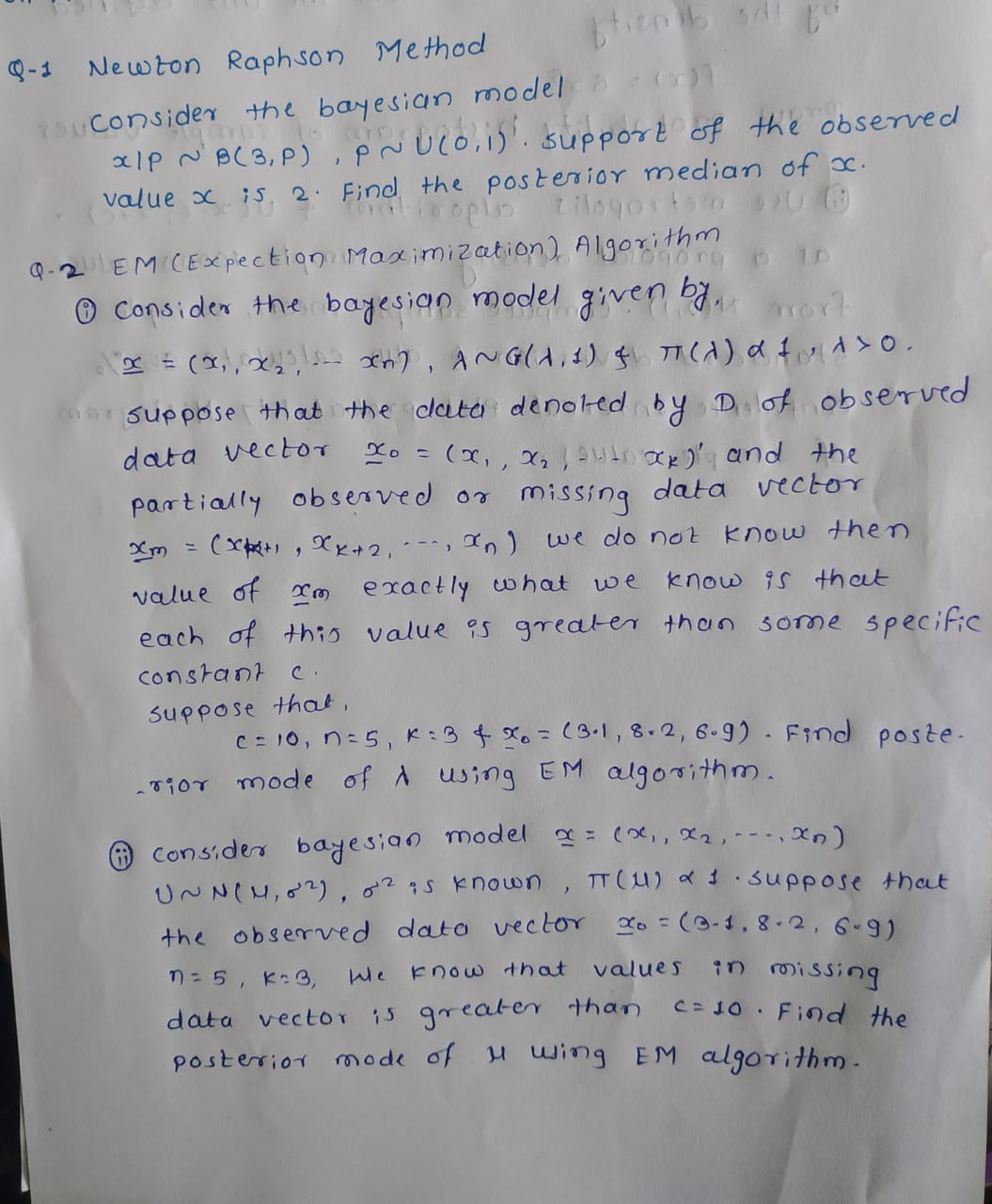
