PriorGen update/extensions ver1

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Candidates for inclusion in PriorGen

Summary of candidate functions

- Updated basic findbeta (original function with percentiles)
  - Mean, Median, Mode
- Raw findbeta (standard location and scale measures (mean,median,mode,variance,range))
  - Mean, Median, Mode
- Abstract findbeta (general statements of how low/high are the mean and variance)
  - Mean
- Panel findbeta (Multiple experts or sources of information contribute to define this prior, based on simple averaging)
  - Mean, Median, Mode
- Updated basic findbetaqq (original functions with 2 percentiles)
  - Percentiles
- Updated basic findbetamupsi (original function with percentiles - two non-linear root functions)
  - Mean
- Raw findbetamupsi (standard location and scale measures (mean, variance))
  - Mean
- Abstract findbetamupsi (general statements of how low/high are the mean and variance)
  - Mean
- Panel findbeta (Multiple experts or sources of information contribute to define this prior, based on simple averaging)
  - Mean
- Plot all the above samples function
  - Generic and applicable to all functions above.
- New root and optim functions
  - RootSolve alterantive
  - Optim alternative

Basic findbeta updated

```
source("~/GitHub/PriorGen-1/R/findbeta.r")
findbeta(themedian = 0.5,lower.v = T,percentile = 0.999,percentile.value = 0.999, silent = F)
```

```
## The desired Beta distribution that satisfies the specified conditions is: Beta( 1 , 1 )
##  Verification: The percentile value 1 corresponds to the 0.999 th percentile
## Descriptive statistics for this distribution can be found below:
```

```
## $parameters
## a b
## 1 1
##
## $summary
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.0005798 0.2548675 0.5011664 0.5009285 0.7471612 0.9999125
##
## $input
##        themedian       percentile percentile.value
##            0.500            0.999            0.999
```

```
#findbeta(themode = 0.5,lower.v = T,percentile = 0.80,percentile.value = 0.95, silent = T)
fb_per=findbeta(themean = 0.5,lower.v = T,percentile = 0.90,percentile.value = 0.95, silent = T)
fb_per$parameters
```

```
##         a         b
## 0.6658199 0.6658199
```

```
fb_per$summary
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.0000004 0.1923723 0.4975507 0.4977591 0.8030204 0.9999862
```

```
fb_per$input
```

```
##          themean       percentile percentile.value
##             0.50             0.90             0.95
```

Raw findbeta (mean/median/mode/variance/range input)

```
source("~/GitHub/PriorGen-1/R/findbeta_raw.r")
findbeta_raw(themedian = 0.5,therange = c(0,1), silent = T)
```

```
## $parameters
##        a        b
## 1.392904 1.392904
##
## $summary
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.001807 0.292863 0.501206 0.500180 0.706959 0.999769
##
## $input
##                themedian scalemetric_var_or_range
##                      0.5                      1.0
##
## $comment
## NULL
```

```
#findbeta_raw(themode = 0.5,therange = c(0,1), silent = T)
fb_raw=findbeta_raw(themean = 0.8,thevariance = 0.2,silent = T)
fb_raw$parameters
```

```
##        a        b
## 7.117155 1.779289
```

```
fb_raw$summary
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.2034  0.7251  0.8225  0.7999  0.8962  0.9980
```

```
fb_raw$input
```

```
##                  themean scalemetric_var_or_range
##               0.80000000               0.05140606
```

Abstract findbeta (General statements input)

```
source("~/GitHub/PriorGen-1/R/findbeta_abstract.r")
findbeta_abstract(themean.cat = "Low",thevariance.cat = "High", silent = T)
```

```
## $parameters
##        a        b
## 2.165306 5.052381
##
## $summary
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.005002 0.179534 0.281517 0.301788 0.404139 0.867105
##
## $input
##          themean      scalemetric percentile.value
##           0.3000           0.1345           0.9990
```

```
#findbeta_abstract(themean.cat = "Very low",thevariance.cat = "Low", silent = T)
fb_abstract=findbeta_abstract(themean.cat =  "Low",thevariance.cat = "High",silent = T)
fb_abstract$parameters
```

```
##        a        b
## 2.165306 5.052381
```

```
fb_abstract$summary
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.005002 0.179534 0.281517 0.301788 0.404139 0.867105
```

```
fb_abstract$input
```

```
##          themean      scalemetric percentile.value
##           0.3000           0.1345           0.9990
```

Panel findbeta (Vector input)

```
source("~/GitHub/PriorGen-1/R/findbeta_panel.r")
#findbeta_panel(themedian.vec = c(0.2,0.02,0.5,0.03,0.04,0.05),silent = T)
findbeta_panel(themode.vec = c(0.2,0.02,0.5,0.03,0.04,0.05),silent = F)
```

```
## The desired Beta distribution that satisfies the specified conditions is: Beta( 4.57 22.94 )
##  Verification: The percentile value 0.5 corresponds to the 0.9999 th percentile
## Descriptive statistics for this distribution can be found below:
```

```
## $parameters
##         a         b
##  4.570939 22.935768
##
## $summary
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## 0.01882 0.11591 0.15828 0.16678 0.20848 0.51874
##
## $input
##          themode       percentile percentile.value
##           0.1400           0.9999           0.4990
```

```
fb_panel=findbeta_panel(themean.vec = c(0.2,0.02,0.5,0.03,0.04,0.05),silent = T)
fb_panel$parameters
```

```
##        a        b
## 11.90200 73.11232
```

```
fb_panel$summary
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## 0.04516 0.11378 0.13739 0.14026 0.16347 0.30894
```

```
fb_panel$input
```

```
##          themean       percentile percentile.value
##        0.1400000        0.9999000        0.2773494
```

