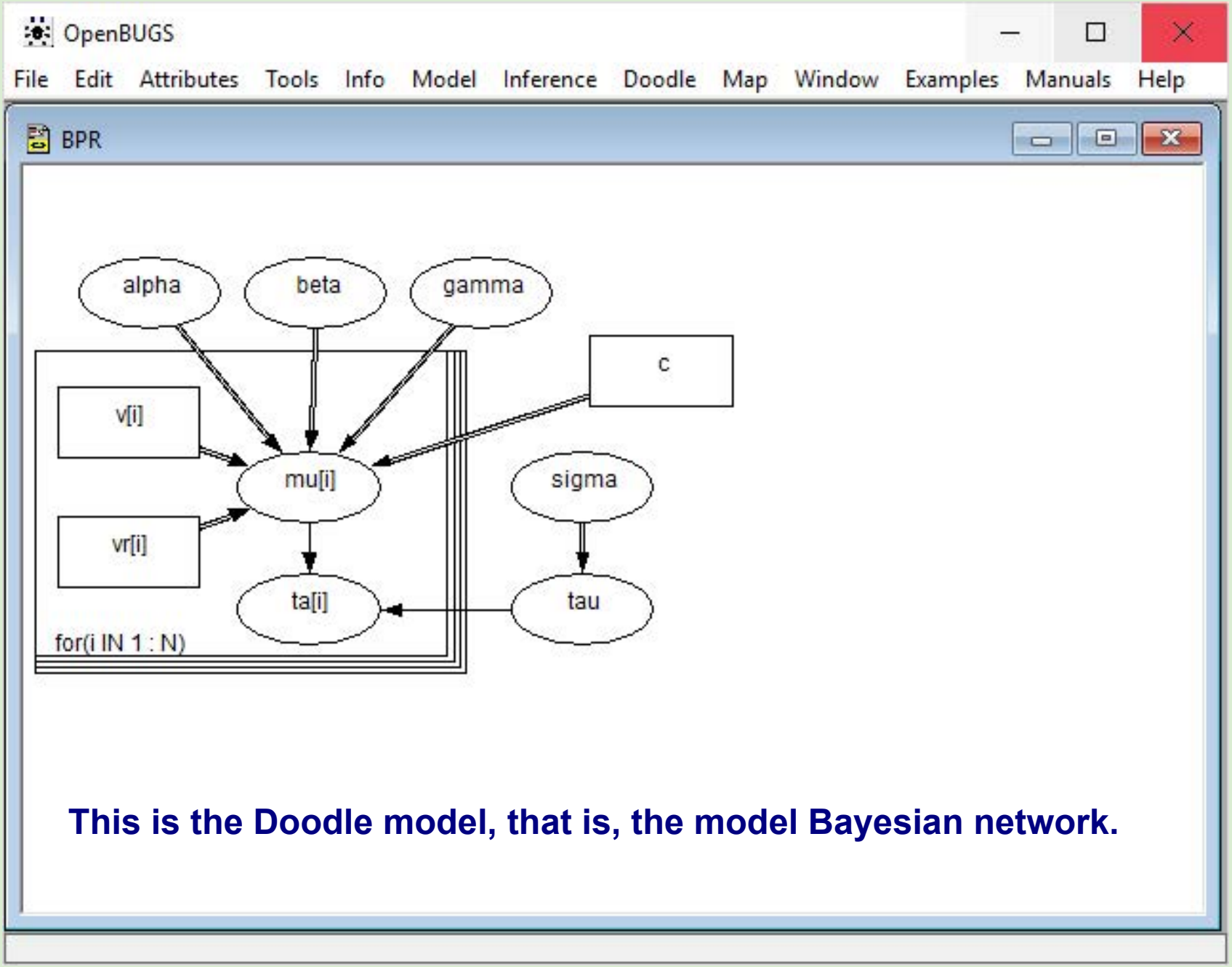
1. Click at the left-top corner of the plate with the control key down for it to appear.

To remove a node click on it keepping the Control key down.

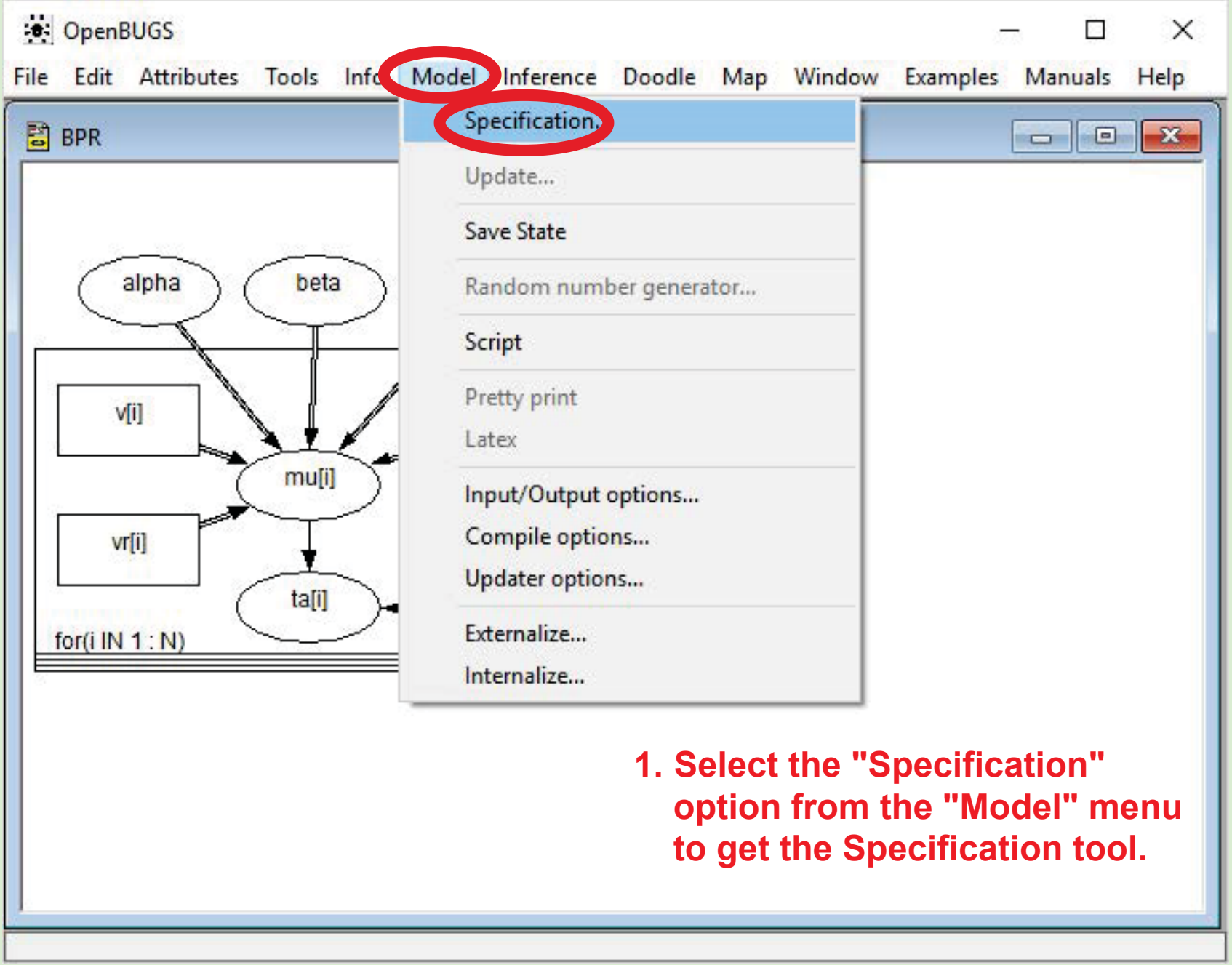


1. Adjust its size by dragging from its right-bottom corner

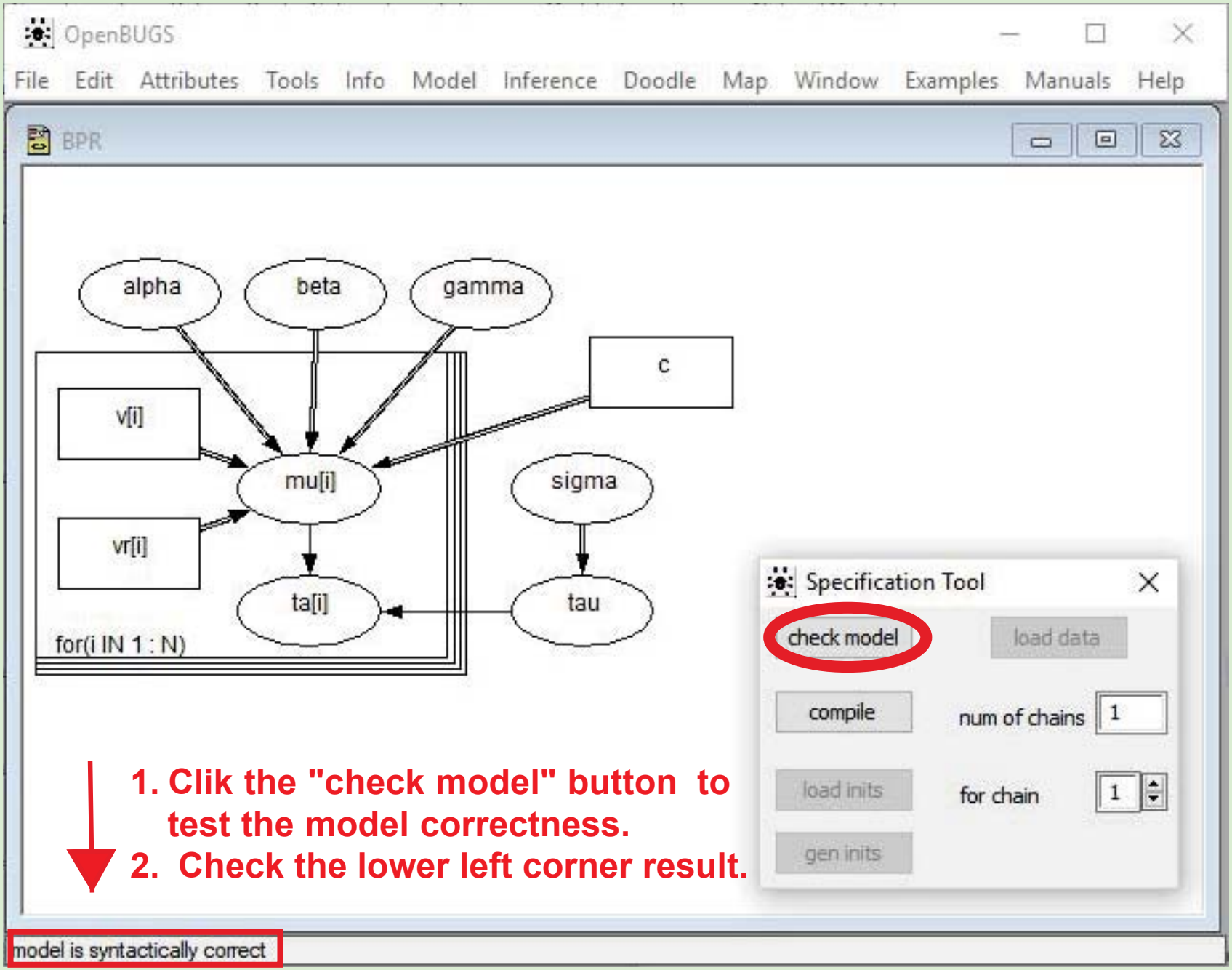
To remove a node click on it keepping the Control key down.