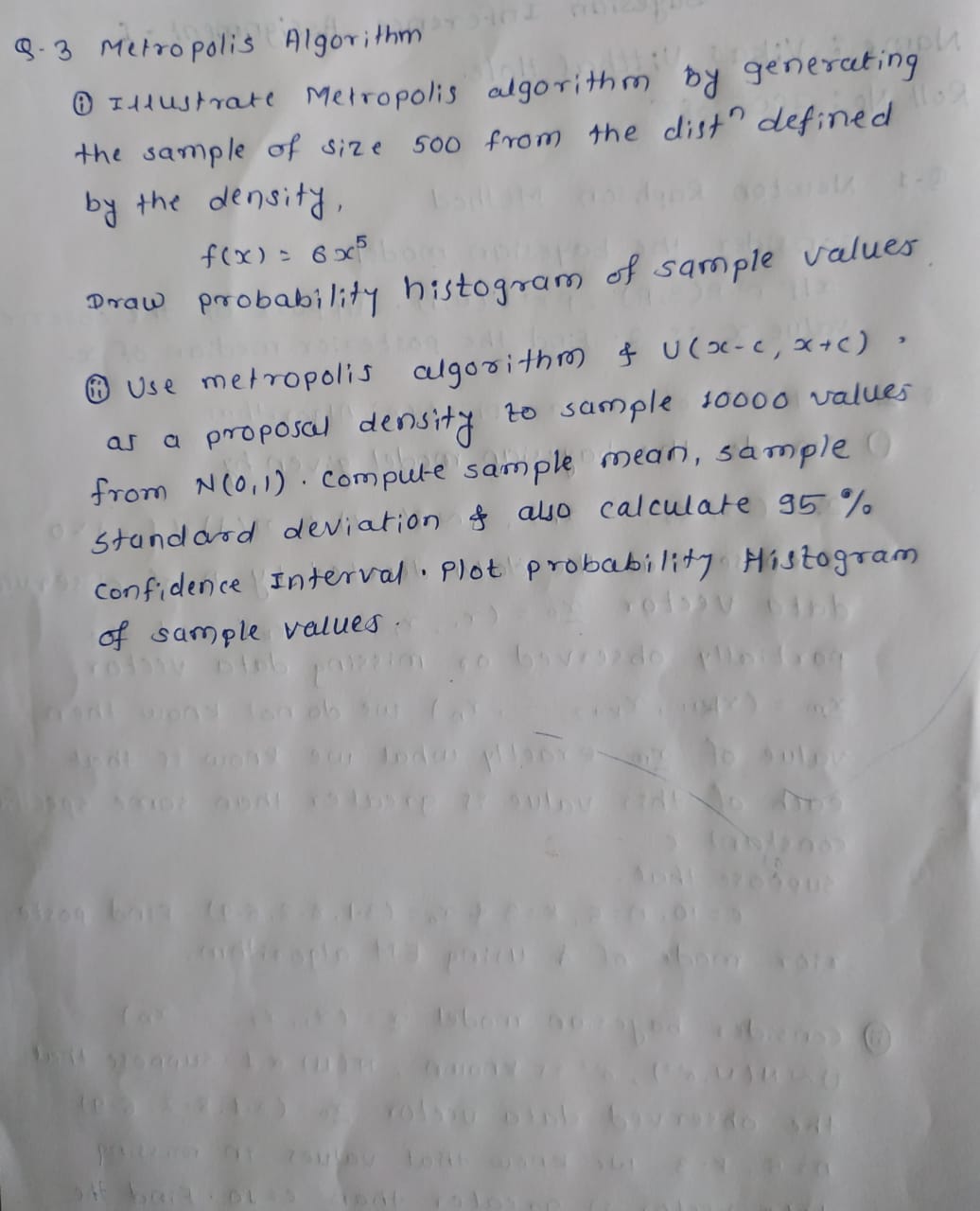
****