Basic findbetaqq updated (Percentiles input)

```
source("~/GitHub/PriorGen-1/R/findbetaqq.r")
require(rootSolve)
```

```
## Loading required package: rootSolve
```

```
fb_qq=findbetaqq(percentile.value1 = 0.3,percentile1 = 0.20,
                 percentile.value2 = 0.7,percentile2 = 0.97,silent=T)
fb_qq$parameters
```

```
##        a        b
## 4.754100 6.398365
```

```
fb_qq$summary
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## 0.06502 0.32446 0.42170 0.42666 0.52329 0.89435
```

```
fb_qq$input
```

```
## percentile.value1       percentile1 percentile.value2       percentile2
##              0.30              0.20              0.70              0.97
```

Basic findbetamupsi updated (Hierarchical input + choice of root function)

```
source("~/GitHub/PriorGen-1/R/findbetamupsi.r")
require(rootSolve)
require(nleqslv)
```

```
## Loading required package: nleqslv
```

```
fb_mupsi_RS=findbetamupsi(themean=0.20, percentile=0.99, lower.v=TRUE,
              percentile.value=0.30, psi.percentile=0.90,
              percentile.median=0.60, percentile95value=0.80,root.method="multiroot")
fb_mupsi_RS$parameters
```

```
##        a        b
## 20.26755 81.07018
```

```
fb_mupsi_RS$summary
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.000000 0.008379 0.085610 0.203784 0.320677 0.999995
```

```
fb_mupsi_RS$input
```

```
##           themean        percentile  percentile.value    psi.percentile
##              0.20              0.99              0.30              0.90
## percentile.median percentile95value
##              0.60              0.80
```

```
fb_mupsi_NL=findbetamupsi(themean=0.20, percentile=0.99, lower.v=TRUE,
              percentile.value=0.30, psi.percentile=0.90,
              percentile.median=0.60, percentile95value=0.80,root.method="nleqslv")
fb_mupsi_RS$parameters
```

```
##        a        b
## 20.26755 81.07018
```

```
fb_mupsi_NL$parameters
```

```
##        a        b
## 20.26755 81.07018
```

```
# Results are similar
```

Raw findbetamupsi updated (Hierarchical input)

```
source("~/GitHub/PriorGen-1/R/findbetamupsi_raw.r")
require(rootSolve)
fb_mupsi_raw=findbetamupsi_raw(themean=0.20,thevariance = 0.05, thepsi=0.15,silent = TRUE)
fb_mupsi_raw$parameters
```

```
##        a        b
## 21.12991 84.51964
```

```
fb_mupsi_raw$summary
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.0000000 0.0000000 0.0000103 0.1935947 0.1337335 1.0000000
```

```
fb_mupsi_raw$input
```

```
##          themean     thevariances       percentile percentile.value
##        0.2000000        0.0500000        0.9999000        0.3645263
##           thepsi
##        0.1500000
```

Abstract findbetamupsi updated (Hierarchical input)

```
source("~/GitHub/PriorGen-1/R/findbetamupsi_abstract.r")
require(rootSolve)
fb_mupsi_abstract=findbetamupsi_abstract(themean="Average",thevariance = "Very high",
                                         psi.percentile=0.90,percentile.median=0.999,
                                         percentile95value=0.9999,silent = TRUE)
fb_mupsi_abstract$parameters
```

```
##        a        b
## 2.111179 1.727328
```

```
fb_mupsi_abstract$summary
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## 0.00000 0.05677 0.64303 0.54865 0.99077 1.00000
```

```
fb_mupsi_abstract$input
```

```
##           themean        percentile  percentile.value    psi.percentile
##         0.5500000         0.9999000         0.9974181         0.9000000
## percentile.median percentile95value
##         0.9990000         0.9999000
```

Panel findbetamupsi updated (Hierarchical input)

```
source("~/GitHub/PriorGen-1/R/findbetamupsi_panel.r")
require(rootSolve)
fb_mupsi_panel=findbetamupsi_panel(themean=c(0.1,0.5,0.6,0.3,0.05,0.01,0.3),
                                   psi.percentile=0.90, percentile.median=0.50,
                                   percentile95value=0.60,silent = TRUE)
fb_mupsi_panel$parameters
```

```
##        a        b
## 21.47864 59.35496
```

```
fb_mupsi_panel$summary
```

