Name: Sourav Bikash

Roll No.:11012338

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Aim of the Problem:

The first part of the problem generates Van Der Corput sequence using base 2. The next part of the problem focuses in using this to generate halton sequences using base 2 and base 3.

Part I:

This question wants us to generate the first 25 members of the VDC sequence of base 2. Then we compare the numbers generated with the linear congruence generator.

Implementation using R:

```
vdc<-function(n){
	z<-NULL;
	for(i in 1:n)
	{
		j<-i;s<-0;k<-1;
		while(j!=0)
		{
			s<-s+((j%%2)/(2^(k)));
			j<-j%/%2;
			k<-k+1;
		}
		z<-c(z,s);
	}
	return(z);
}
f<-vdc(1000);
```

The following are the first 25 members

0.50000	**0.56250**	**0.31250**	**0.53125**	**0.65625**
0.25000	0.93750	0.81250	0.31250	0.40625
0.75000	0.06250	0.18750	0.28125	0.90625
0.12500	0.43750	0.6875	0.78125	0.09375
0.62500	0.37500	0.87500	0.15625	0.59375

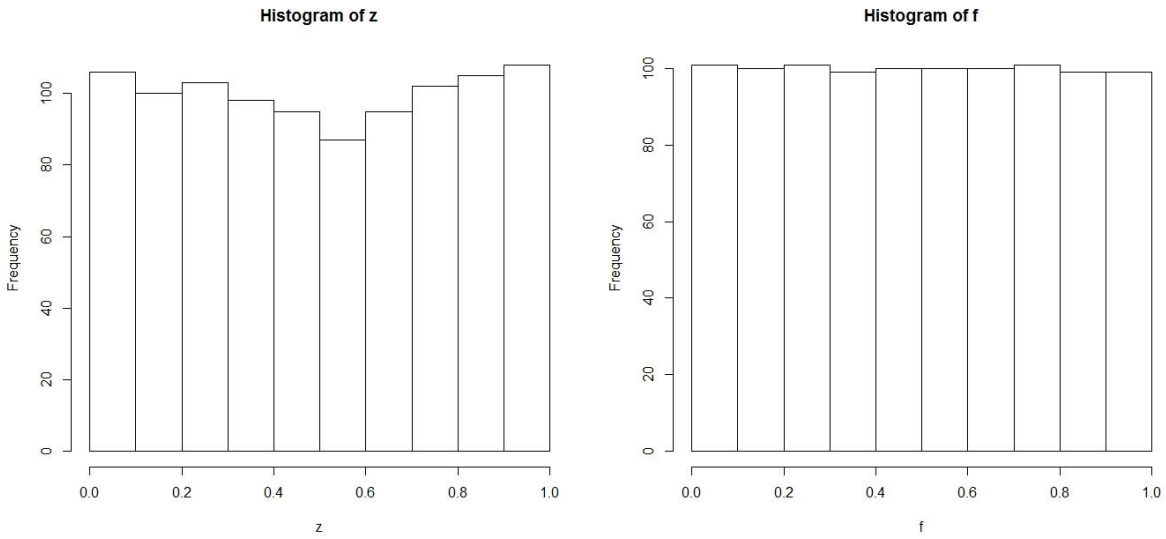
Then we generate the first 1000 and 100000 members. Then we plot the overlapping points.

We also use the LCG:

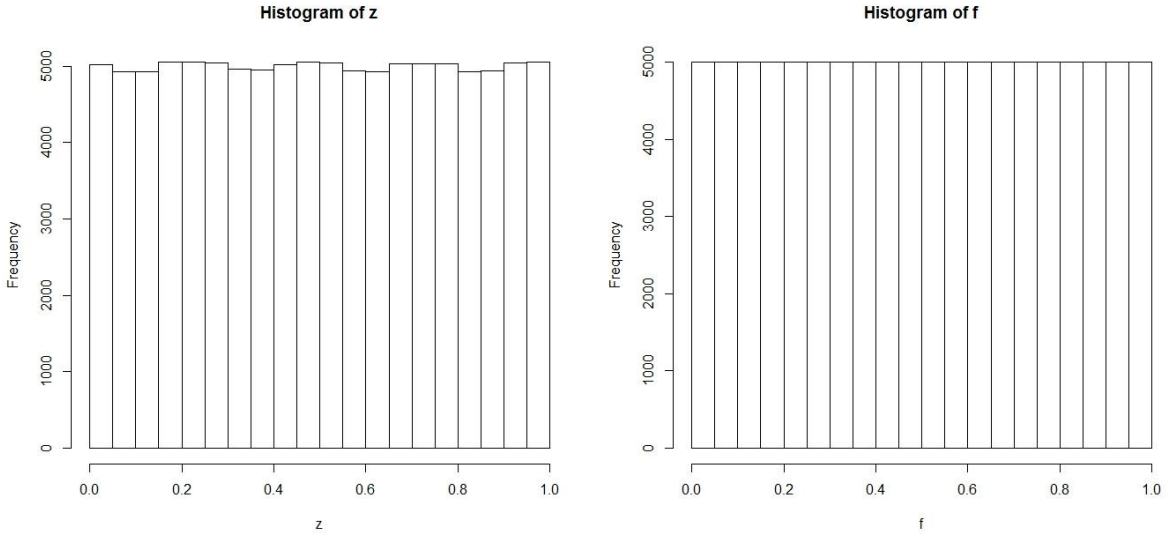
x<-((1597*x)+1)% 244944, u<-u/244944;

Then we plot their distribution comparatively:

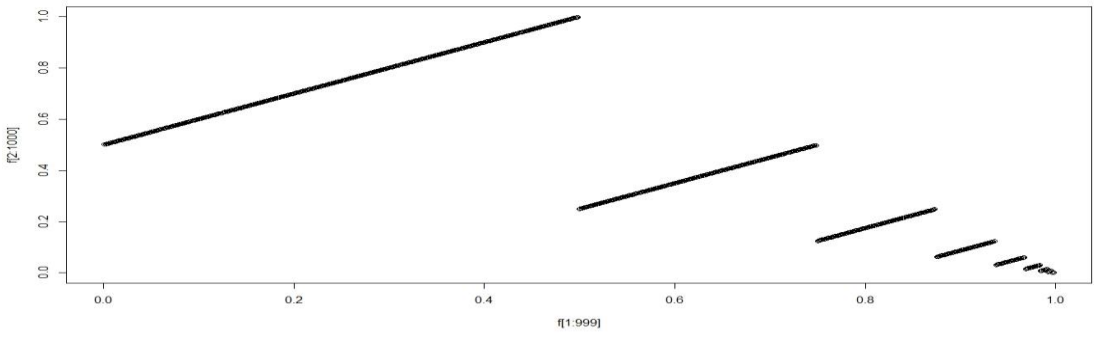
For 1000 samples:



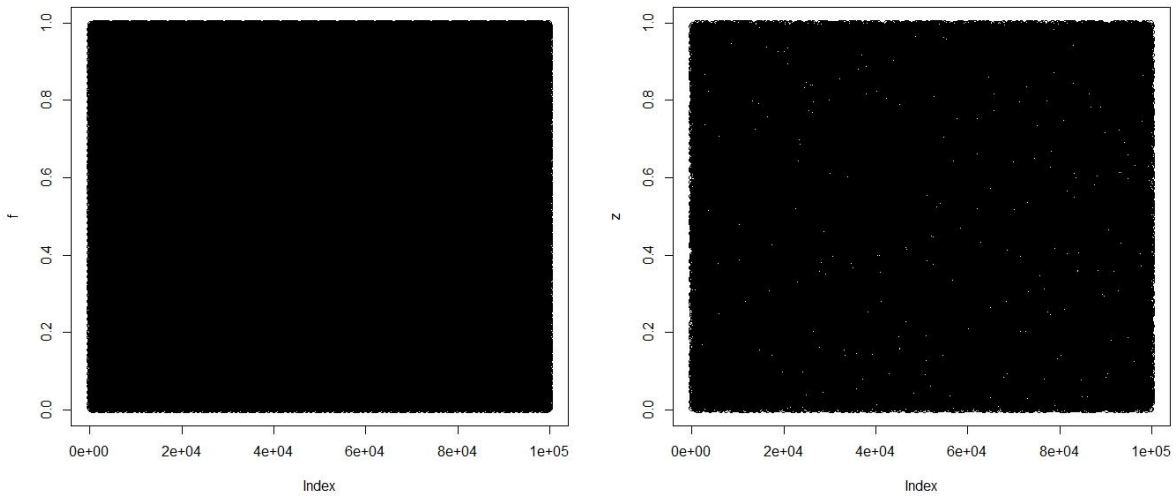
For 100000 samples:



Plot of the overlapping points:



Overall plot of the points of the lcg verses VDC:



We can see that the VDC sequence is better than the lcg (notice the white spaces in the lcg plot).

Part II:

This part generates the Halton sequences.

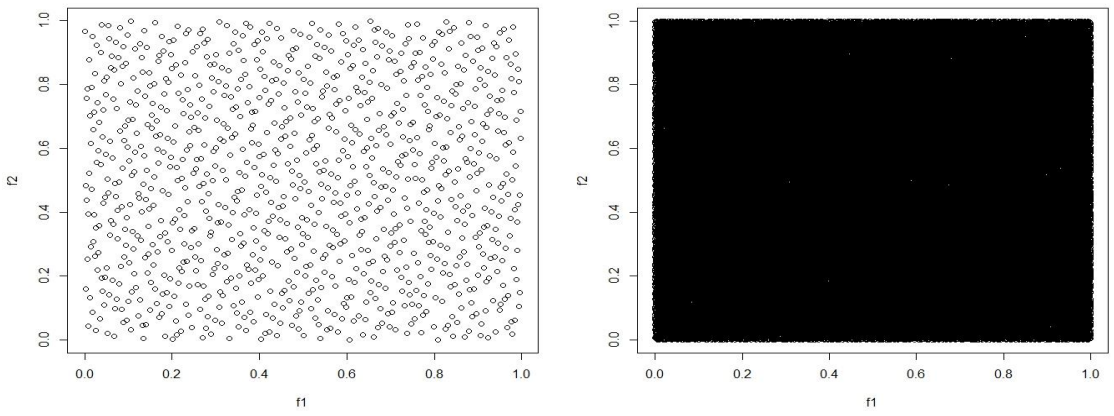
Implementation using R:

```
vdc2<-function(n){
	z<-NULL;
	for(i in 1:n)
	{
		j<-i;s<-0;k<-1;
		while(j!=0)
		{
			s<-s+((j%%2)/(2^(k)));
			j<-j%/%2;
			k<-k+1;
		}
		z<-c(z,s);
	}
```

```
        return(z);
}
vdc3<-function(n){
        z<-NULL;
        for(i in 1:n)
        {
                j<-i;s<-0;k<-1;
                while(j!=0)
                {
                        s<-s+((j%%3)/(3^(k)));
                        j<-j%/%3;
                        k<-k+1;
                }
                z<-c(z,s);
        }
        return(z);
}
f1<-vdc2(100000);
f2<-vdc3(100000);
```

Plot of the sequences:

For 1000 and 100000 respectively:



Observations:

1) The VDC sequence is better than the LCG.
2) The histogram plot is much more uniformly distributed than that of LCG.
3) The halton sequence gives a fairly uniform distribution of numbers.