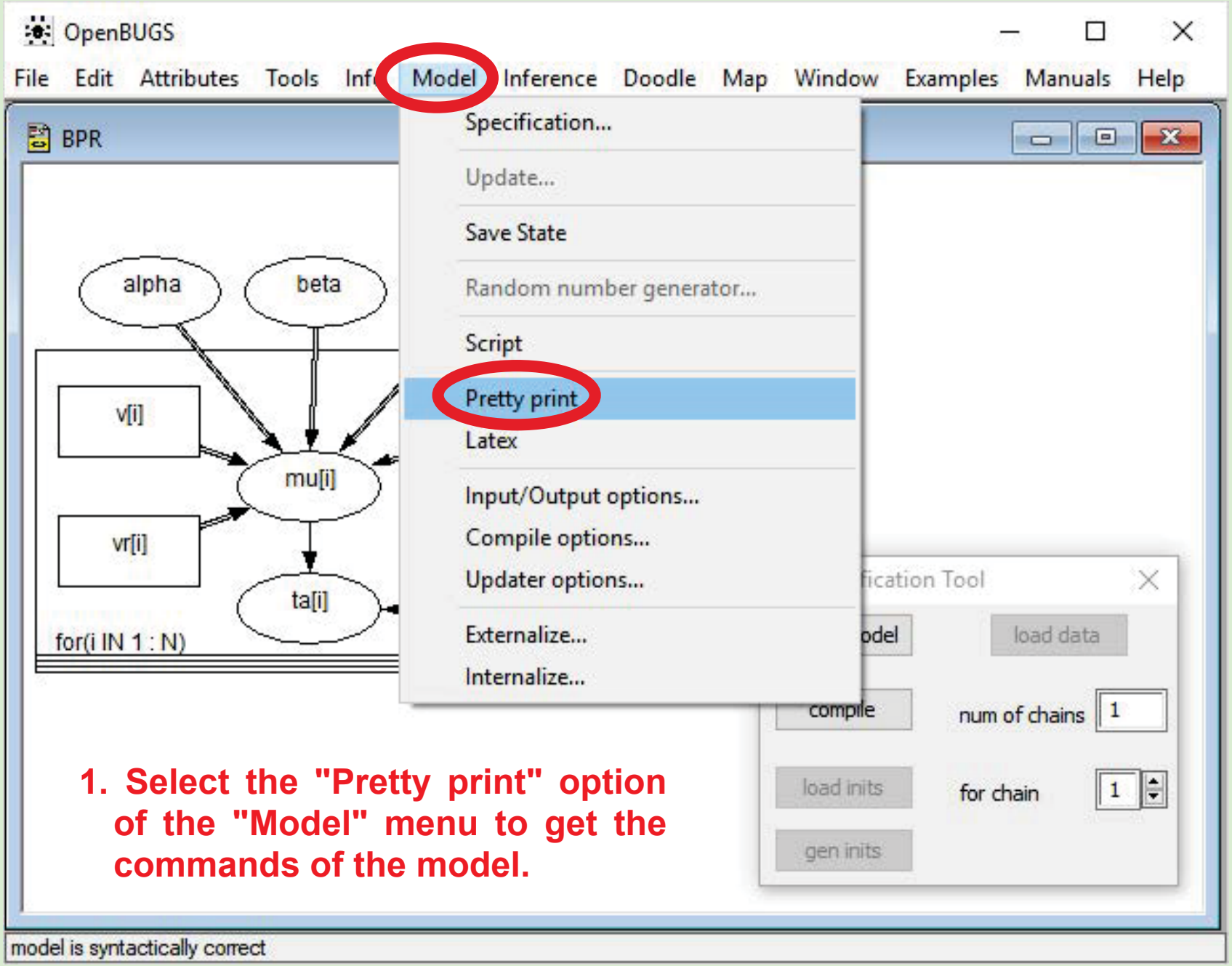


This is the Doodle model, that is, the model Bayesian network.



1. Select the "Specification" option from the "Model" menu to get the Specification tool.


OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Window Examples Manuals Help
BPR
alpha
beta
gamma
c
v[i]
mu[i]
sigma
vr[i]
ta[i]
tau
for(i IN 1 : N)
Specification Tool
check model
load data
compile
num of chains
1
load inits
for chain
1
gen inits
1. Clik the "check model" button to test the model correctness.
2. Check the lower left corner result.
model is syntactically correct



1. Select the "Pretty print" option of the "Model" menu to get the commands of the model.

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Commands.txt

```
model {
  for (i in 1:N){
      ta[i]~dnorm(mu[i],tau)
      mu[i]<-1+alpha*pow((v[i]+gamma*vr[i])/c,beta)
  }
  alpha~dunif(0.05,0.84)
  beta~dunif(2,6)
  gamma~dunif(0.05,0.2)
  sigma~dgamma(0.001,0.001)
  tau<-1/(sigma*sigma)
}
```

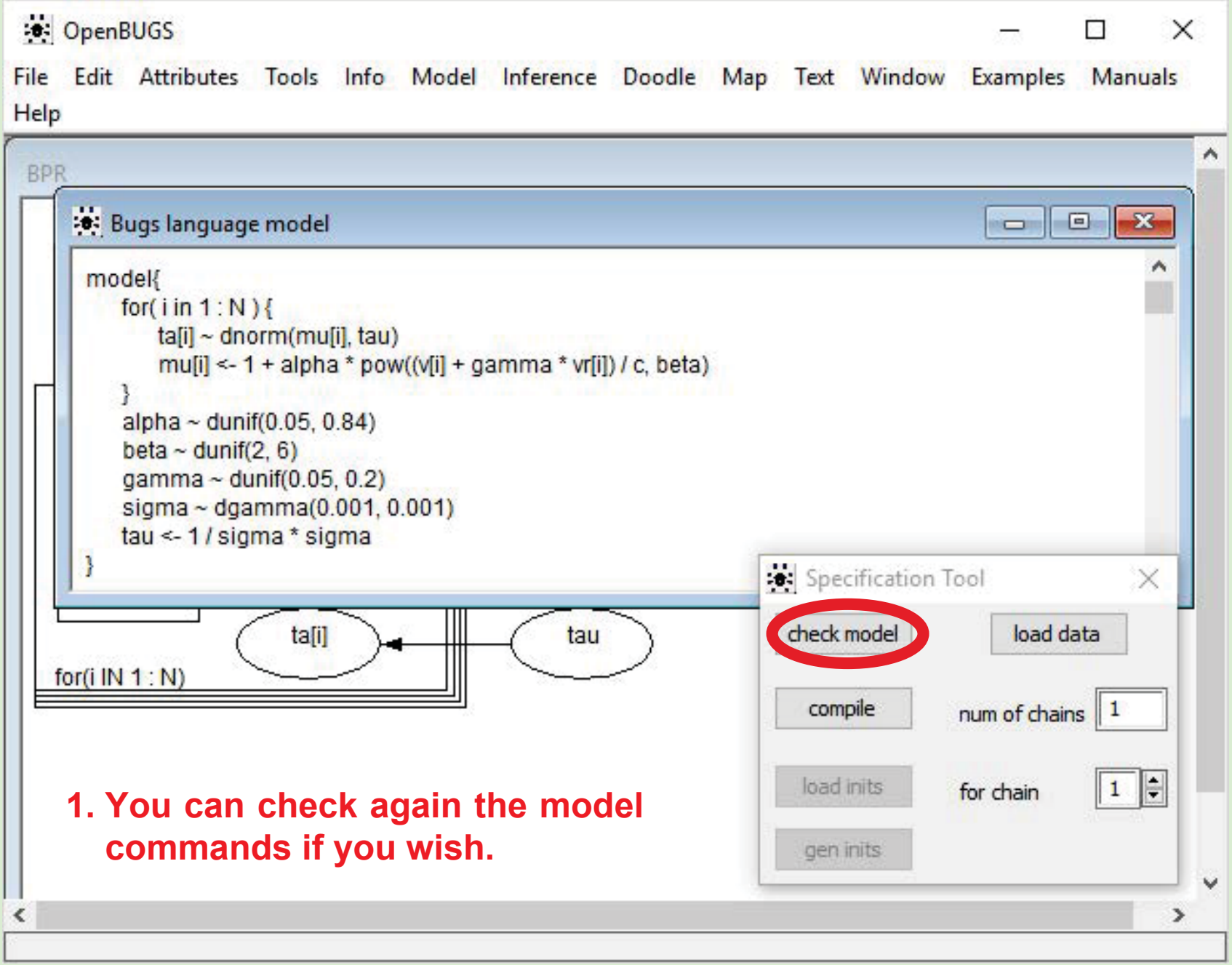
ORDER OF COMMANDS IS UNIMPORTANT

BLOCK DELIMITERS : { } (model and for loop)

"LOGICAL" RELATION: <-

"STOCHASTIC" RELATION: ~

FOR LOOP RANGE: (i in 1:N)



1. You can check again the model commands if you wish.

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Dataformat.txt

```
list(N=20,c=1000,
v=c(279.24, 431.76, 270.12, 240.86, 262.87,
      285.61, 286.77, 348.19, 316.92, 382.20),
vr=c(241.93, 470.22, 345.40, 319.78, 179.87,
       193.42, 220.74, 423.82, 236.59, 366.42),
ta=c(0.99, 1.01, 0.99, 0.99, 1.00,
      0.99, 0.99,  0.99, 0.99, 1.01))

DATA IS A LIST: list ( .... )

CONSTANTS: N=10,

UNIDIMENSIONAL ARRAY: c( .... ),

BIDIMENSIONAL ARRAY:
                    Y = structure(
                 .Data =   c(234, 432, 231, 476, 135,
                             225, 110, 309, 241, 189,
                             213, 342, 137, 222, 342),
                 .Dim = c(3,5))
```

saved

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Initials1.txt

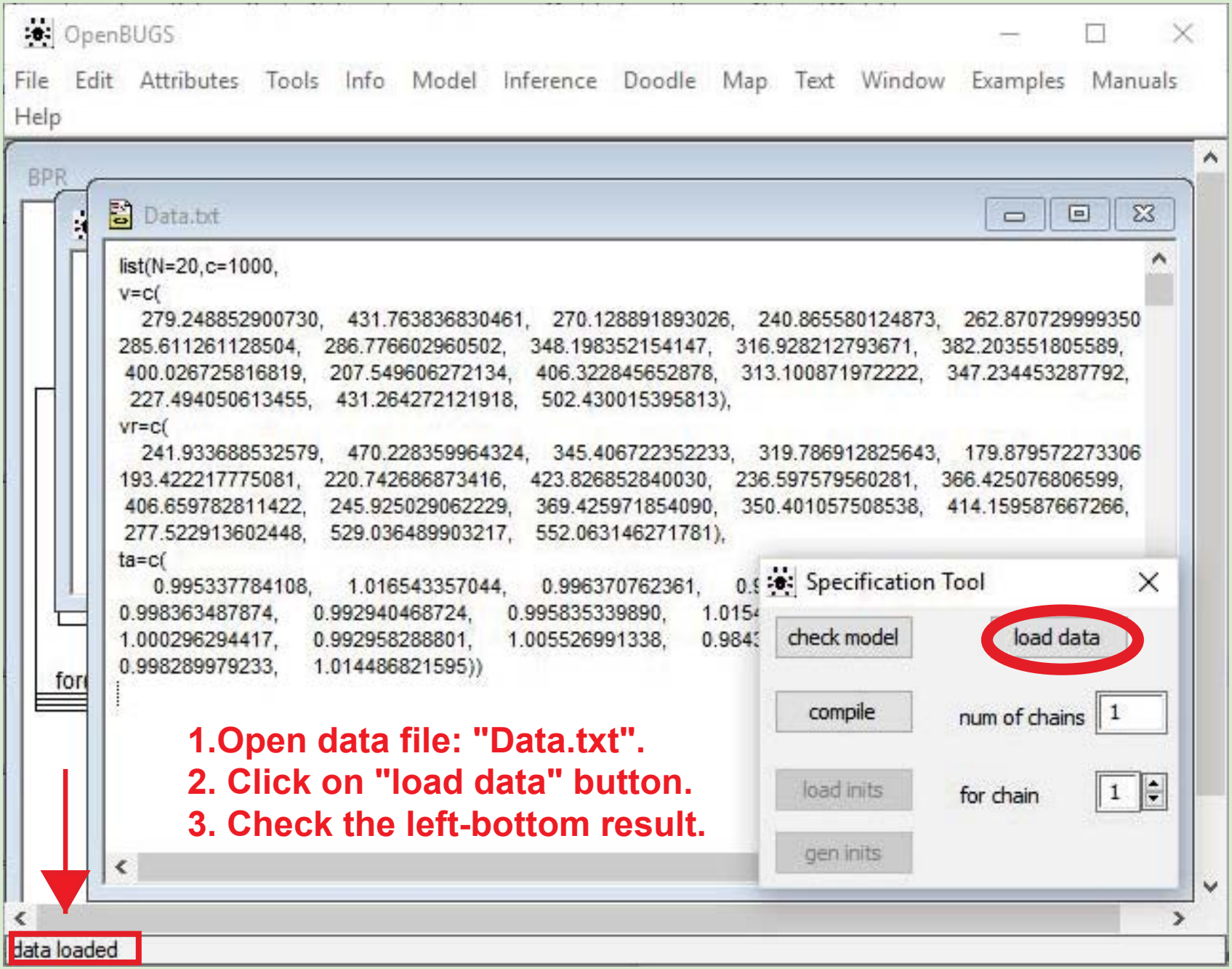
```
list(alpha=0.2,beta=4,gamma=0.1,sigma=0.01)
```