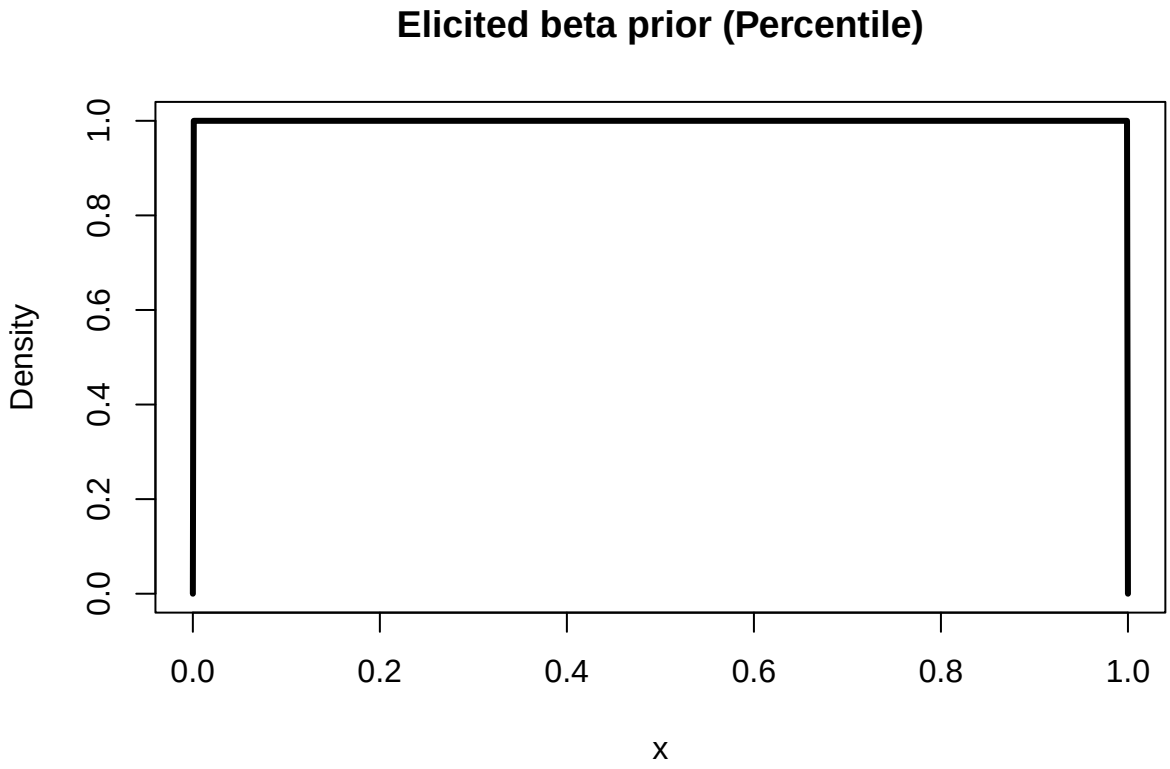
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.0000001 0.1293974 0.2387243 0.2681315 0.3763673 0.9607058
```

```
fb_mupsi_panel$input
```

```
##           themean        percentile  percentile.value    psi.percentile
##         0.2657143         0.9999000         0.4656722         0.9000000
## percentile.median percentile95value
##         0.5000000         0.6000000
```

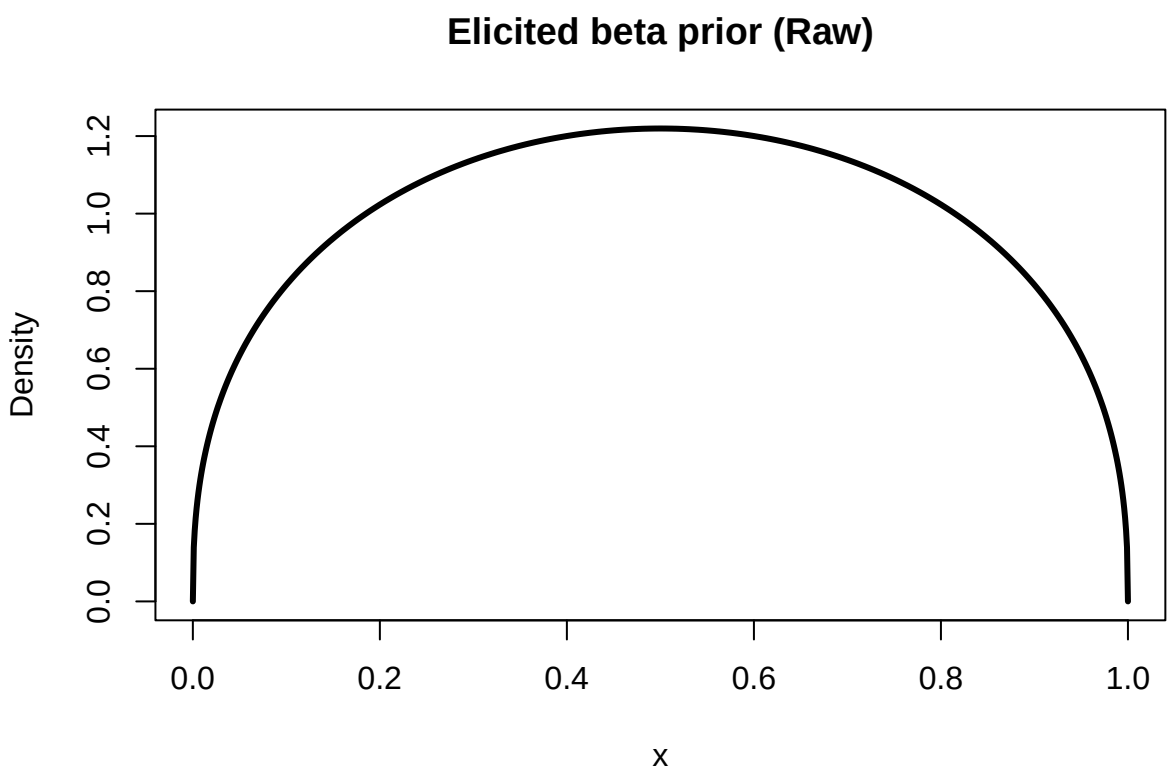
Plot for findbeta