****

**> #Question1**

**> #Newton Raphson Algorithm**

>

> p=2/3 ; #We took initial guess as a 2/3 because 2/3 is estimated value of phat=xhat/n=x/n=2/3

> gy=function(p)

+ {

+ return(3\*p^4-4\*p^3+1/2)

+ }

> g\_y=function(p)

+ {

+ return(12\*p^3-12\*p^2)

+ }

> k=0

> for(i in 2:1000)

+ {

+ p[i]=p[i-1]-(gy(p[i-1])/g\_y(p[i-1]))

+ k=k+1

+ a=abs(p[i]-p[i-1])

+ if(a<0.000001)

+ {

+ print(p[i])

+ k

+ return(0)

+ }

+ }

[1] 0.6142724

> k

[1] 3

> print(paste("No. of iterations used",k))

[1] "No. of iterations used 3"

> print(paste("Posterior median of p",p[i]))

[1] "Posterior median of p 0.614272431867611"

>

>

>

>

**> #EM Algorithm:**

**> #Example 1**

> n=5

> L=1

> c=10

> k=3

> x01=c(3.1,8.2,6.9)

> x0t=sum(x01)

> d=0.000001

> for(i in 2:100)

+ {

+ L[i]=(n/(x0t+(n-k)\*(c+(1/L[i-1]))))

+ if(abs(L[i]-L[i-1])<d)

+ {

+ print(paste("No of iteration",i))

+ print(paste("Posterior mode ",L[i]))

+ break;

+ }

+ }

[1] "No of iteration 14"

[1] "Posterior mode 0.0785345170595558"

>

>

>

**> #Example 2**

> n=1000

> n1=5

> k=3

> x0=c(3.1,8.2,6.9)

> x0t=mean(x0)

> c=10

> sig=1

> mu=3

> d=0.000001

> e=function(p)

+ {

+ p+sig\*(dnorm((c-p)/sig))/(1-pnorm((c-p)/sig))

+ }

> for(i in 2:n)

+ {

+ mu[i]=(k\*x0t+(n1-k)\*e(mu)[i-1])/n1

+ if(abs(mu[i]-mu[i-1])<d)

+ {

+ print(paste("No of iteration",i))

+ print(paste("Posterior mode ",mu[i]))

+ break;

+ }

+ }

[1] "No of iteration 7"

[1] "Posterior mode 7.77976784180798"

>

>

>

**> #Metropolis algorithm**

>

**> #Example 1**

> A=function(a,b)

+ {

+ (a/b)^5

+ }

> c=0.1

> #Sample size

> n=500

> x = c() # to store values coming from target

> y = c() # to store values coming from proposal

> x[1]=0.5

>

> # initial value

>

> for (i in 2:n)

+ {

+ y[i]=runif(1,x[i-1]-c,x[i-1]+c)

+ ap=A(y[i],x[i-1])

+ ap=ifelse(ap>=1,1,ap)

+ ap=ifelse(y[i]<0,0,ap)

+ ap=ifelse(y[i]>1,0,ap)

+ u=runif(1,0,1)

+

+ x[i]=ifelse(u<=ap,y[i],x[i-1])

+ }

> x

[1] 0.5000000 0.4147034 0.4147034 0.3672182 0.4454041 0.4260132 0.4260132 0.3995461 0.3995461 0.3995461 0.4590063

[12] 0.4806764 0.4666218 0.4770016 0.3817268 0.3817268 0.3582108 0.3826061 0.4624155 0.4530025 0.4938426 0.5579016

[23] 0.6236293 0.7165078 0.6318678 0.6318678 0.6318678 0.6872794 0.6512653 0.6281736 0.7226040 0.7007604 0.6376126

[34] 0.6786944 0.7131922 0.6259918 0.7116746 0.6736126 0.6338041 0.5785940 0.5658123 0.4963685 0.5233707 0.5321034

[45] 0.5321034 0.4497893 0.4497893 0.4310130 0.4013251 0.4902990 0.4884487 0.5416886 0.5696693 0.5705385 0.5877985

[56] 0.6844536 0.6948056 0.7602846 0.6879462 0.6864980 0.6864980 0.7020361 0.7770887 0.7190496 0.7190496 0.6581108