IT IS A LIST WITH SAME FORMAT AS DATA LIST

ONE SEPARATED FILE PER INITIAL

THE NUMBER OF CHAINS MUST BE GIVEN BEFORE COMPILING THE PROGRAM

IN SOME CASES THE INITIALS CAN BE GENERATED AUTOMATICALLY BY SIMULATION


OpenBUGS
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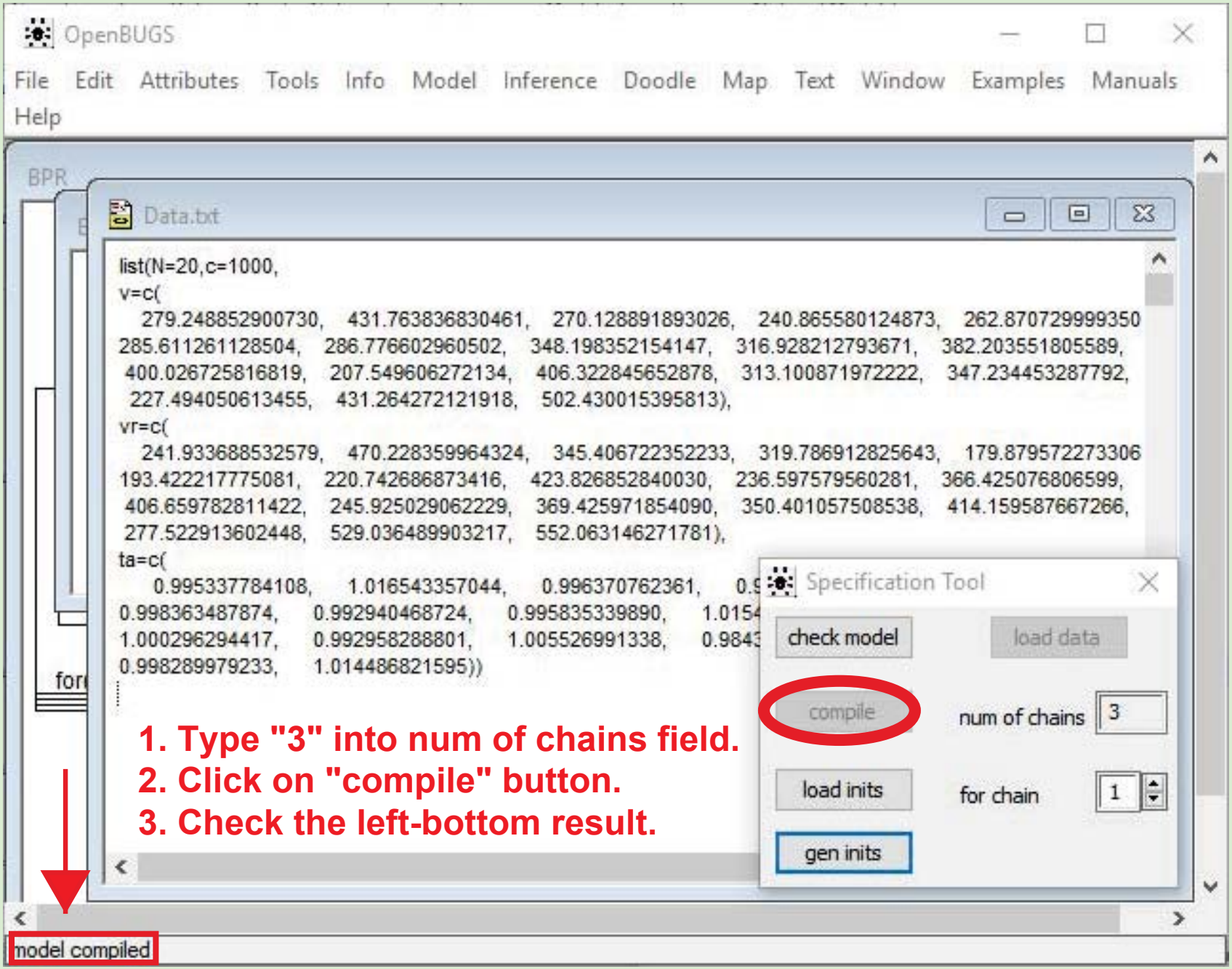
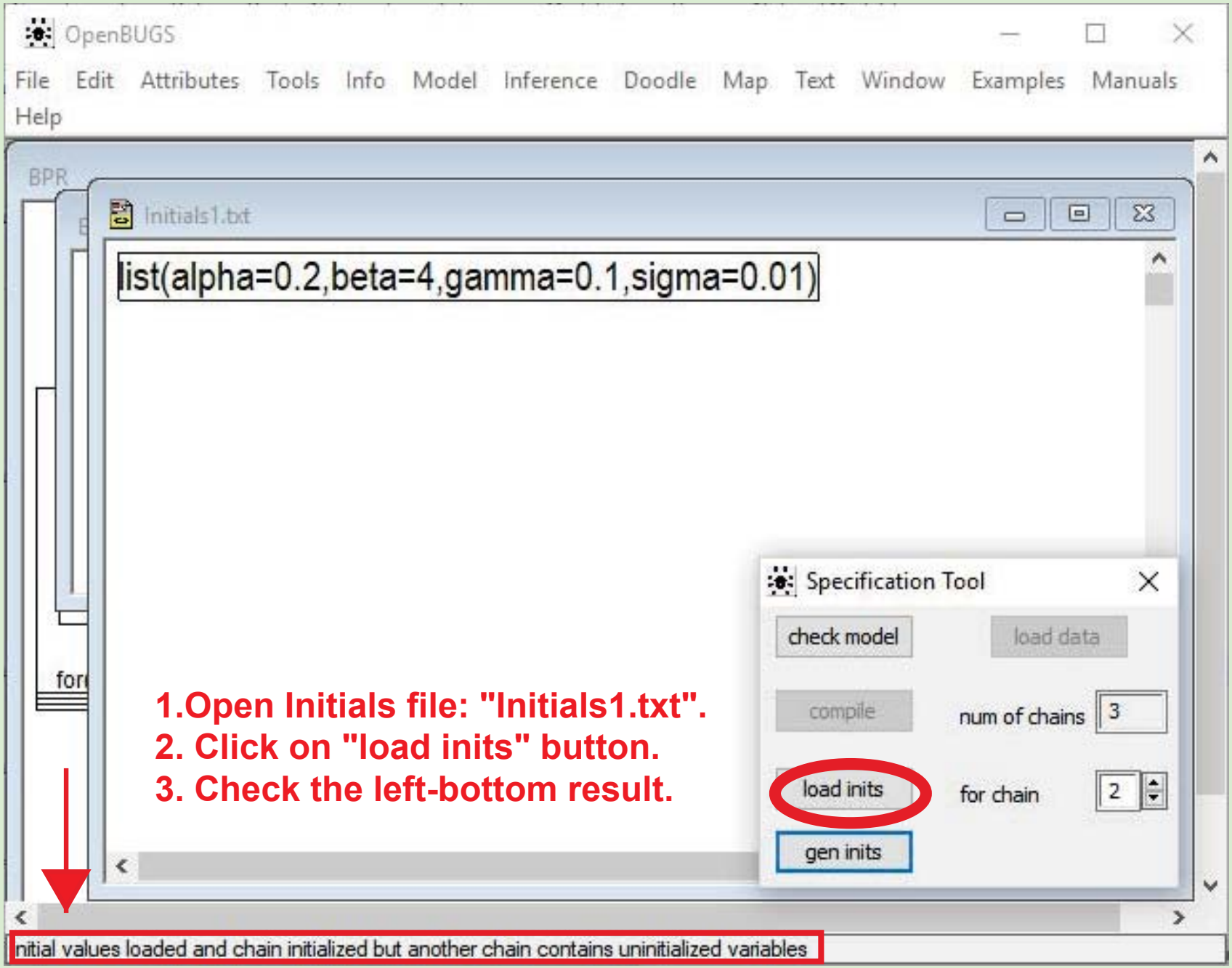
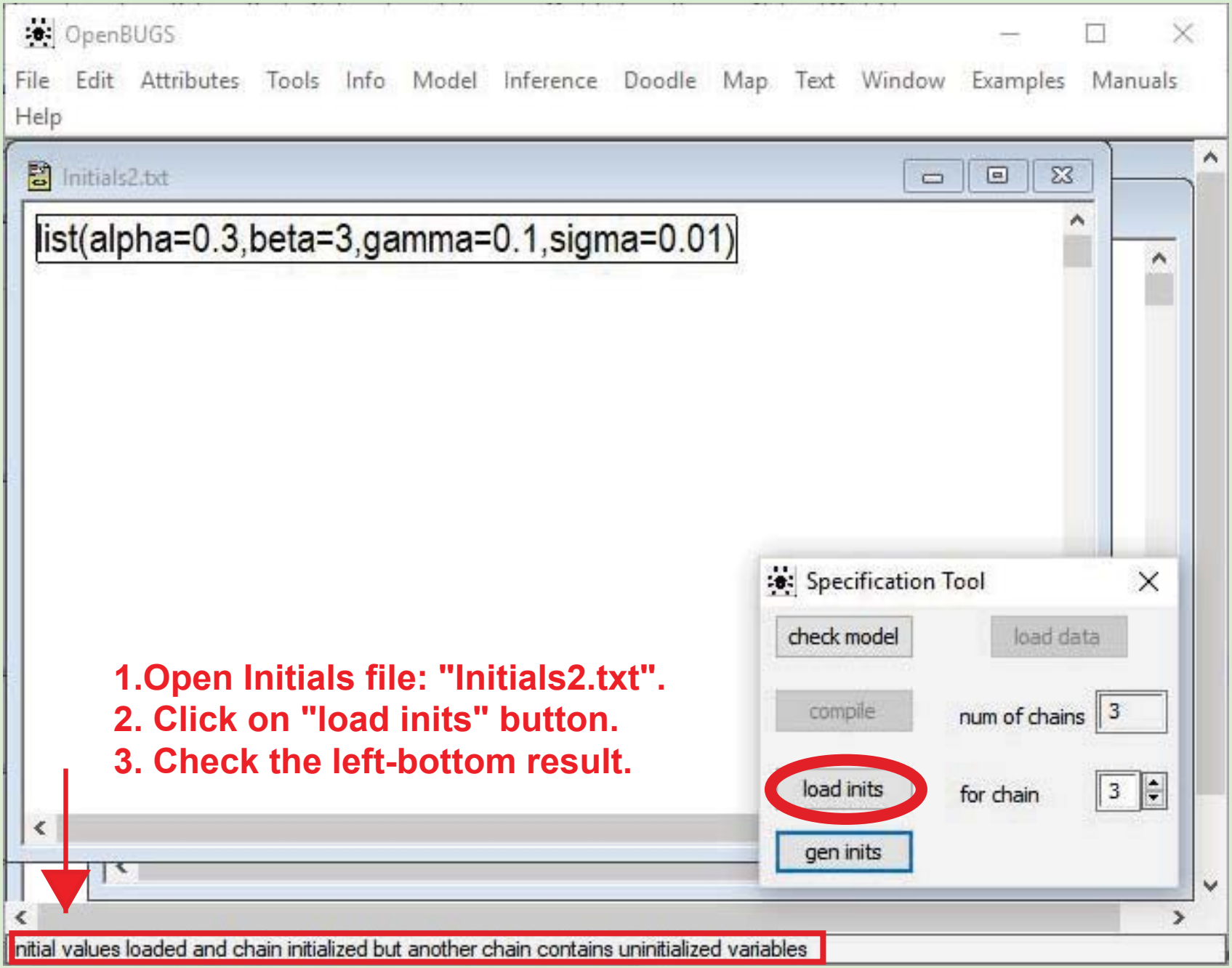
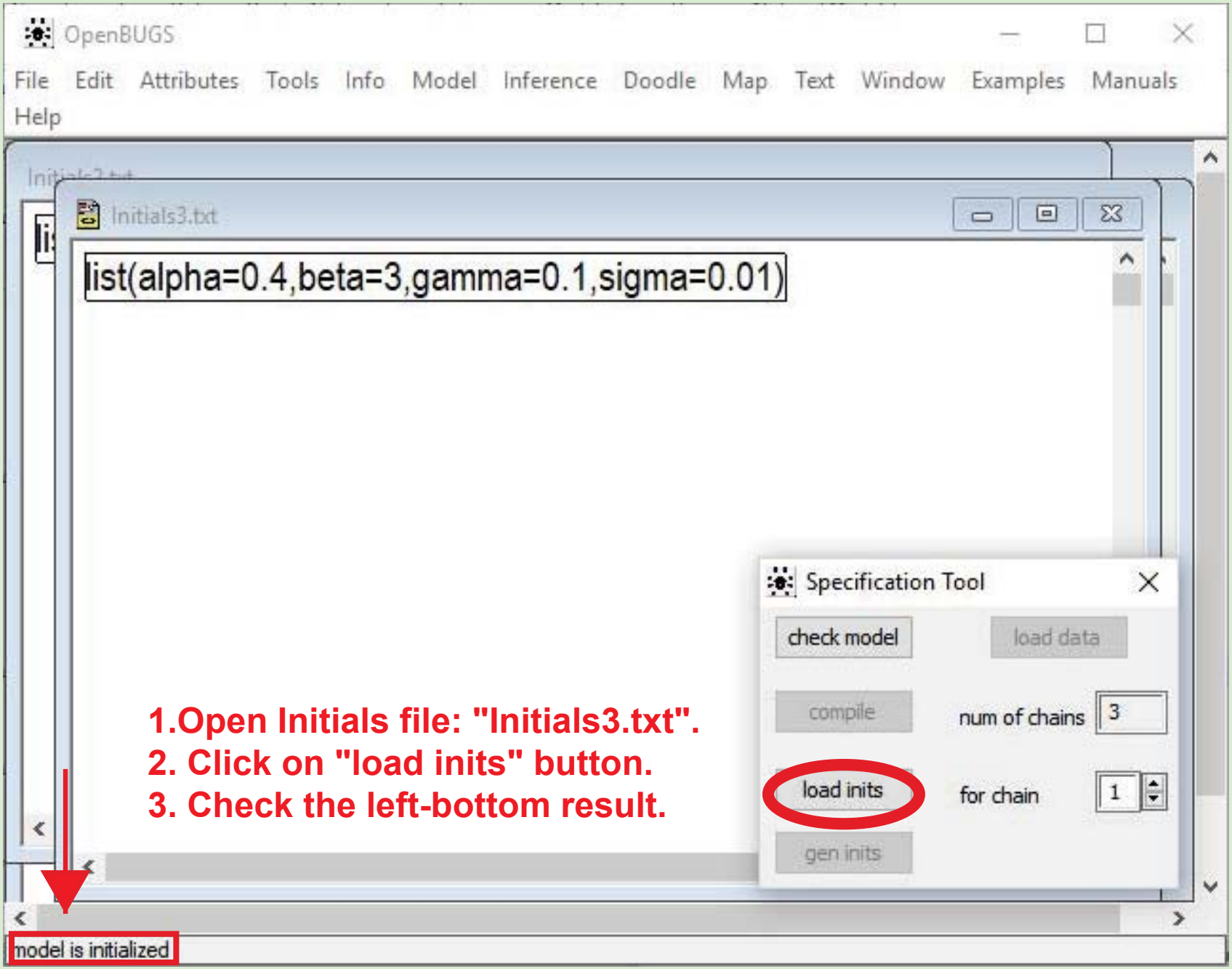
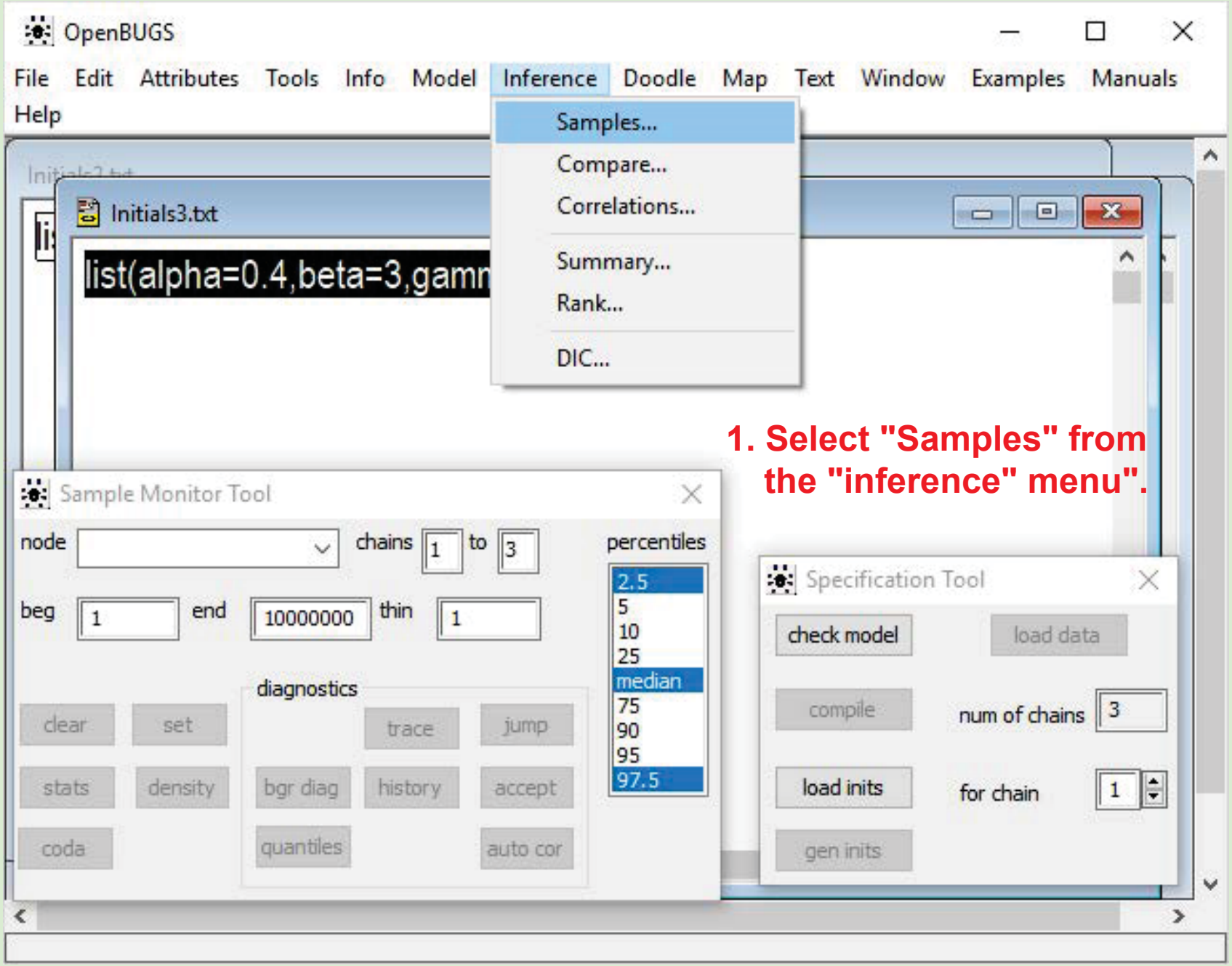
Help
BPR
Data.txt
list(N=20,c=1000,
v=c(
279.248852900730, 431.763836830461, 270.128891893026, 240.865580124873, 262.870729999350
285.611261128504, 286.776602960502, 348.198352154147, 316.928212793671, 382.203551805589,
400.026725816819, 207.549606272134, 406.322845652878, 313.100871972222, 347.234453287792,
227.494050613455, 431.264272121918, 502.430015395813),
vr=c(
241.933688532579, 470.228359964324, 345.406722352233, 319.786912825643, 179.879572273306
193.422217775081, 220.742686873416, 423.826852840030, 236.597579560281, 366.425076806599,
406.659782811422, 245.925029062229, 369.425971854090, 350.401057508538, 414.159587667266,
277.522913602448, 529.036489903217, 552.063146271781),
ta=c(
0.995337784108, 1.016543357044, 0.996370762361,
0.998363487874, 0.992940468724, 0.995835339890,
1.000296294417, 0.992958288801, 1.005526991338,
0.998289979233, 1.014486821595))
1.Open data file: "Data.txt".
2. Click on "load data" button.
3. Check the left-bottom result.
Specification Tool
check model
load data
compile
num of chains
1
load inits
for chain
1
gen inits
data loaded