```
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
fb_pr=findbeta(themean = 0.5,lower.v = T,percentile = 0.999,percentile.value = 0.999,silent = T)
findbeta_plot(fb_pr,main="Elicited beta prior (Percentile)",ylab = "Density",lwd=3,type="l")
```



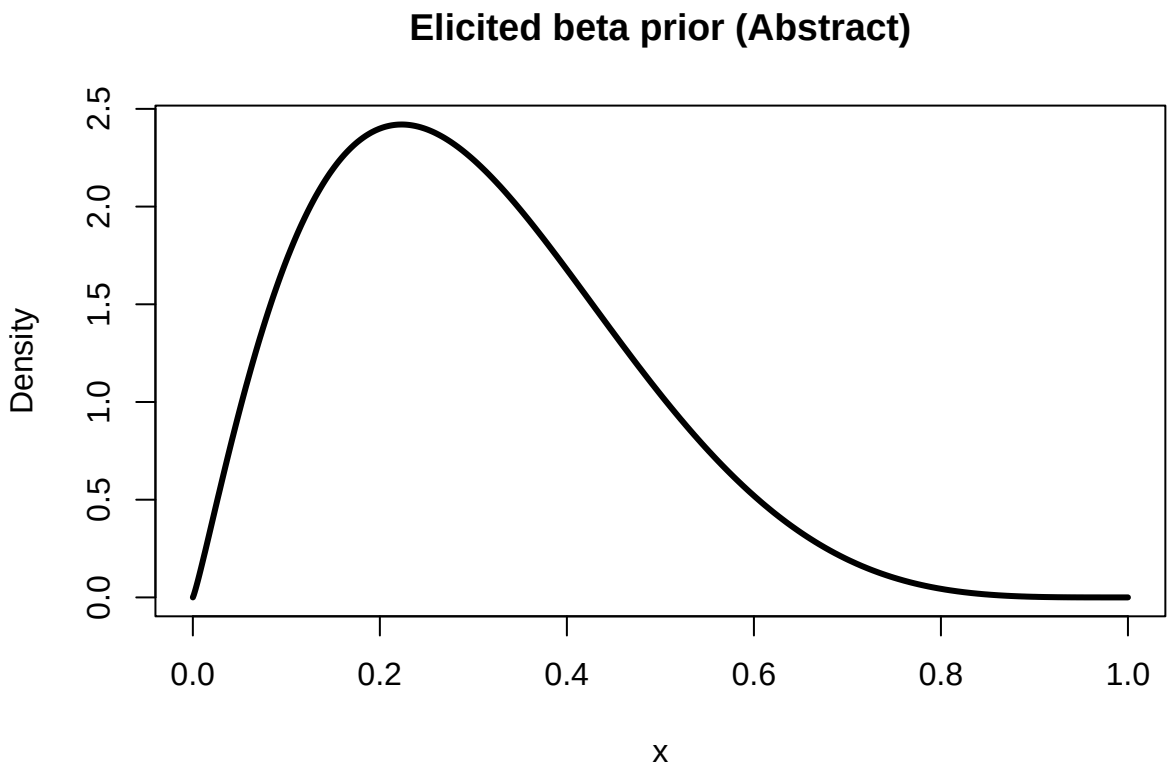
Plot for finbeta_raw

```
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
fb_raw=findbeta_raw(themean = 0.5,thevariance = 0.5)
findbeta_plot(fb_raw,main="Elicited beta prior (Raw)",ylab = "Density",lwd=3,type="l")
```



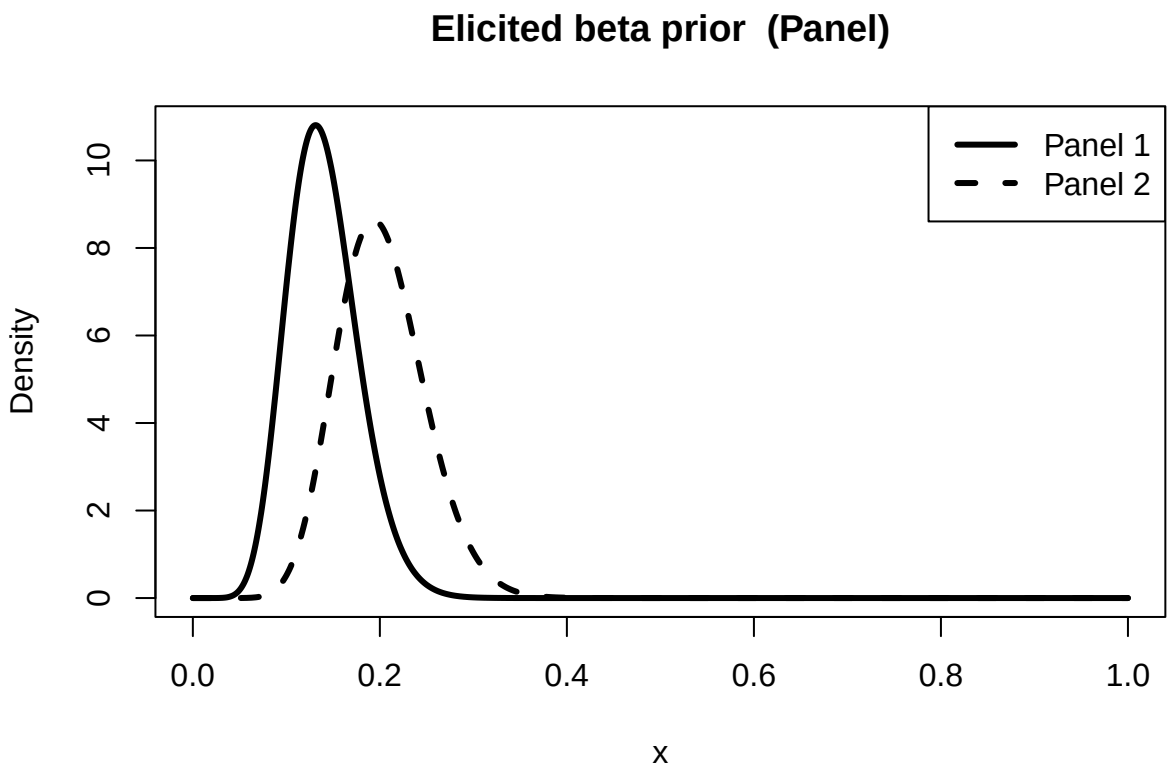
Plot for findbeta_abstract