[67] 0.7052960 0.7052960 0.6954783 0.6507822 0.6580744 0.6261862 0.6944172 0.7024801 0.6920940 0.7065643 0.6429834

[78] 0.5765486 0.5055246 0.5728021 0.5728021 0.6431750 0.6764495 0.6764495 0.6277803 0.7020133 0.7020133 0.7267163

[89] 0.7687783 0.7924195 0.7356049 0.7260534 0.6814020 0.6752856 0.7564694 0.7501972 0.7083375 0.6592375 0.6905619

[100] 0.6569285 0.6642103 0.6642103 0.5757424 0.5757424 0.6623858 0.5981037 0.5981037 0.6676826 0.7337248 0.7337248

[111] 0.7129254 0.7129254 0.6575377 0.7296126 0.6341339 0.5506047 0.5136351 0.5136351 0.5136351 0.5136351 0.5699758

[122] 0.6386254 0.7316654 0.6559682 0.7077385 0.6614383 0.6614383 0.6216274 0.6353304 0.6861392 0.7142272 0.7470199

[133] 0.7665438 0.7665438 0.6748661 0.6748661 0.6748661 0.6745340 0.7723448 0.7348389 0.6845961 0.7321412 0.8143224

[144] 0.8620810 0.8188548 0.7210493 0.6315008 0.7134608 0.7625077 0.7938853 0.8325098 0.7978327 0.8081299 0.7182127

[155] 0.7182127 0.7198536 0.6401333 0.6712311 0.6712311 0.6769610 0.7400610 0.7485160 0.6979602 0.7710792 0.7796936

[166] 0.7729705 0.6878898 0.6596690 0.7465486 0.8440489 0.9176612 0.9176612 0.8267579 0.9224497 0.9224497 0.8333644

[177] 0.8738256 0.8727701 0.8418400 0.7628930 0.7560954 0.7560954 0.7245000 0.7245000 0.7245000 0.7023262 0.6614707

[188] 0.6783079 0.6002128 0.6776669 0.6465306 0.7260883 0.7316862 0.7902387 0.7902387 0.7141579 0.6588551 0.6994860

[199] 0.6966475 0.7508750 0.7991438 0.7858837 0.6917316 0.7617286 0.7411128 0.7977427 0.8897183 0.8389227 0.8240770

[210] 0.7862059 0.8110462 0.7591463 0.7069481 0.7604399 0.8282982 0.8188248 0.7869976 0.8740729 0.8970165 0.9337176

[221] 0.9337176 0.9337176 0.8979576 0.8929661 0.8017891 0.8017891 0.8112576 0.8318430 0.9198379 0.9235451 0.8902791

[232] 0.9029663 0.8763860 0.8371104 0.8371104 0.8713642 0.8976074 0.9077750 0.9225137 0.8857865 0.9746427 0.9746427

[243] 0.9746427 0.9351848 0.9646447 0.9646447 0.9646447 0.9646447 0.9166115 0.8314021 0.8821612 0.8731273 0.8731273

[254] 0.8105442 0.8105442 0.8064149 0.7620174 0.7620174 0.7480895 0.7480895 0.7315645 0.7587086 0.7961220 0.7961220

[265] 0.7961220 0.7449315 0.7188604 0.6825805 0.6139109 0.6365429 0.6921271 0.7670564 0.7670564 0.7790437 0.7878262

[276] 0.8315616 0.8533744 0.8147581 0.8491977 0.7835132 0.8459639 0.9413900 0.9413900 0.9413900 0.9413900 0.8520092

[287] 0.8661922 0.8737921 0.8413152 0.8646348 0.8946532 0.8899078 0.8875767 0.8875767 0.8875767 0.9147602 0.8984435

[298] 0.9844198 0.9925126 0.9925126 0.9925126 0.9515408 0.9515408 0.9552059 0.9533155 0.9559025 0.9559025 0.8847117

[309] 0.8359301 0.8721609 0.8721609 0.8043236 0.8043236 0.8043236 0.7696696 0.8124410 0.8938099 0.8931803 0.9732973

