Monte Carlo MAP 5615 HW4

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>> rand('seed',0);

>> R=rand(1,2000);

>> adtest(InvNorm(R))

ans =

**0.4367**

>> adtest(box\_muller(2000))

ans =

**0.1792**

To compare the Box Muller method and the Beasley Springer Moro algorithm, I set the seed 0 to generate the same pseudorandom number sequence.

Using Anderson Darling test, the test statistics for the two methods are as following

**Beasley Springer Moro algorithm: 0.4376**

**Box Muller method: 0.1792**

Codes for the two methods and Anderson darling test are in appendix [1].

Both statistics are less than 2.492 under 5% significant level. So we accept that both methods generate standard normal variables.

As the test statistics measure the distance between c.d.f and the empirical c.d.f, the smaller value is the better. Thus Box Muller method is better to generate standard normal variables.

# Appendix

[1] code of problem 6

**Beasley Springer Moro algorithm**

function x=InvNorm(u)

a0=2.50662823884;

a1=-18.61500062529;

a2=41.39119773534;

a3=-25.44106049637;

b0=-8.47351093090;

b1=23.08336743743;

b2=-21.06224101826;

b3=3.13082909833;

c0=0.3374754822726147;

c1=0.9761690190917186;

c2=0.1607979714918209;

c3=0.0276438810333863;

c4=0.0038405729373609;

c5=0.0003951896511919;

c6=0.0000321767881768;

c7=0.0000002888167364;

c8=0.0000003960315187;

y=u-0.5;

index1=abs(y)<0.42;

index2=not(index1);

x=zeros(size(u));

r1=abs(y(index1));

r=r1.^2;

x(index1)=r1.\*polyval([a3,a2,a1,a0],r)./polyval([b3,b2,b1,b0,1],r);

r=u(index2);

r=min(r,1-r);

r=log(-log(r));

x(index2)=polyval([c8,c7,c6,c5,c4,c3,c2,c1,c0],r);

x=x.\*sign(y);

end

**Box Muller method**

function U=box\_muller(n)

rand('seed',0);

R=rand(1,n);

for i = 1:2:n

u1 = R(i);

u2 = R(i+1);

U(i) = sqrt(-2\*log(u1))\*cos(2\*pi\*u2);

U(i+1) = sqrt(-2\*log(u1))\*sin(2\*pi\*u2);

end

**Anderson Darling test**

function A2=adtest(X)

X=sort(X);

n=length(X);

Y=(X-mean(X))/std(X);

A2=0;

for i=1:n

A2=A2+(2\*i-1)\*(log(normcdf(Y(i)))+log(1-normcdf(Y(n+1-i))));

end

A2=-n-A2/n;