```
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
fb_abstract=findbeta_abstract(themean.cat = "Low",thevariance.cat = "High")
findbeta_plot(fb_abstract,main="Elicited beta prior (Abstract)",ylab = "Density",lwd=3,type="l")
```



Plot for findbeta_panel

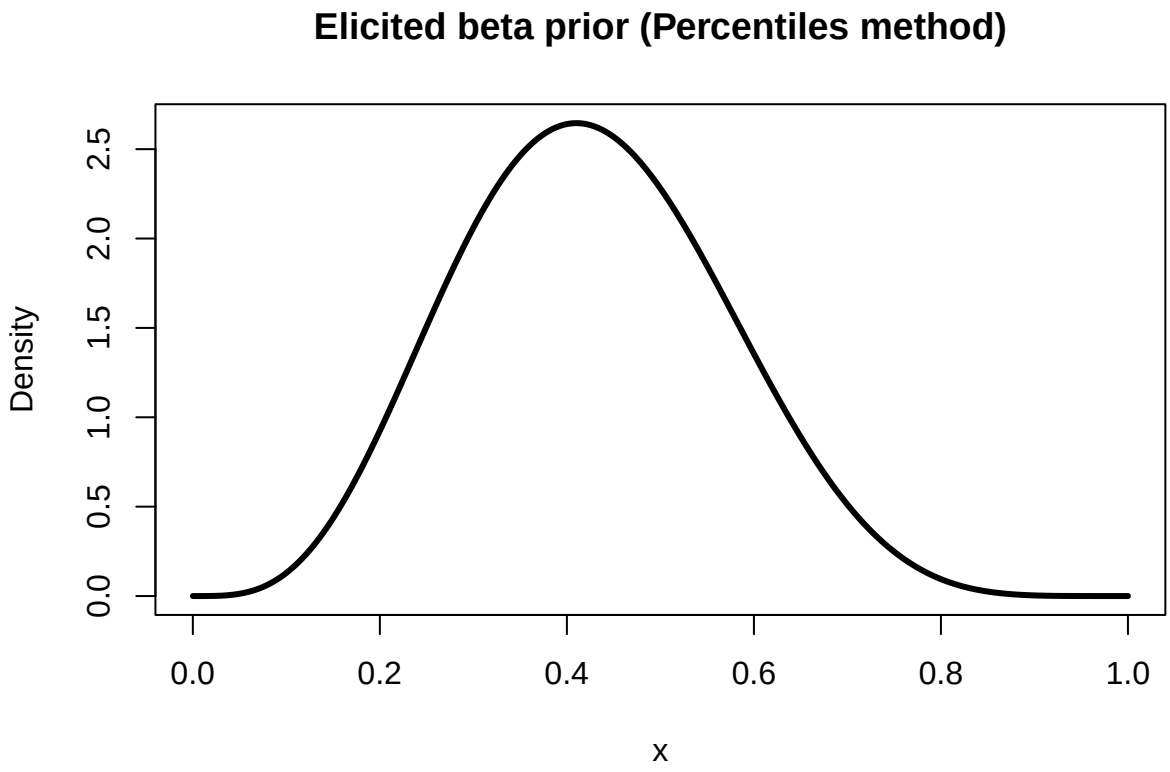
```
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
fb_panel1=findbeta_panel(themean.vec = c(0.2,0.02,0.5,0.03,0.04,0.05),silent = T)
fb_panel2=findbeta_panel(themean.vec = c(0.2,0.02,0.5,0.4,0.04,0.05),silent =T)
findbeta_plot(fb_panel1,main="Elicited beta prior  (Panel)",ylab = "Density",lwd=3,type="l")
findbeta_plot(fb_panel2,lwd=3,type="l",lines = T,lty=2)
legend("topright",c("Panel 1", "Panel 2"),lty = c(1,2),lwd=3)
```



Plot for findbetaqq

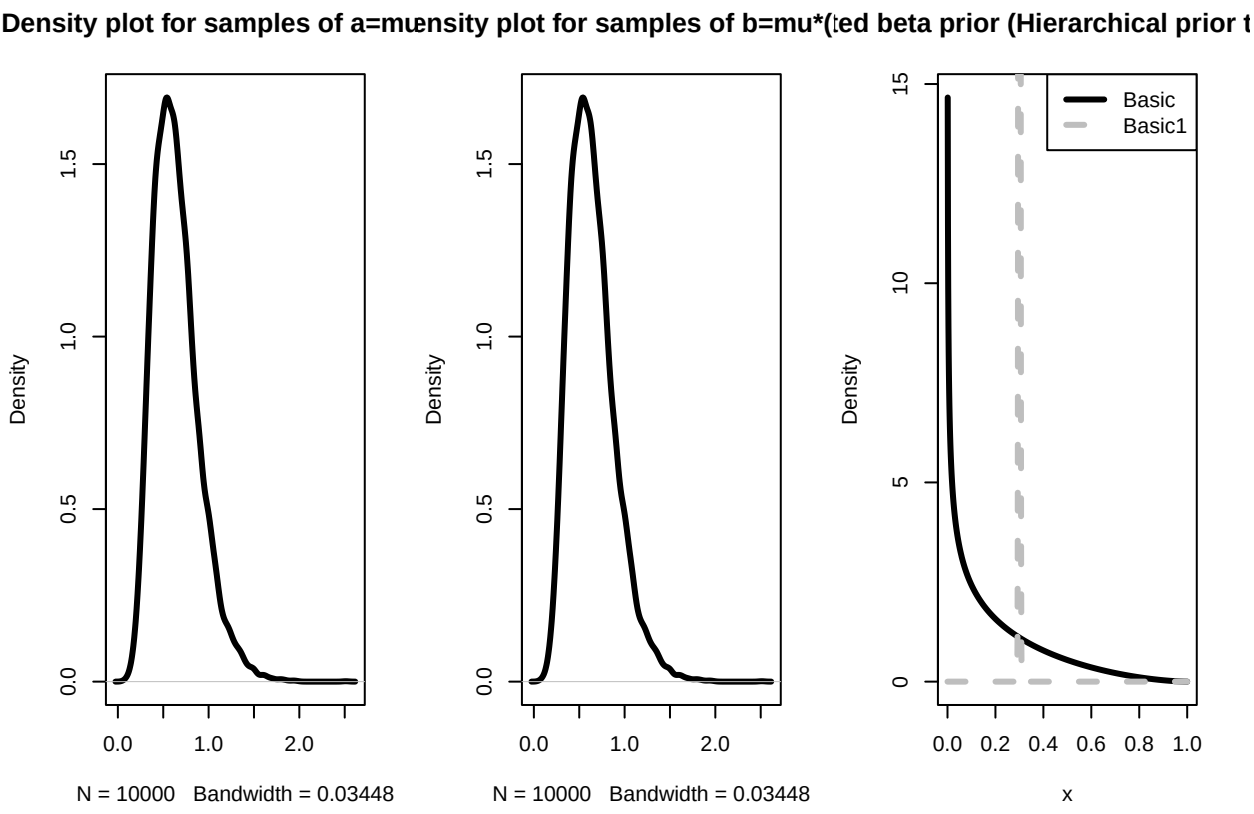
```
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
require(rootSolve)
fb_qq=findbetaqq(percentile.value1 = 0.3,percentile1 = 0.20,
percentile.value2 = 0.7,percentile2 = 0.97,silent=T)

