Report

Assignment:11

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Question 1(a): The Code to implement this Question is as follows:

R Code

```
1
2  for(i in 1:25){
3     p=NULL;
4     res <- 0;
5     num=i;
6     for(j in 1:5){
7        p[j]=num%%2;
8        num=num%/%2;
9     }
10    for(k in 1:5){
11       res=res+p[k]*2^(-k);
12    }
13       cat(res, " ");
14 }
```

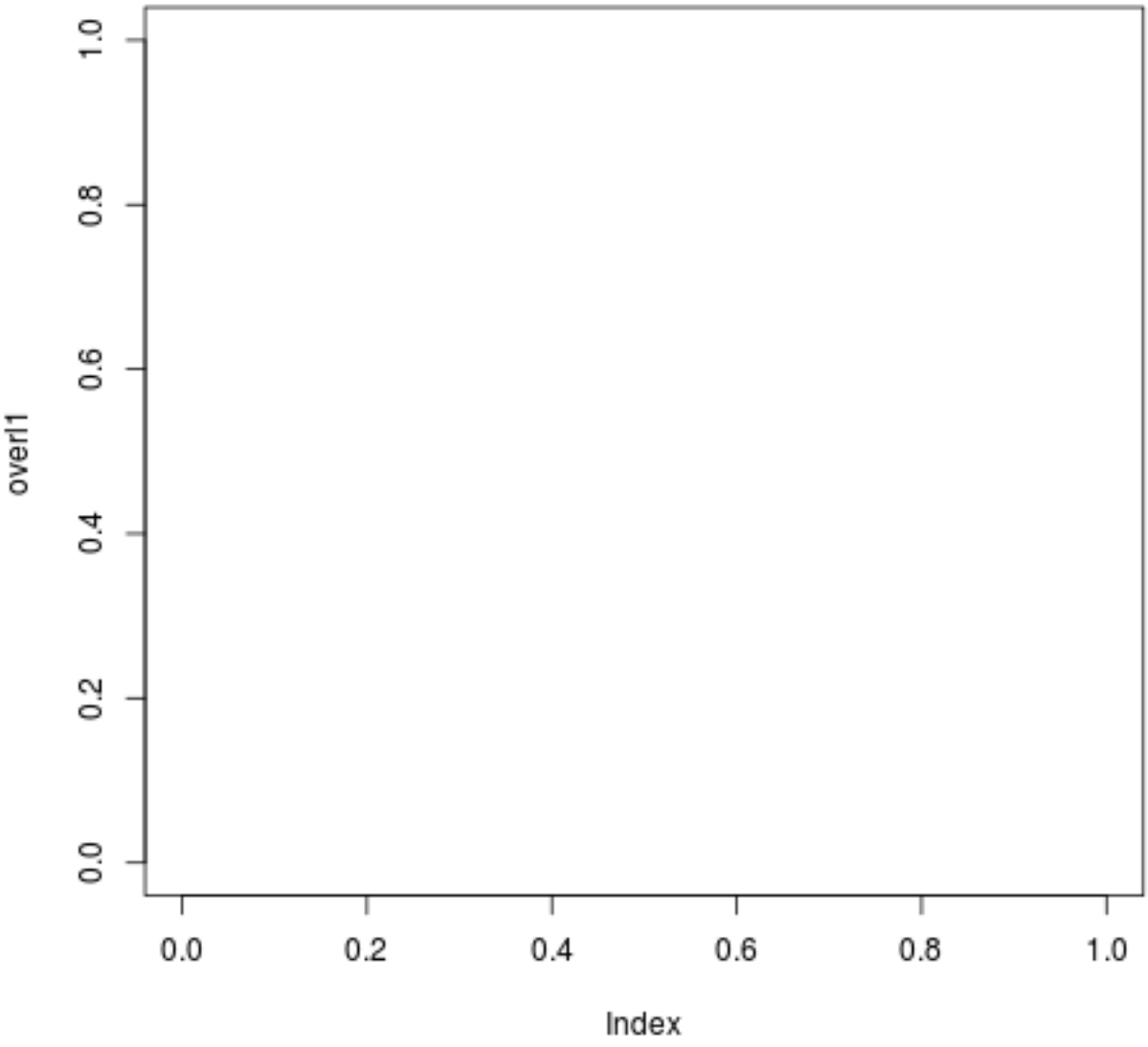
The Output of this code gives:

0.5 , 0.25 , 0.75 , 0.125 , 0.625 , 0.375 , 0.875 , 0.0625 , 0.5625 , 0.3125 , 0.8125 , 0.1875 , 0.6875 , 0.4375 , 0.9375 , 0.03125 , 0.53125 , 0.28125 , 0.78125 , 0.15625 , 0.65625 , 0.40625 , 0.90625 , 0.09375 , 0.59375.