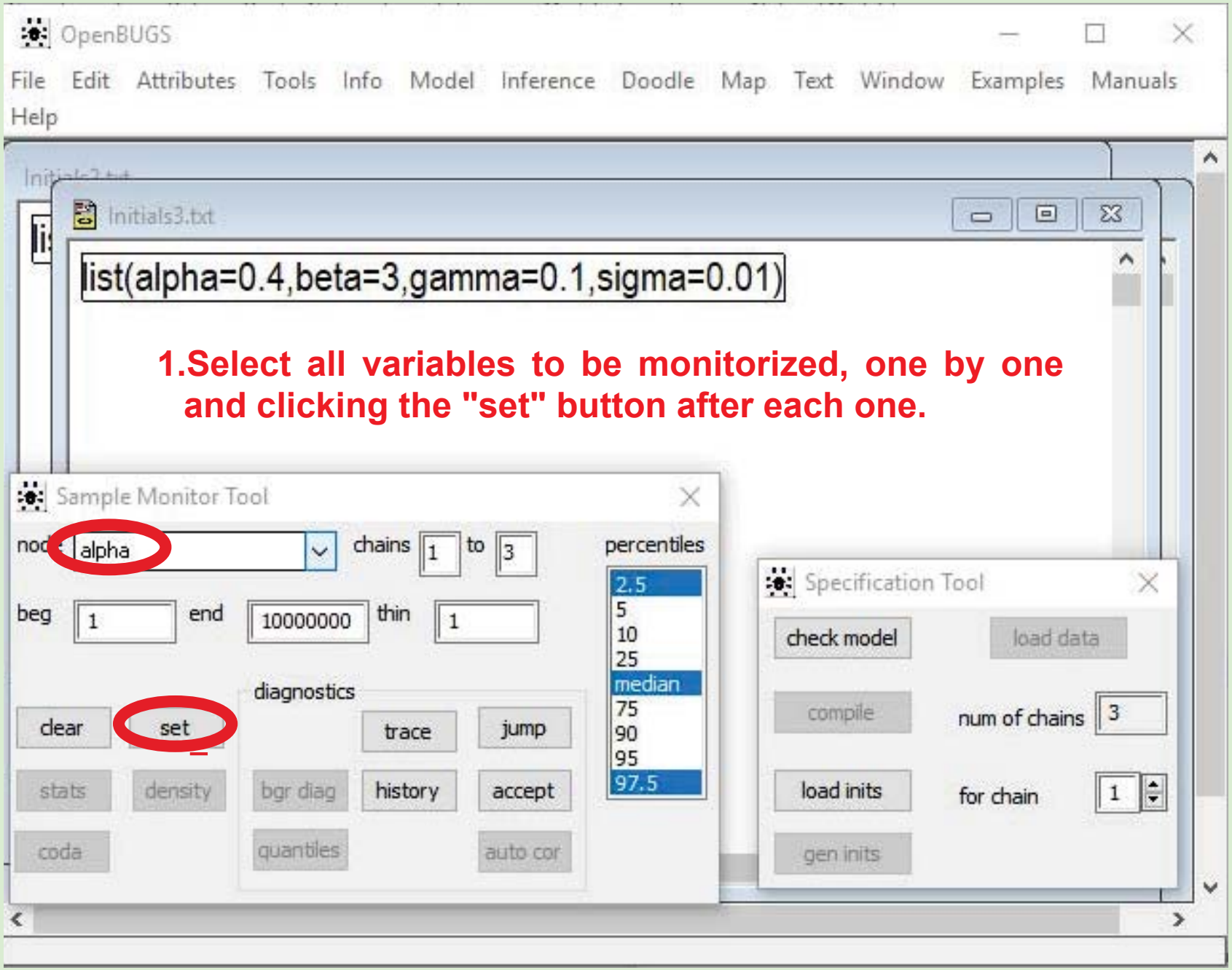

OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
BPR
Data.txt
list(N=20,c=1000,
v=c(
279.248852900730, 431.763836830461, 270.128891893026, 240.865580124873, 262.870729999350
285.611261128504, 286.776602960502, 348.198352154147, 316.928212793671, 382.203551805589,
400.026725816819, 207.549606272134, 406.322845652878, 313.100871972222, 347.234453287792,
227.494050613455, 431.264272121918, 502.430015395813),
vr=c(
241.933688532579, 470.228359964324, 345.406722352233, 319.786912825643, 179.879572273306
193.422217775081, 220.742686873416, 423.826852840030, 236.597579560281, 366.425076806599,
406.659782811422, 245.925029062229, 369.425971854090, 350.401057508538, 414.159587667266,
277.522913602448, 529.036489903217, 552.063146271781),
ta=c(
0.995337784108, 1.016543357044, 0.996370762361,
0.998363487874, 0.992940468724, 0.995835339890,
1.000296294417, 0.992958288801, 1.005526991338,
0.998289979233, 1.014486821595))
1. Type "3" into num of chains field.
2. Click on "compile" button.
3. Check the left-bottom result.
Specification Tool
check model
load data
compile
num of chains
3
load inits
for chain
1
gen inits
model compiled