findbeta_plot(fb_qq,main="Elicited beta prior (Percentiles method)",ylab = "Density",lwd=3,type="l")
```



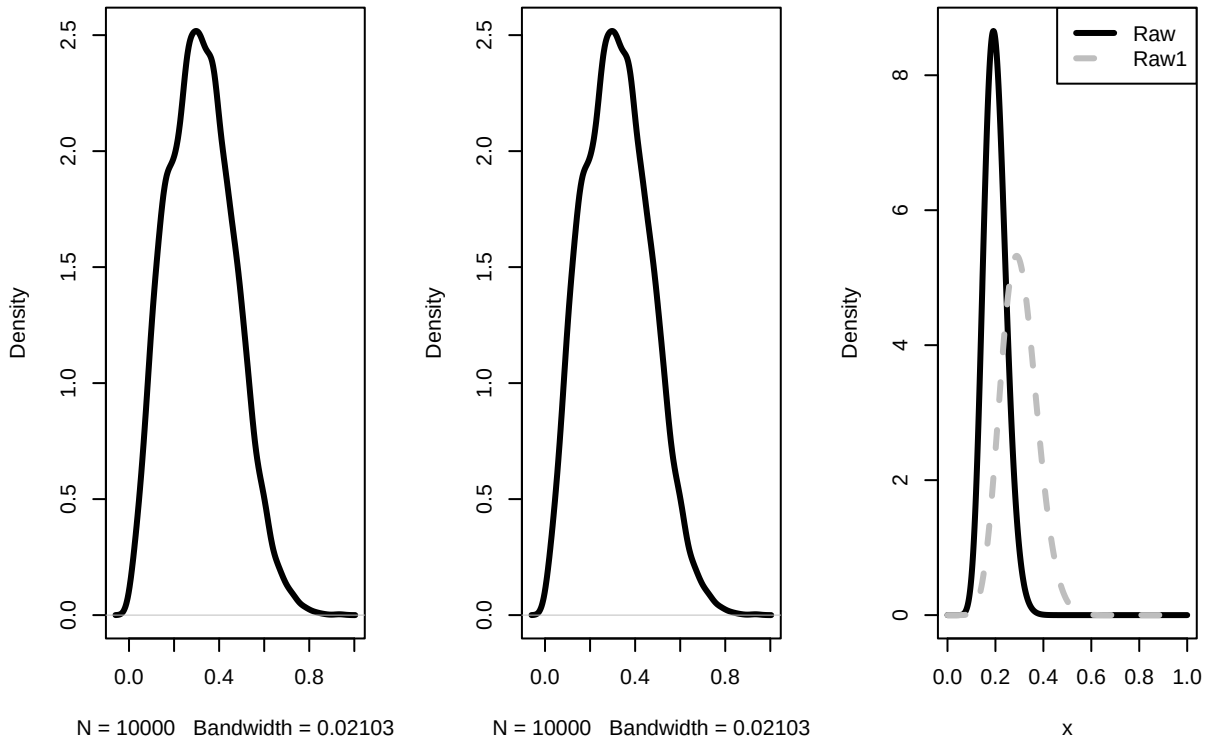
Plots for finbetamupsi

```
source("~/GitHub/PriorGen-1/R/findbetamupsi.r")
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
require(rootSolve)
fb_mupsi=findbetamupsi(themean=0.20, percentile=0.99, lower.v=TRUE,
              percentile.value=0.30, psi.percentile=0.90,
              percentile.median=0.50, percentile95value=0.60,silent = TRUE)
par(mfrow=c(1,3))
plot(density(fb_mupsi$bot_param$at),lwd=3,main="Density plot for samples of a=mu*psi") #
plot(density(fb_mupsi$bot_param$at),lwd=3,main="Density plot for samples of b=mu*(1-psi)") #
fb_mupsi$parameters[1]=mean(fb_mupsi$bot_param$at)
fb_mupsi$parameters[2]=mean(fb_mupsi$bot_param$bt)
findbeta_plot(fb_mupsi,main="Elicited beta prior (Hierarchical prior top level)",
              ylab = "Density",lwd=3,type="l")
fb_mupsi1=findbetamupsi(themean=0.30, percentile=0.8, lower.v=TRUE,
              percentile.value=0.30, psi.percentile=0.90,
              percentile.median=0.70, percentile95value=0.80,silent = TRUE)
findbeta_plot(fb_mupsi1,main="Elicited beta prior (Hierarchical prior top level)",
              ylab = "Density",lwd=3,type="l",lines = T,lty=2,col="gray")
legend("topright",c("Basic","Basic1"),col=c("black","gray"),lty=1:2,lwd=3)
```



Plots for findbetamupsi_raw