[320] 0.9862756 0.9907598 0.9528609 0.9718024 0.8814925 0.8745886 0.9479110 0.9479110 0.9479110 0.9479110 0.9479110

[331] 0.9841244 0.9727212 0.9727212 0.9175926 0.9175926 0.8788526 0.8788526 0.9113028 0.9575022 0.9985740 0.9985740

[342] 0.9985740 0.9026087 0.9548628 0.8625498 0.8625498 0.8158565 0.8267880 0.8433398 0.8856398 0.9608569 0.9608569

[353] 0.9608569 0.9322255 0.9903615 0.9903615 0.9903615 0.9903615 0.9903615 0.9660480 0.9978828 0.9978828 0.9452256

[364] 0.9170354 0.9289358 0.9371291 0.8791126 0.8840932 0.8820698 0.9171423 0.9029029 0.9472249 0.8969890 0.9932329

[375] 0.9932329 0.9932329 0.9932329 0.9932329 0.9454177 0.9393300 0.8974399 0.8463018 0.9117512 0.9117512 0.9117512

[386] 0.9734877 0.9734877 0.9734877 0.9711706 0.9788886 0.9788886 0.9975978 0.9856584 0.9856584 0.9844927 0.9968826

[397] 0.9968826 0.9968826 0.9968826 0.9331435 0.9178491 0.9178491 0.9758144 0.9758144 0.8793266 0.8793266 0.8793266

[408] 0.8907796 0.9279018 0.9817310 0.9817310 0.9817310 0.9064700 0.8915444 0.8828913 0.8328112 0.8328112 0.7782475

[419] 0.8350833 0.7718787 0.7400432 0.7158160 0.7140966 0.7291277 0.7134956 0.7245853 0.6606128 0.6519015 0.5865194

[430] 0.5865194 0.5772593 0.5772593 0.6596313 0.6283320 0.6924361 0.7570472 0.8432879 0.8487920 0.8391604 0.9287126

[441] 0.9287126 0.8992427 0.8185630 0.7915637 0.8109706 0.8716084 0.9019176 0.9019176 0.9888652 0.9475048 0.8997735

[452] 0.8162763 0.8162763 0.7671845 0.8536585 0.8405640 0.7879298 0.7777645 0.8179847 0.9028986 0.9028986 0.9908231

[463] 0.9908231 0.9908231 0.9781305 0.9781305 0.9754400 0.9754400 0.9754400 0.9754400 0.8814484 0.9648489 0.8920887

[474] 0.9827264 0.9520786 0.9253465 0.9416066 0.9231044 0.8955069 0.8856698 0.9817116 0.9817116 0.9817116 0.9817116

[485] 0.9066698 0.8140916 0.8868693 0.8645994 0.8792034 0.9359556 0.9953935 0.9953935 0.9659190 0.9707531 0.9707531

[496] 0.9074683 0.9074683 0.9649274 0.9883593 0.9883593

> x=x[100:n];x

[1] 0.6569285 0.6642103 0.6642103 0.5757424 0.5757424 0.6623858 0.5981037 0.5981037 0.6676826 0.7337248 0.7337248

[12] 0.7129254 0.7129254 0.6575377 0.7296126 0.6341339 0.5506047 0.5136351 0.5136351 0.5136351 0.5136351 0.5699758

[23] 0.6386254 0.7316654 0.6559682 0.7077385 0.6614383 0.6614383 0.6216274 0.6353304 0.6861392 0.7142272 0.7470199

[34] 0.7665438 0.7665438 0.6748661 0.6748661 0.6748661 0.6745340 0.7723448 0.7348389 0.6845961 0.7321412 0.8143224

[45] 0.8620810 0.8188548 0.7210493 0.6315008 0.7134608 0.7625077 0.7938853 0.8325098 0.7978327 0.8081299 0.7182127

[56] 0.7182127 0.7198536 0.6401333 0.6712311 0.6712311 0.6769610 0.7400610 0.7485160 0.6979602 0.7710792 0.7796936