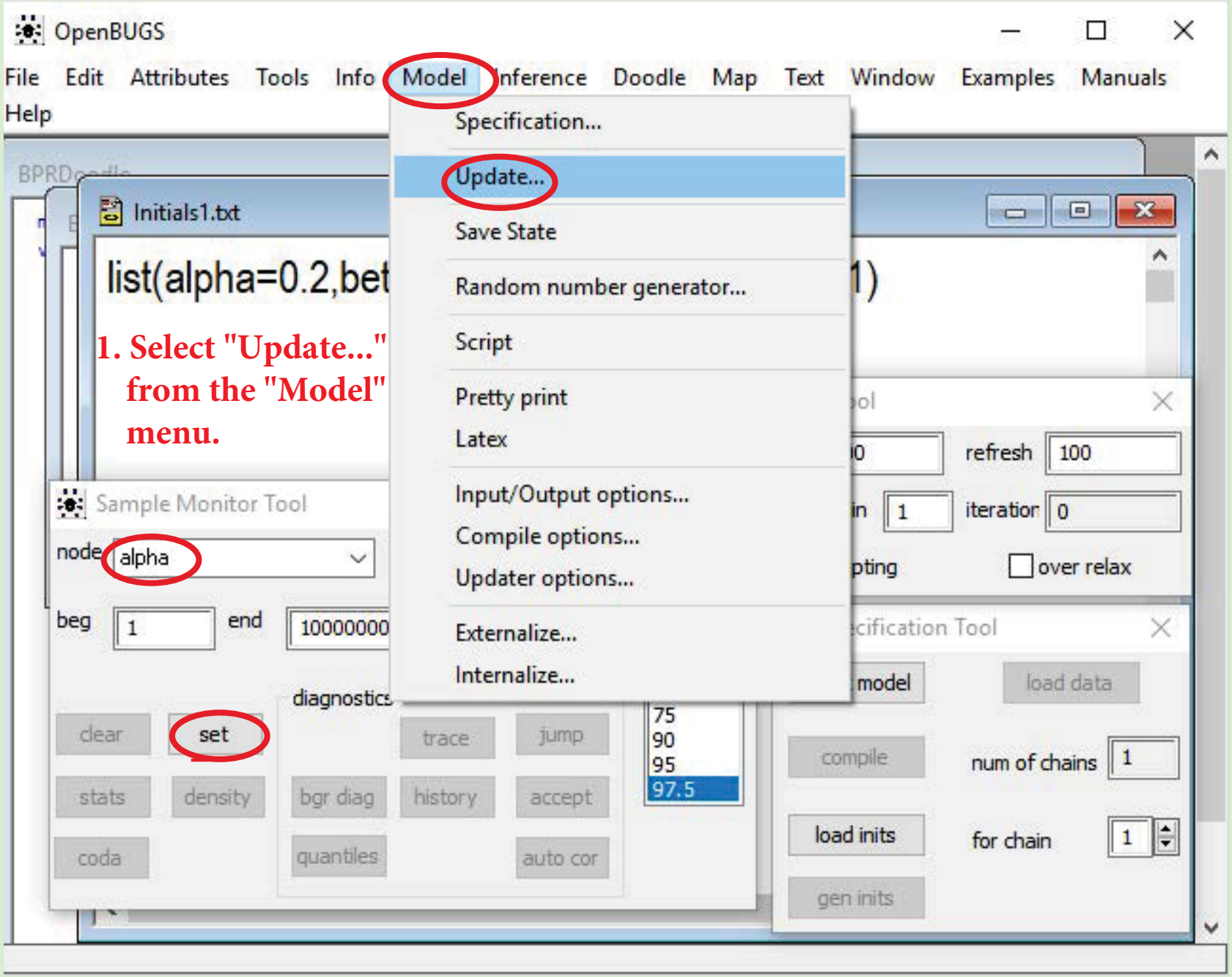

OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
BPR
Initials1.txt
list(alpha=0.2,beta=4,gamma=0.1,sigma=0.01)
Specification Tool
check model
load data
compile
num of chains
3
load inits
for chain
2
gen inits
1.Open Initials file: "Initials1.txt".
2. Click on "load inits" button.
3. Check the left-bottom result.
nitial values loaded and chain initialized but another chain contains uninitialized variables

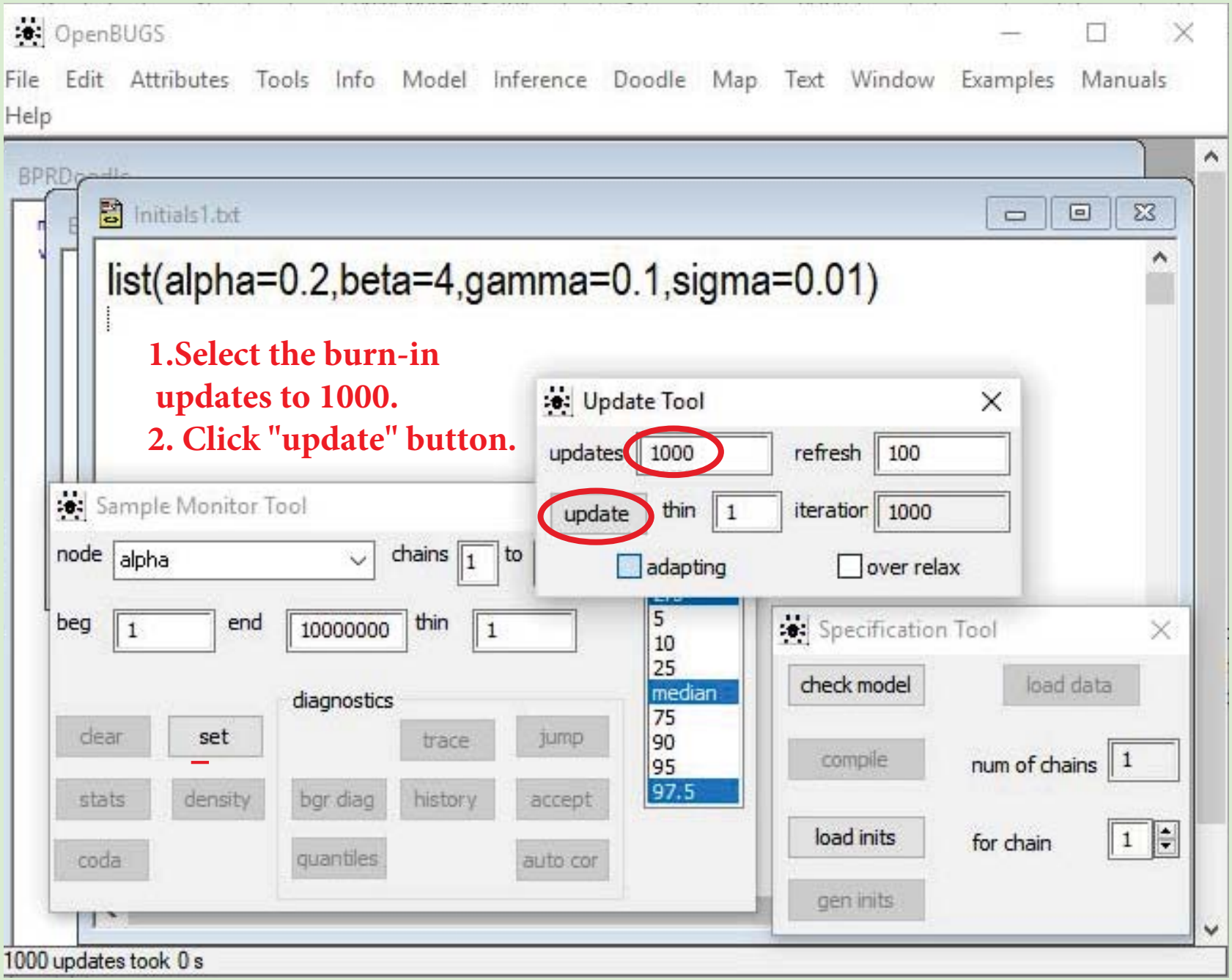

OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
Initials2.txt
list(alpha=0.3,beta=3,gamma=0.1,sigma=0.01)
Specification Tool
check model
load data
compile
num of chains
3
load inits
for chain
3
gen inits
1.Open Initials file: "Initials2.txt".
2. Click on "load inits" button.
3. Check the left-bottom result.
nitial values loaded and chain initialized but another chain contains uninitialized variables

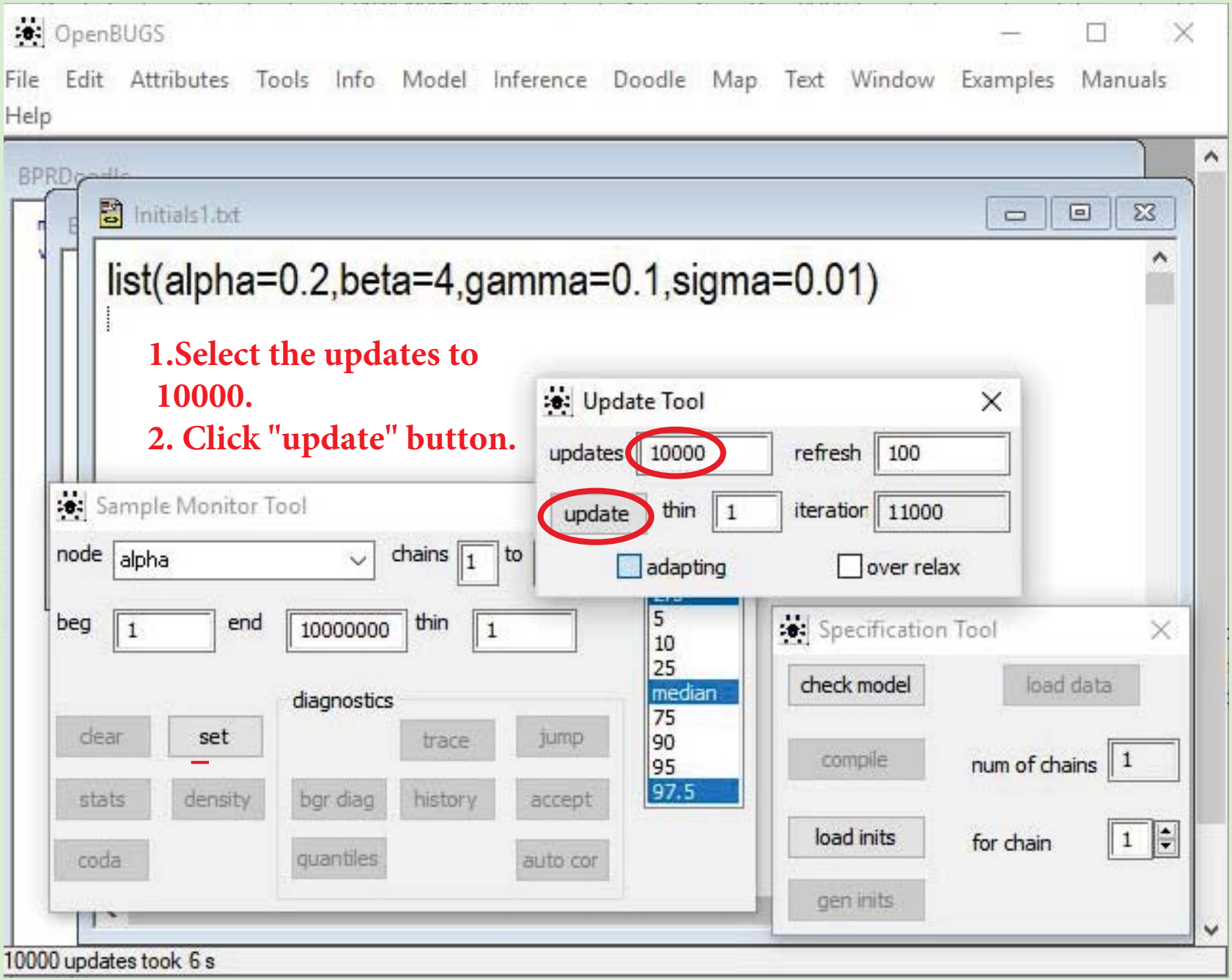

OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
Initials3.txt
list(alpha=0.4,beta=3,gamma=0.1,sigma=0.01)
Specification Tool
check model
load data
compile
num of chains
3
load inits
for chain
1
gen inits
1.Open Initials file: "Initials3.txt".
2. Click on "load inits" button.
3. Check the left-bottom result.
model is initialized