```
source("~/GitHub/PriorGen-1/R/findbetamupsi_raw.r")
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
require(rootSolve)
fb_mupsi_raw=findbetamupsi_raw(themean=0.20, thevariance = 0.1, thepsi=0.15,silent = TRUE)
par(mfrow=c(1,3))
plot(density(fb_mupsi_abstract$bot_param$at),lwd=3,main="Density plot for samples of a=mu*psi") #
plot(density(fb_mupsi_abstract$bot_param$at),lwd=3,main="Density plot for samples of b=mu*(1-psi)") #
fb_mupsi_abstract$parameters[1]=mean(fb_mupsi_abstract$bot_param$at)
fb_mupsi_abstract$parameters[2]=mean(fb_mupsi_abstract$bot_param$bt)
findbeta_plot(fb_mupsi_raw,main="Elicited beta prior (Hierarchical prior top level)",
              ylab = "Density",lwd=3,type="l")
fb_mupsi_raw1=findbetamupsi_raw(themean=0.30, thevariance = 0.15, thepsi=0.15,silent = TRUE)
findbeta_plot(fb_mupsi_raw1,main="Elicited beta prior (Hierarchical prior top level)",
              ylab = "Density",lwd=3,type="l",lines = T,lty=2,col="gray")
legend("topright",c("Raw","Raw1"),col=c("black","gray"),lty=1:2,lwd=3)
```



Plots for findbetamupsi_abstract

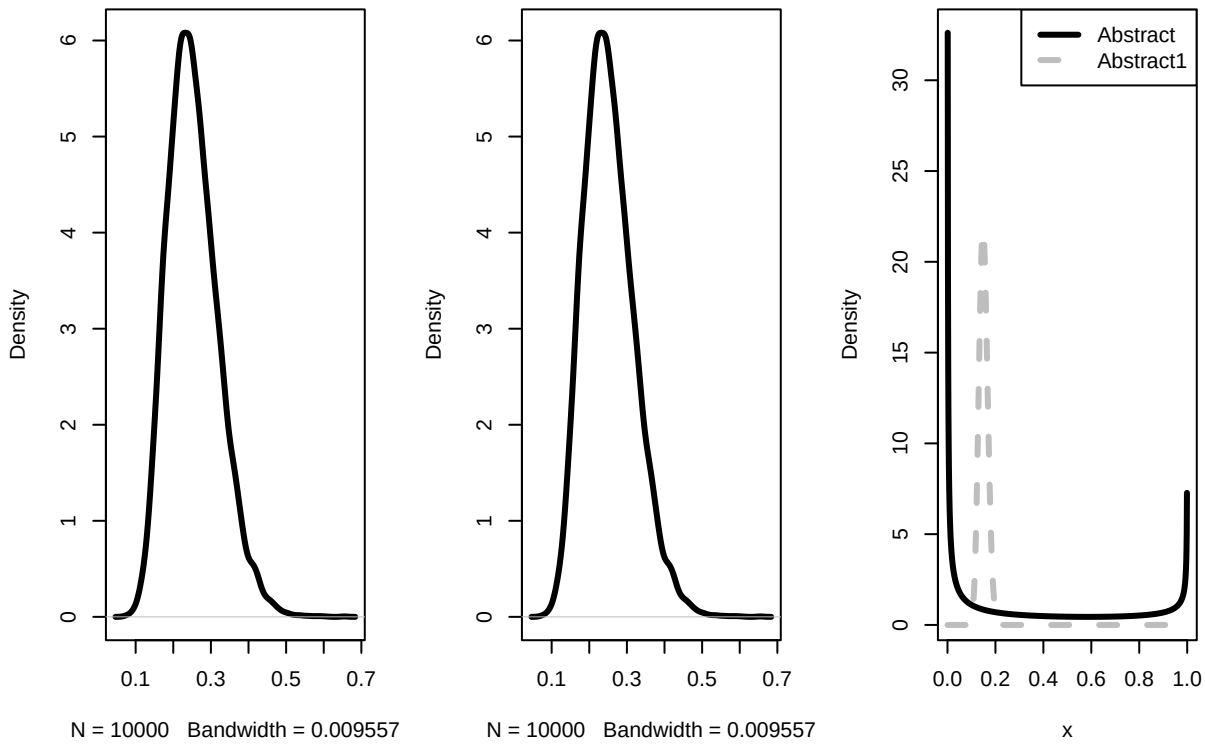
```
source("~/GitHub/PriorGen-1/R/findbetamupsi_abstract.r")
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
require(rootSolve)
fb_mupsi_abstract=findbetamupsi_abstract(themean="Low", thevariance = "High",
psi.percentile=0.90, percentile.median=0.95, percentile95value=0.98,silent = FALSE)
```

```
## [1] "The desired Beta distribution that satisfies the specified conditions about the mean of the prev
## [1] "The desired Gamma distribution that satisfies the specified conditions about the variability 'ps
## [1] "Descriptive statistics for this distrubiton are:"
```