[67] 0.7729705 0.6878898 0.6596690 0.7465486 0.8440489 0.9176612 0.9176612 0.8267579 0.9224497 0.9224497 0.8333644

[78] 0.8738256 0.8727701 0.8418400 0.7628930 0.7560954 0.7560954 0.7245000 0.7245000 0.7245000 0.7023262 0.6614707

[89] 0.6783079 0.6002128 0.6776669 0.6465306 0.7260883 0.7316862 0.7902387 0.7902387 0.7141579 0.6588551 0.6994860

[100] 0.6966475 0.7508750 0.7991438 0.7858837 0.6917316 0.7617286 0.7411128 0.7977427 0.8897183 0.8389227 0.8240770

[111] 0.7862059 0.8110462 0.7591463 0.7069481 0.7604399 0.8282982 0.8188248 0.7869976 0.8740729 0.8970165 0.9337176

[122] 0.9337176 0.9337176 0.8979576 0.8929661 0.8017891 0.8017891 0.8112576 0.8318430 0.9198379 0.9235451 0.8902791

[133] 0.9029663 0.8763860 0.8371104 0.8371104 0.8713642 0.8976074 0.9077750 0.9225137 0.8857865 0.9746427 0.9746427

[144] 0.9746427 0.9351848 0.9646447 0.9646447 0.9646447 0.9646447 0.9166115 0.8314021 0.8821612 0.8731273 0.8731273

[155] 0.8105442 0.8105442 0.8064149 0.7620174 0.7620174 0.7480895 0.7480895 0.7315645 0.7587086 0.7961220 0.7961220

[166] 0.7961220 0.7449315 0.7188604 0.6825805 0.6139109 0.6365429 0.6921271 0.7670564 0.7670564 0.7790437 0.7878262

[177] 0.8315616 0.8533744 0.8147581 0.8491977 0.7835132 0.8459639 0.9413900 0.9413900 0.9413900 0.9413900 0.8520092

[188] 0.8661922 0.8737921 0.8413152 0.8646348 0.8946532 0.8899078 0.8875767 0.8875767 0.8875767 0.9147602 0.8984435

[199] 0.9844198 0.9925126 0.9925126 0.9925126 0.9515408 0.9515408 0.9552059 0.9533155 0.9559025 0.9559025 0.8847117

[210] 0.8359301 0.8721609 0.8721609 0.8043236 0.8043236 0.8043236 0.7696696 0.8124410 0.8938099 0.8931803 0.9732973

[221] 0.9862756 0.9907598 0.9528609 0.9718024 0.8814925 0.8745886 0.9479110 0.9479110 0.9479110 0.9479110 0.9479110

[232] 0.9841244 0.9727212 0.9727212 0.9175926 0.9175926 0.8788526 0.8788526 0.9113028 0.9575022 0.9985740 0.9985740

[243] 0.9985740 0.9026087 0.9548628 0.8625498 0.8625498 0.8158565 0.8267880 0.8433398 0.8856398 0.9608569 0.9608569

[254] 0.9608569 0.9322255 0.9903615 0.9903615 0.9903615 0.9903615 0.9903615 0.9660480 0.9978828 0.9978828 0.9452256

[265] 0.9170354 0.9289358 0.9371291 0.8791126 0.8840932 0.8820698 0.9171423 0.9029029 0.9472249 0.8969890 0.9932329

[276] 0.9932329 0.9932329 0.9932329 0.9932329 0.9454177 0.9393300 0.8974399 0.8463018 0.9117512 0.9117512 0.9117512

[287] 0.9734877 0.9734877 0.9734877 0.9711706 0.9788886 0.9788886 0.9975978 0.9856584 0.9856584 0.9844927 0.9968826

[298] 0.9968826 0.9968826 0.9968826 0.9331435 0.9178491 0.9178491 0.9758144 0.9758144 0.8793266 0.8793266 0.8793266

[309] 0.8907796 0.9279018 0.9817310 0.9817310 0.9817310 0.9064700 0.8915444 0.8828913 0.8328112 0.8328112 0.7782475