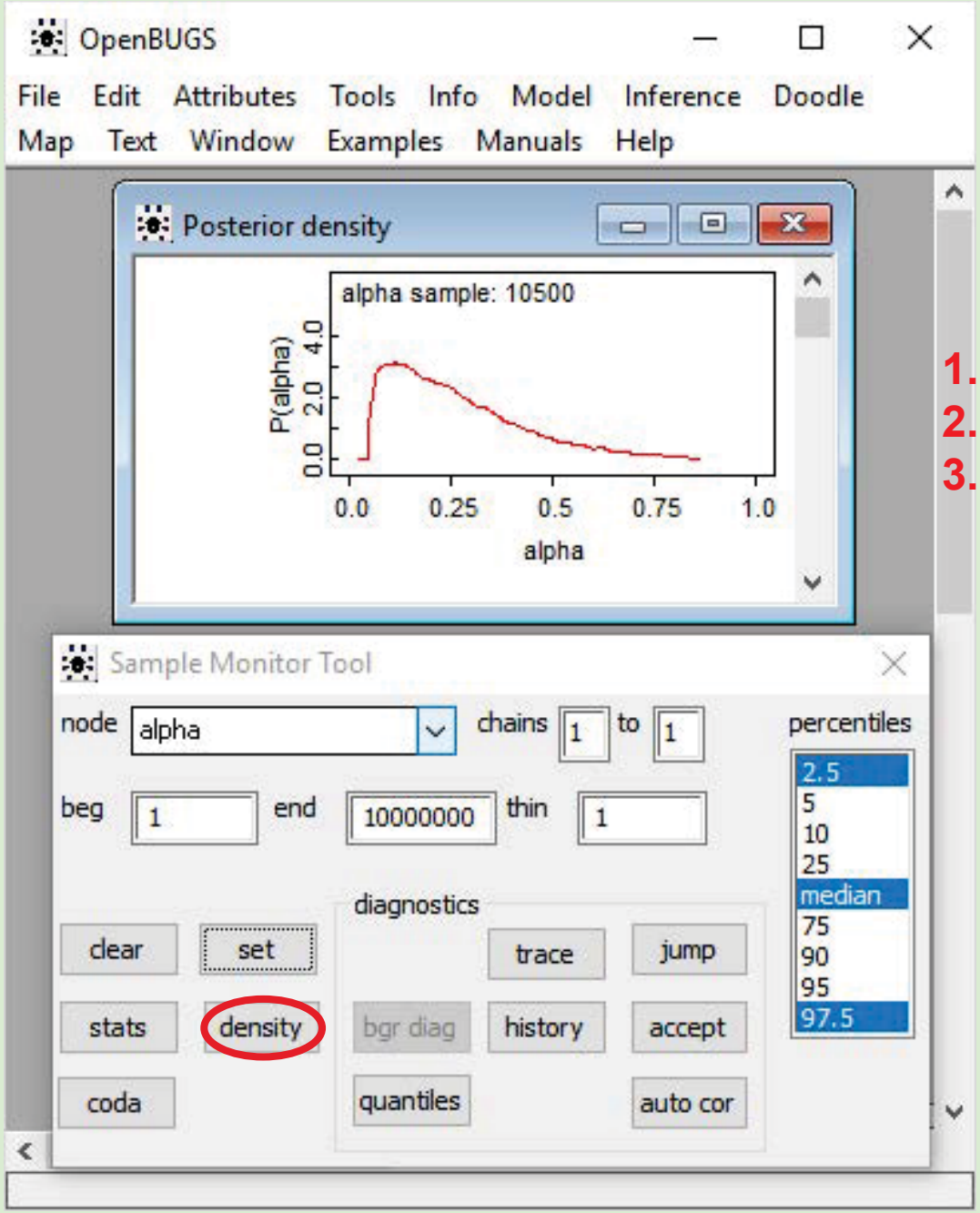

OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
Samples...
Compare...
Correlations...
Summary...
Rank...
DIC...
Initials3.txt
list(alpha=0.4,beta=3,gamm
1. Select "Samples" from the "inference" menu".
Sample Monitor Tool
node
chains 1 to 3
percentiles
beg 1
end 10000000
thin 1
2.5
5
10
25
median
75
90
95
97.5
diagnostics
clear
set
trace
jump
stats
density
bgr diag
history
accept
coda
quantiles
auto cor
Specification Tool
check model
load data
compile
num of chains 3
load inits
for chain 1
gen inits


OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
Initials3.txt
list(alpha=0.4,beta=3,gamma=0.1,sigma=0.01)
1.Select all variables to be monitorized, one by one and clicking the "set" button after each one.
Sample Monitor Tool
node
alpha
chains
1
to
3
percentiles
beg
1
end
10000000
thin
1
2.5
5
10
25
median
75
90
95
97.5
diagnostics
clear
set
trace
jump
stats
density
bgr diag
history
accept
coda
quantiles
auto cor
Specification Tool
check model
load data
compile
num of chains
3
load inits
for chain
1
gen inits

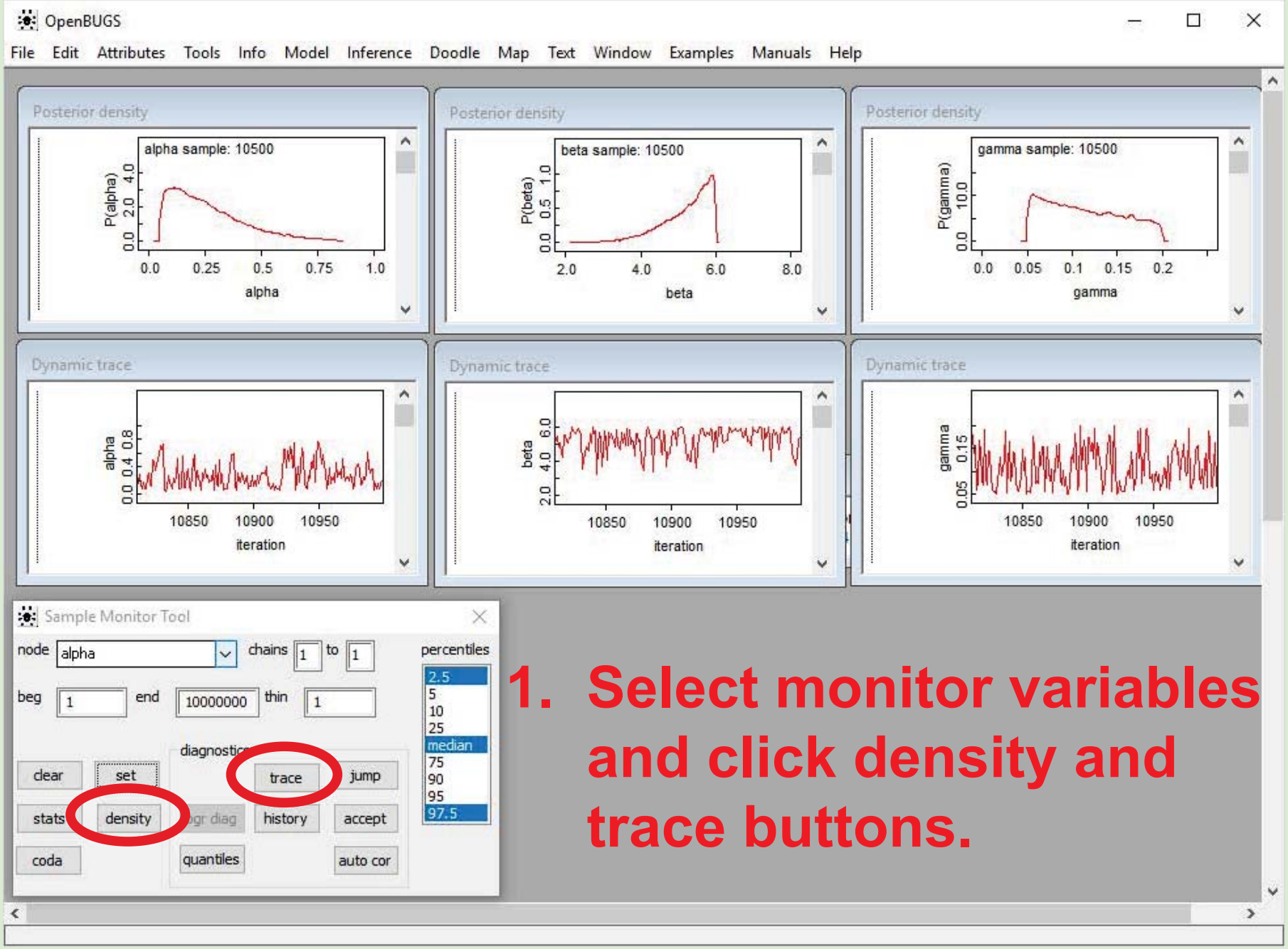

OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
Specification...
Update...
Save State
Random number generator...
Script
Pretty print
Latex
Input/Output options...
Compile options...
Updater options...
Externalize...
Internalize...
Initials1.txt
list(alpha=0.2,bet
1. Select "Update..." from the "Model" menu.
Sample Monitor Tool
node alpha
beg 1
end 10000000
diagnostics
clear
set
trace
jump
stats
density
bgr diag
history
accept
coda
quantiles
auto cor
75
90
95
97.5
refresh 100
iteration 0
over relax
model
load data
compile
num of chains 1
load inits
for chain 1
gen inits


OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
Initials1.txt
list(alpha=0.2,beta=4,gamma=0.1,sigma=0.01)
1.Select the burn-in
updates to 1000.
2. Click "update" button.
Update Tool
updates 1000
refresh 100
update
thin 1
iteration 1000
adapting
over relax
Sample Monitor Tool
node alpha
chains 1 to
beg 1
end 10000000
thin 1
5
10
25
median
75
90
95
97.5
diagnostics
clear
set
trace
jump
stats
density
bgr diag
history
accept
coda
quantiles
auto cor
Specification Tool
check model
load data
compile
num of chains 1
load inits
for chain 1
gen inits
1000 updates took 0 s