```
par(mfrow=c(1,3))
plot(density(fb_mupsi_abstract$bot_param$at),lwd=3,main="Density plot for samples of a=mu*psi") #
plot(density(fb_mupsi_abstract$bot_param$at),lwd=3,main="Density plot for samples of b=mu*(1-psi)") #
fb_mupsi_abstract$parameters[1]=mean(fb_mupsi_abstract$bot_param$at)
fb_mupsi_abstract$parameters[2]=mean(fb_mupsi_abstract$bot_param$bt)
findbeta_plot(fb_mupsi_abstract,main="Elicited beta prior (Hierarchical prior top level)",
              ylab = "Density",lwd=3,type="l")
fb_mupsi_abstract1=findbetamupsi_abstract(themean="Very low", thevariance = "Average", psi.percentile=0
```

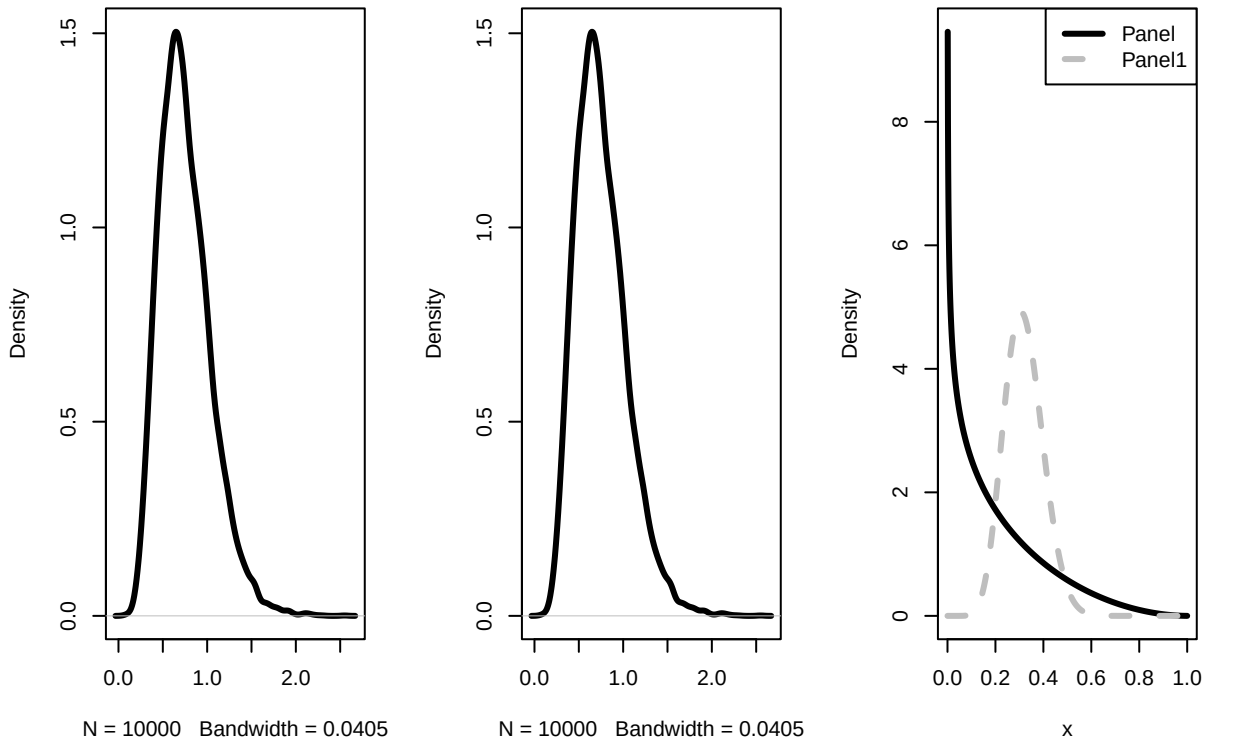
```
## [1] "The desired Beta distribution that satisfies the specified conditions about the mean of the prev
## [1] "The desired Gamma distribution that satisfies the specified conditions about the variability 'ps
## [1] "Descriptive statistics for this distrubiton are:"
```

```
findbeta_plot(fb_mupsi_abstract1,main="Elicited beta prior (Hierarchical prior top level)",
              ylab = "Density",lwd=3,type="l",lines = T,lty=2,col="gray")
legend("topright",c("Abstract","Abstract1"),col=c("black","gray"),lty=1:2,lwd=3)
```



Plots for findbetamupsi_panel

```
source("~/GitHub/PriorGen-1/R/findbetamupsi_panel.r")
source("~/GitHub/PriorGen-1/R/findbeta_plot.r")
require(rootSolve)
fb_mupsi_panel=findbetamupsi_panel(themean=c(0.1,0.5,0.05,0.01,0.4,0.2), psi.percentile=0.90,
                                   percentile.median=0.50, percentile95value=0.60,silent = TRUE)
par(mfrow=c(1,3))
plot(density(fb_mupsi_panel$bot_param$at),lwd=3,main="Density plot for samples of a=mu*psi") #
plot(density(fb_mupsi_panel$bot_param$at),lwd=3,main="Density plot for samples of b=mu*(1-psi)") #
fb_mupsi_panel$parameters[1]=mean(fb_mupsi_panel$bot_param$at)
fb_mupsi_panel$parameters[2]=mean(fb_mupsi_panel$bot_param$bt)
findbeta_plot(fb_mupsi_panel,main="Elicited beta prior (Hierarchical prior top level)",
              ylab = "Density",lwd=3,type="l")
fb_mupsi_panel1=findbetamupsi_panel(themean=c(0.1,0.5,0.05,0.01,0.6,0.65), psi.percentile=0.90,
              percentile.median=0.80, percentile95value=0.90,silent = TRUE)
findbeta_plot(fb_mupsi_panel1,main="Elicited beta prior (Hierarchical prior top level)",
              ylab = "Density",lwd=3,type="l",lines = T,lty=2,col="gray")
legend("topright",c("Panel","Panel1"),col=c("black","gray"),lty=1:2,lwd=3)
```



New root and optim functions