[320] 0.8350833 0.7718787 0.7400432 0.7158160 0.7140966 0.7291277 0.7134956 0.7245853 0.6606128 0.6519015 0.5865194

[331] 0.5865194 0.5772593 0.5772593 0.6596313 0.6283320 0.6924361 0.7570472 0.8432879 0.8487920 0.8391604 0.9287126

[342] 0.9287126 0.8992427 0.8185630 0.7915637 0.8109706 0.8716084 0.9019176 0.9019176 0.9888652 0.9475048 0.8997735

[353] 0.8162763 0.8162763 0.7671845 0.8536585 0.8405640 0.7879298 0.7777645 0.8179847 0.9028986 0.9028986 0.9908231

[364] 0.9908231 0.9908231 0.9781305 0.9781305 0.9754400 0.9754400 0.9754400 0.9754400 0.8814484 0.9648489 0.8920887

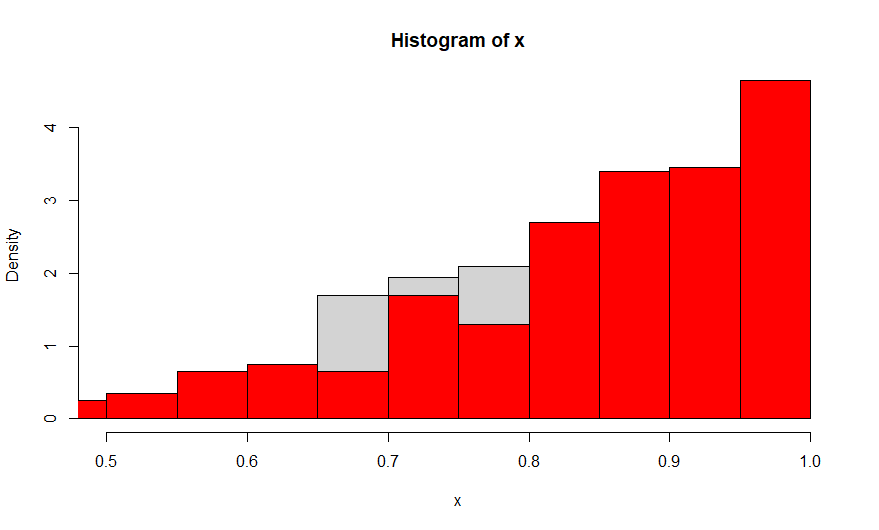
[375] 0.9827264 0.9520786 0.9253465 0.9416066 0.9231044 0.8955069 0.8856698 0.9817116 0.9817116 0.9817116 0.9817116

[386] 0.9066698 0.8140916 0.8868693 0.8645994 0.8792034 0.9359556 0.9953935 0.9953935 0.9659190 0.9707531 0.9707531

[397] 0.9074683 0.9074683 0.9649274 0.9883593 0.9883593

> hist(x,freq=FALSE)

> hist(rbeta(400,6,1),freq=FALSE,add=T,col = "red")



**> #Example 2**

> c=4

> #Sample size

> n=10000

> x = c() # to store values coming from target

> y = c() # to store values coming from proposal

> x[1]=0.5

> r=4 #tunning parameter

> # initial value

>

> for (i in 2:n)

+ {

+

+ y[i]=runif(1,x[i-1]-c,x[i-1]+c)

+ ap=dnorm(y[i])/dnorm(x[i-1])

+ ap=ifelse(ap>=1,1,ap)

+

+ u=runif(1,0,1)

+

+ x[i]=ifelse(u<=ap,y[i],x[i-1])

+ }

> x

[1] 0.500000000 -0.868167236 -2.325749084 -1.134699414 0.143719759 0.143719759 0.143719759 0.107609903

[9] 0.107609903 -0.811277706 0.801384488 0.147546658 0.147546658 -0.714301262 -0.714301262 -0.714301262

[17] -0.714301262 0.587293971 0.587293971 -0.141244827 -0.141244827 -0.141244827 -0.116658092 -0.261735301