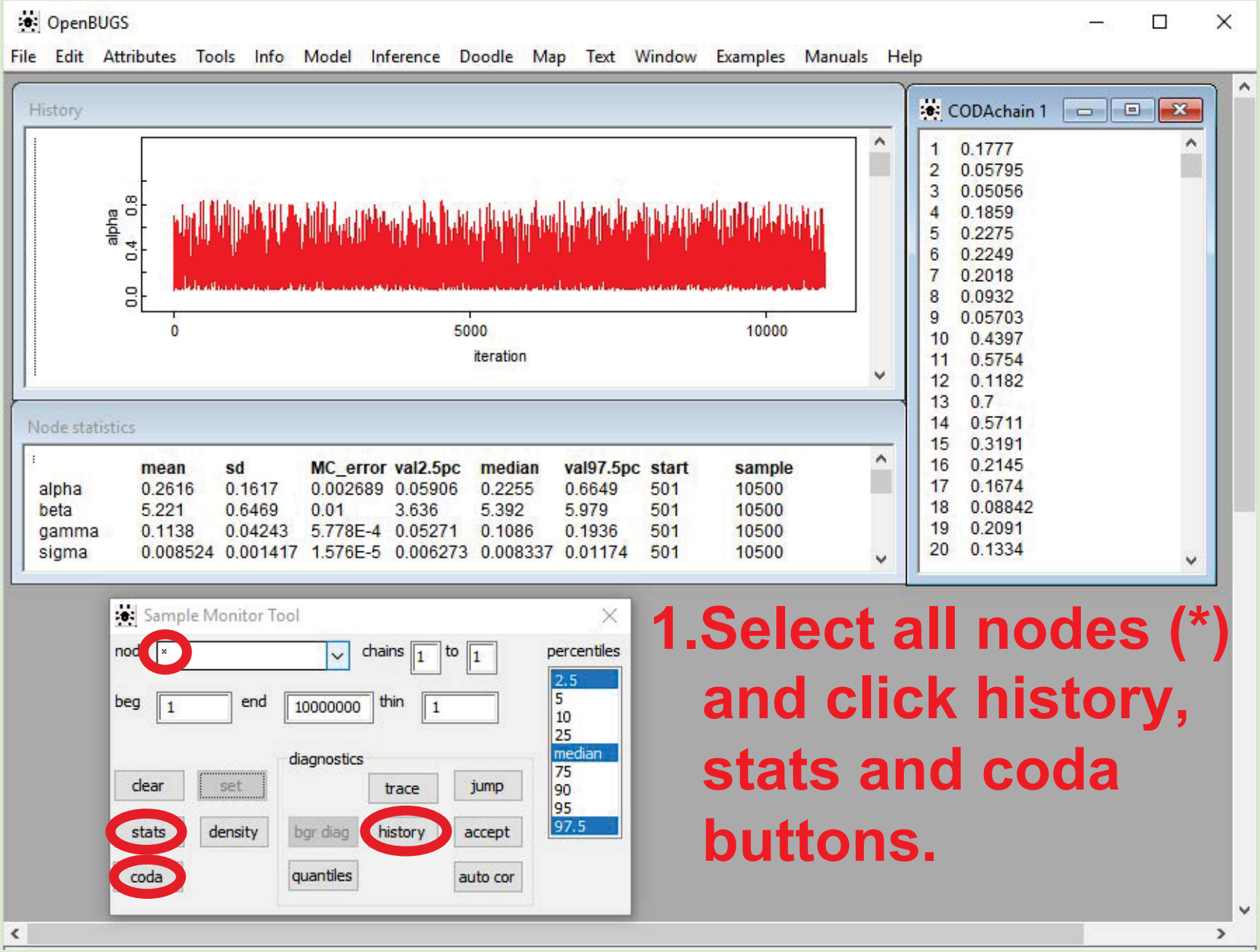

OpenBUGS
File Edit Attributes Tools Info Model Inference Doodle Map Text Window Examples Manuals
Help
Initials1.txt
list(alpha=0.2,beta=4,gamma=0.1,sigma=0.01)
1.Select the updates to 10000.
2. Click "update" button.
Update Tool
updates 10000
refresh 100
update
thin 1
iteration 11000
adapting
over relax
Sample Monitor Tool
node alpha
chains 1 to
beg 1
end 10000000
thin 1
diagnostics
clear
set
trace
jump
stats
density
bgr diag
history
accept
coda
quantiles
auto cor
5
10
25
median
75
90
95
97.5
Specification Tool
check model
load data
compile
num of chains 1
load inits
for chain 1
gen inits
10000 updates took 6 s



1. Select node
2. and click
3. density button



1. **Select monitor variables and click density and trace buttons.**



1.Select all nodes (*) and click history, stats and coda buttons.

The BPR Travel Time Commands

```
# BPR Example
model {
  for (i in 1:N){
      mu[i]<-1+alpha*pow((flow[i]+gamma*reverseflow[i])/capacity,beta)
  # Data
      reltraveltime[i]~dnorm(mu[i],tau)
  }

  # Priors

  alpha~dunif(0.05,0.84)
  beta~dunif(2,6)
  gamma~dunif(0.05,0.2)
  sigma~dgamma(0.001,0.001)

  # Reparameterization
    tau<-1/(sigma*sigma)
}
```

The BPR Commands, Data and Initial Files

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Commands.txt

```
model {
for (i in 1:N){
mu[i]<-1+alpha*pow((flow[i]+gamma*reverseflow[i])/capacity,beta)
reltraveltime[i]~dnorm(mu[i],tau)
}
sigma~dgamma(0.001,0.001)
tau<-1/(sigma*sigma)
alpha~dunif(0.05,0.84)
beta~dunif(2,6)
gamma~dunif(0.05,0.2)
}
```

Specification Tool

check model | load data | compile | num of chains 1 | load inits | for chain 1 | gen inits

Sample Monitor Tool

node | chains 1 to 1 | percentiles: 2.5, 5, 10, 25, median, 75, 90, 95, 97.5

beg 1 | end 10000000 | thin 1

diagnostics: clear, set, trace, jump, stats, density, bgr diag, history, accept, coda, quantiles, auto cor

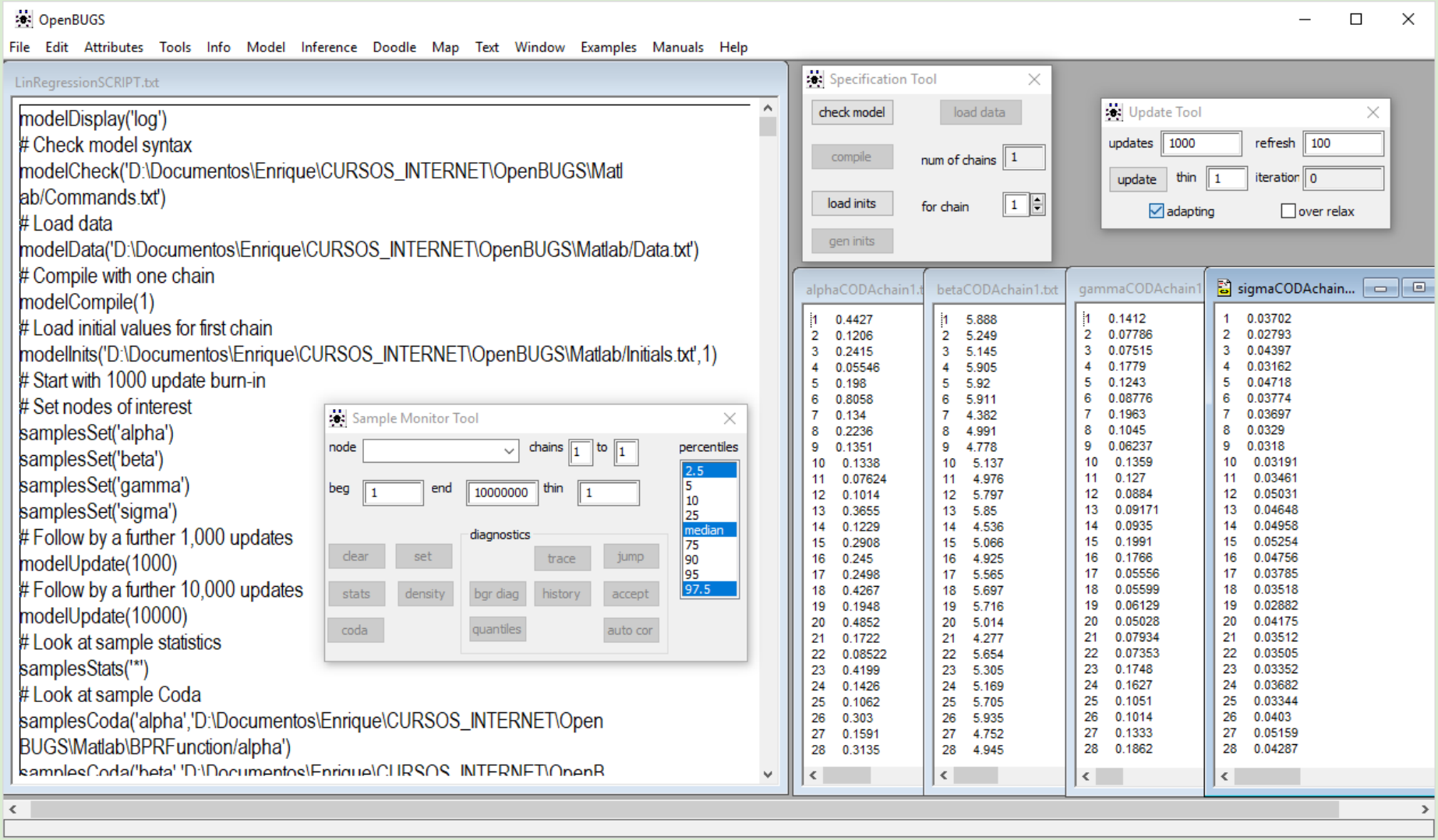
Data.txt

```
list(N=20,capacity=1000,
flow=c(
  279.248852900730,  431.763836830461,  270.128891893026,  240.865580124873,
 262.870729999350,  285.611261128504,  286.776602960502,  348.198352154147,
316.928212793671,  382.203551805589,  262.342752531461,  400.026725816819,
207.549606272134,  406.322845652878,  313.100871972222,  347.234453287792,
169.548440893102,  227.494050613455,  431.264272121918,  502.430015395813),
reverseflow=c(
  241.933688532579,  470.228359964324,  345.406722352233,  319.786912825643,
 179.879572273306,  193.422217775081,  220.742686873416,  423.826852840030,
236.597579560281,  366.425076806599,  353.920658561561,  406.659782811422,
245.925029062229,  369.425971854090,  350.401057508538,  414.159587667266,
73.206096361940,  277.522913602448,  529.036489903217,  552.063146271781),
reltraveltime=c(
    1.001632062913,    1.010570225576,    1.001669717242,    1.001092873683,
1.001305673670,    1.001625240167,    1.001785243767,    1.004537376447,
1.002622649016,    1.006247900476,    1.001423455925,    1.007487703657,
1.000577980222,    1.007573583086,    1.002963881762,    1.004361299612,
1.000215695003,    1.000891509046,    1.010863409394,    1.019290488069))
```

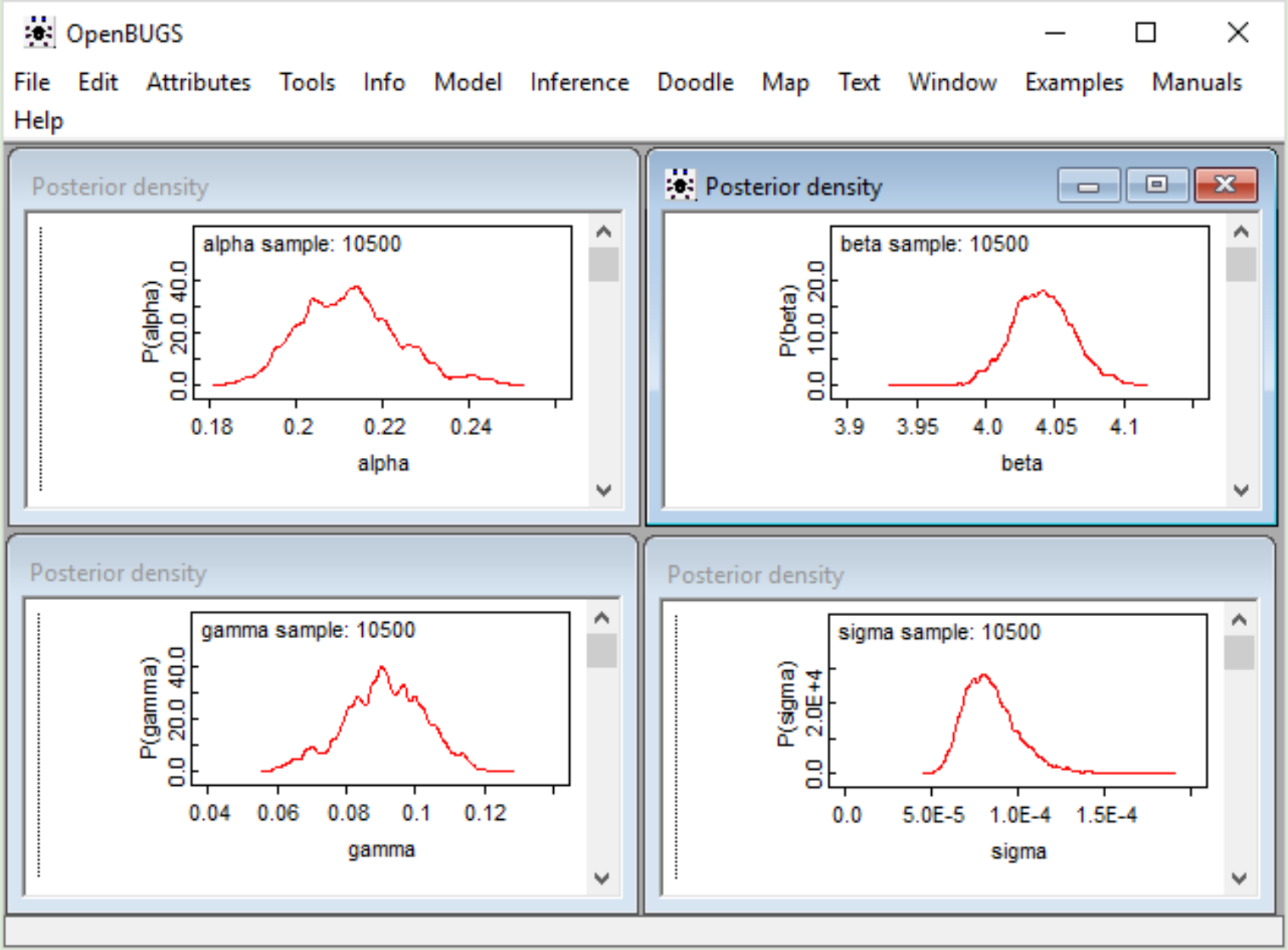
Initials.txt

```
list(alpha=0.2,beta=4,gamma=0.1,sigma=0.0001)
```

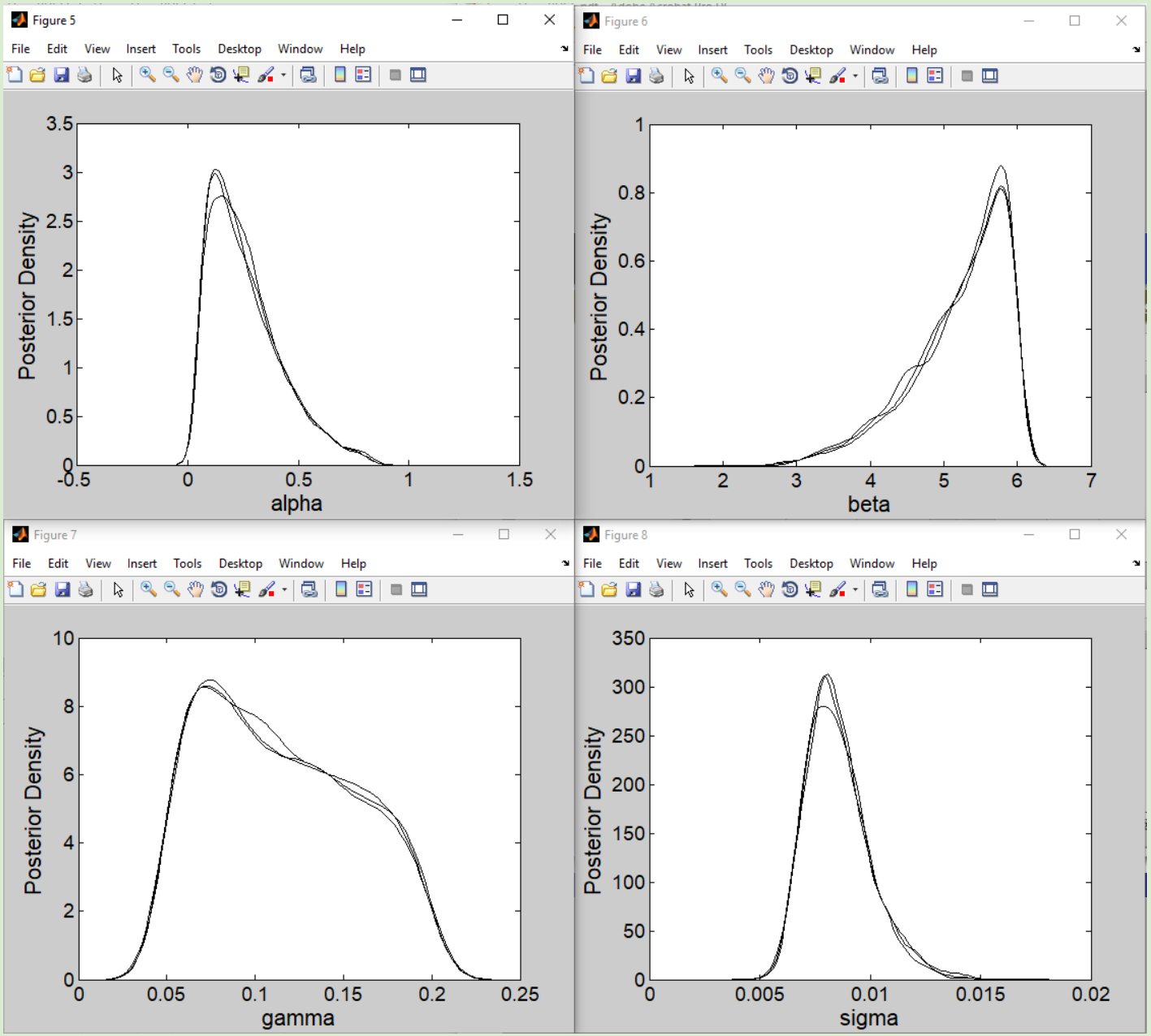
The BPR Script and Coda Files



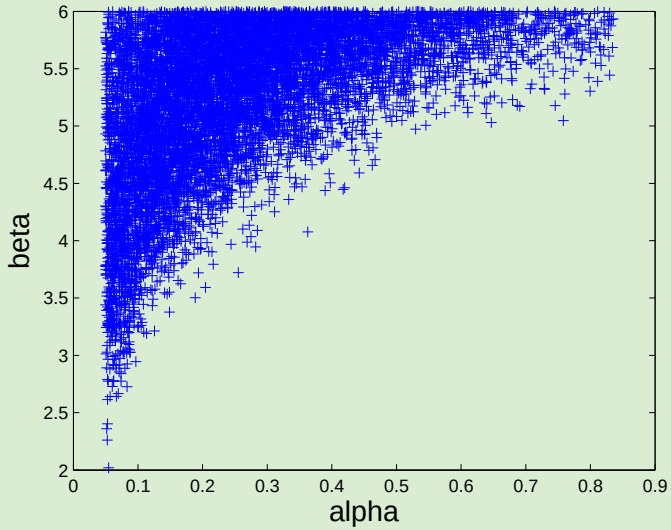
The BPR Posterior Densities of α, β, γ and σ

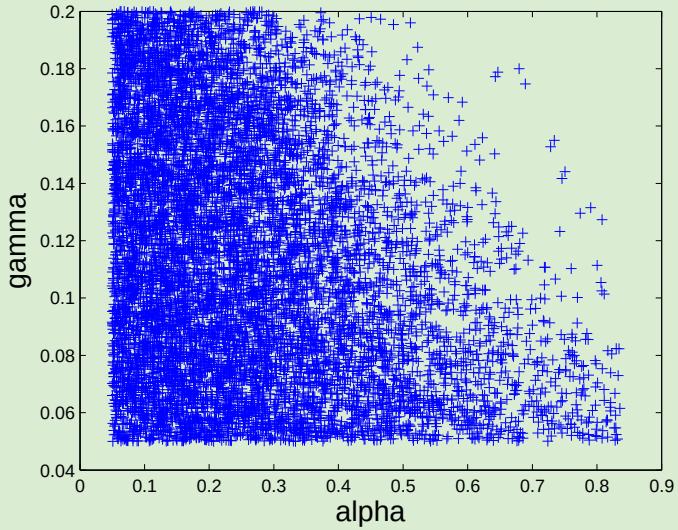


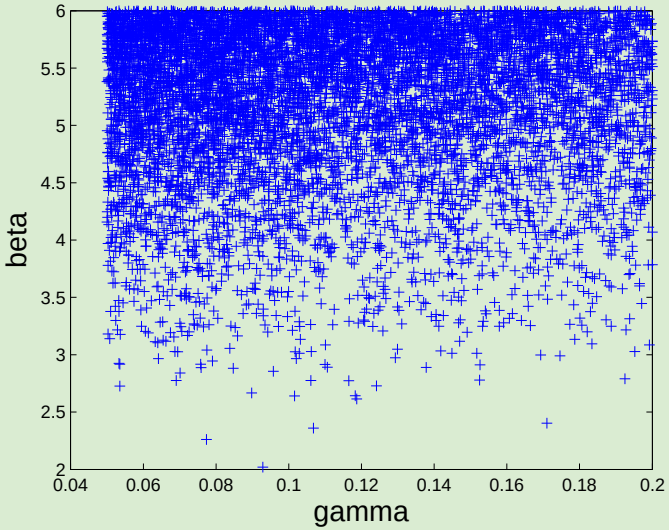
The BPR Posterior Densities of α, β, γ and σ



Dependencies of α, β and γ Parameters

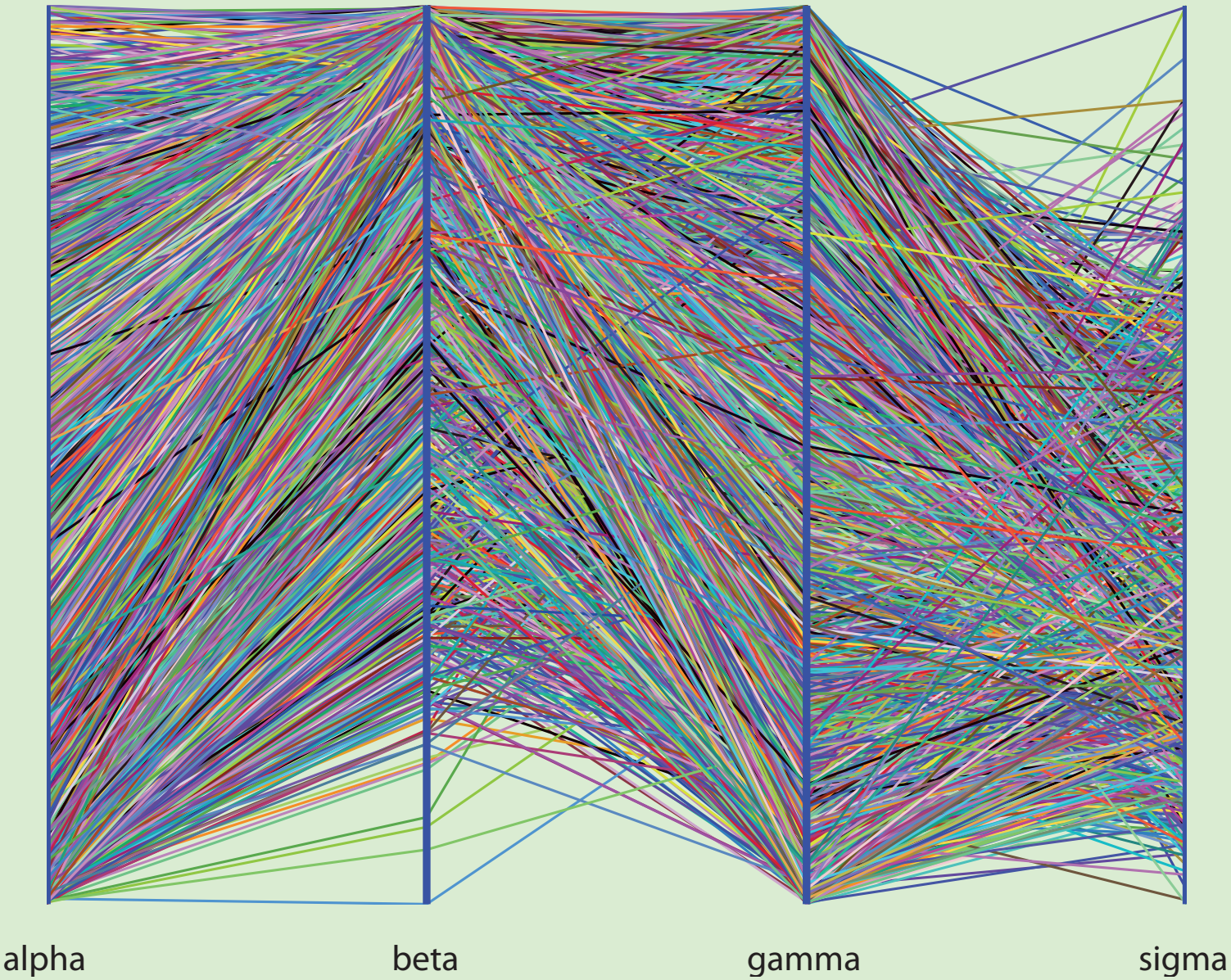






Even though the prior distributions of α, β and γ parameters were assumed to be independent, the data reveals some dependencies.

Dependencies of α, β and γ Parameters



0-1 normalized values of the sample