[25] -0.261735301 -0.261735301 1.506082689 1.506082689 0.495922783 0.104751706 0.104751706 0.104751706

[33] 0.104751706 -1.346152792 0.664007282 0.664007282 0.664007282 -0.560987836 -0.560987836 1.944065038

[41] -1.758543750 1.726866059 1.726866059 1.726866059 -0.925881023 -0.715536566 -1.710781243 1.836898027

[49] 0.962994786 1.309193734 1.631846819 1.304564286 1.304564286 1.155646179 1.280652516 1.280652516

[57] 1.280652516 1.448687108 0.789386569 0.789386569 0.789386569 -0.673911687 -0.673911687 1.941235289

[65] 1.941235289 2.572006879 2.572006879 1.759628817 1.759628817 -0.048349246 -0.048349246 0.855683710

[73] 0.297619862 0.369356206 0.369356206 0.369356206 0.369356206 -0.296382464 -1.464631736 -1.464631736

[81] 0.063742019 0.063742019 0.063742019 0.063742019 0.063742019 0.063742019 0.063742019 0.939961493

[89] -1.332856394 1.587551510 1.587551510 1.587551510 1.587551510 1.587551510 1.587551510 1.686403899

[97] 1.686403899 0.221051438 -0.205155222 -0.765814671 -0.765814671 -0.266532850 -0.266532850 -0.266532850

[105] -0.266532850 1.143856654 0.983817425 -0.375946054 -0.375946054 -0.375946054 -0.375946054 -0.375946054

[113] -0.375946054 -0.375946054 -0.375946054 -0.375946054 1.242939943 -0.925512973 0.684367802 0.463280577

[121] 0.463280577 0.463280577 0.463280577 1.329172654 1.329172654 1.329172654 1.329172654 1.329172654

[129] 1.329172654 -0.291231340 -0.291231340 -0.291231340 -0.291231340 -0.291231340 -0.291231340 -0.291231340

[137] -0.291231340 -0.291231340 0.703126747 0.703126747 0.703126747 1.111456944 1.111456944 1.111456944

[145] 1.111456944 0.711092426 0.711092426 0.711092426 1.574689837 1.574689837 -1.848736268 -0.785646992

[153] 0.906179396 0.906179396 0.906179396 0.906179396 -1.006158704 -1.006158704 -1.006158704 -0.184130214

[161] -0.184130214 1.465255409 1.465255409 2.672488891 2.772604296 2.772604296 -0.559410647 0.866130156

[169] 0.866130156 0.866130156 1.100094983 -0.389308585 -0.389308585 -0.389308585 -0.389308585 -0.389308585

[177] -0.541055482 -0.541055482 -0.541055482 -0.534687396 -0.534687396 -0.534687396 -0.534687396 -0.534687396

[185] -0.714850316 0.151724244 -0.549992878 -0.549992878 -0.740258958 -0.740258958 -0.740258958 -0.740258958

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[ reached getOption("max.print") -- omitted 8901 entries ]

> x=x[seq(1,9900,by=25)];x

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[9] -1.165141637 1.463242061 -0.763395524 0.611753093 -0.740887463 0.285857836 0.357179478 0.324037842

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[393] -0.819424141 -1.166365039 -1.522651924 0.204339104

> n1=length(x)

> sm=mean(x);sm #sample mean

[1] 0.09753565

> sv=sqrt(((n1-1)/n1)\*var(x));sv #sample sd

[1] 1.0204

> #95% confidence interval

> lb=sm-(-qt(0.025,n1-1))\*(sqrt(n1-1)\*sv)/n1;lb

[1] -0.003147037

> ub=sm+(-qt(0.025,n1-1))\*(sqrt(n1-1)\*sv)/n1;ub

[1] 0.1982183

> print(paste('95% confidence interval for sample mean is lb and ub',lb,ub))

[1] "95% confidence interval for sample mean is lb and ub -0.00314703663278336 0.198218333408591"

> #Plot Probability Histogram

> hist(x,freq=FALSE)

> hist(rnorm(n1,0,1),freq=FALSE,add=T,col = "red")