Question 1(b): The Code to implement this Question is as follows:

R Code

```
1
2  seq=NULL;
3  for(i in 1:1000){
4     p=NULL;
5     res <- 0;
6     num=i;
7     for(j in 1:11){
8        p[j]=num%%2;
9        num=num%/%2;
10    }
11    for(k in 1:11){
12       res=res+p[k]*2^(-k);
13    }
14    seq[i]=res;
15 }
16 #Making 2-D pairs.
17 seq2=NULL;
18 for(s in 1:999){
19    seq2[s]=seq[s+1];
20 }
21 #Finding the overlapping values and plotting.
22
23 overl1=NULL;
24 overl2=NULL;
25 m <- 0;
26 for(q in 2:999){
27    cor1 <- seq[q];
28    cor2 <- seq2[q];
29    for(r in 2:q-1){
30       n1=seq[r];
31       n2=seq2[r];
32       if((cor1==n1) & (cor2==n2)){
33          m=m+1;
34          overl1[m]=cor1;
35          overl2[m]=cor2;
36          break;
37       }
38    }
39 }
40 pk=c(0,1);
41 plot(overl1,overl2, xlim=pk, ylim=pk);
```

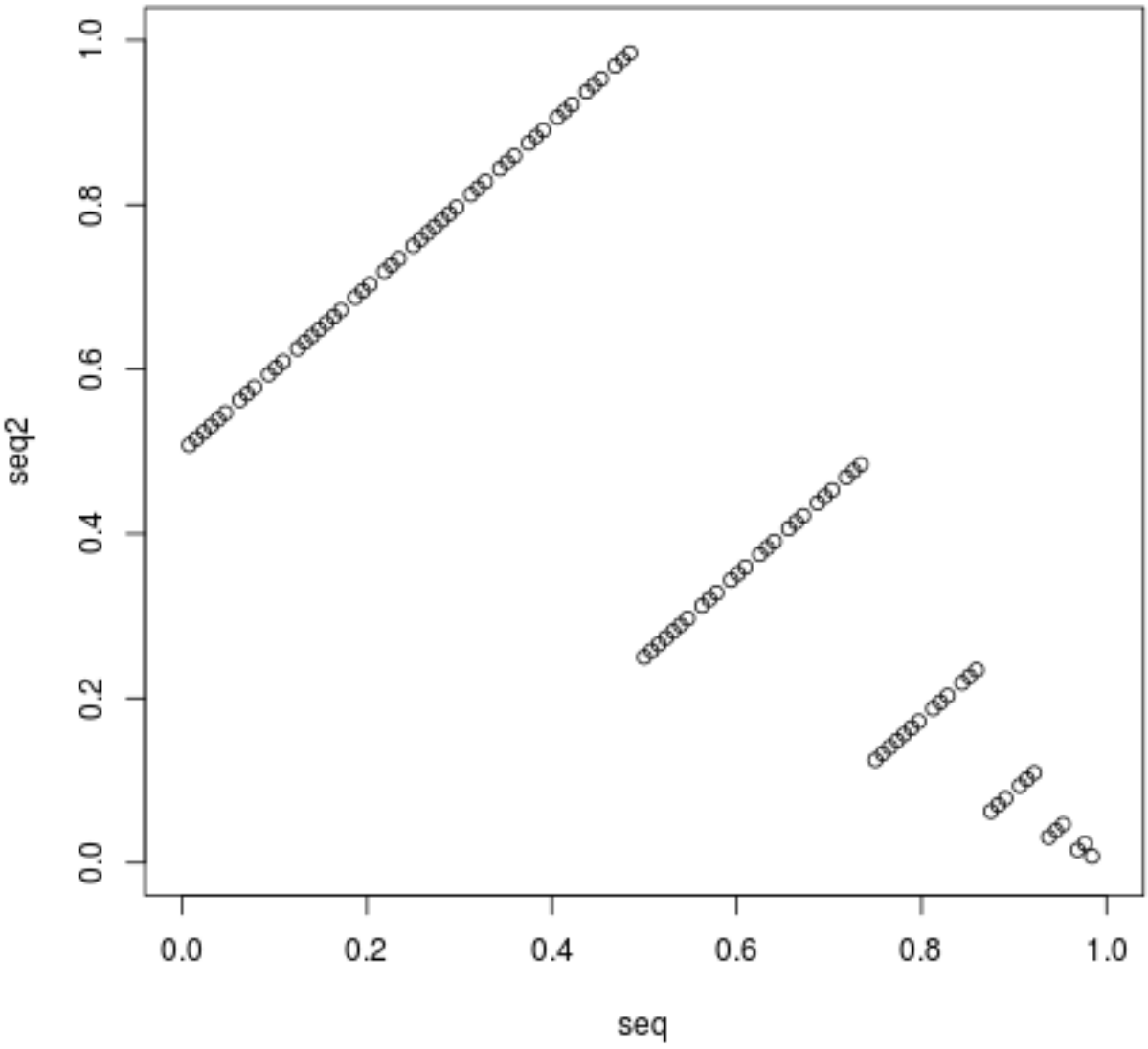


We observe that there are no values in the plot which shows that none of the sequence of values overlaps with each other.

Question 1(c): The Code to implement this Question is as follows:

R Code

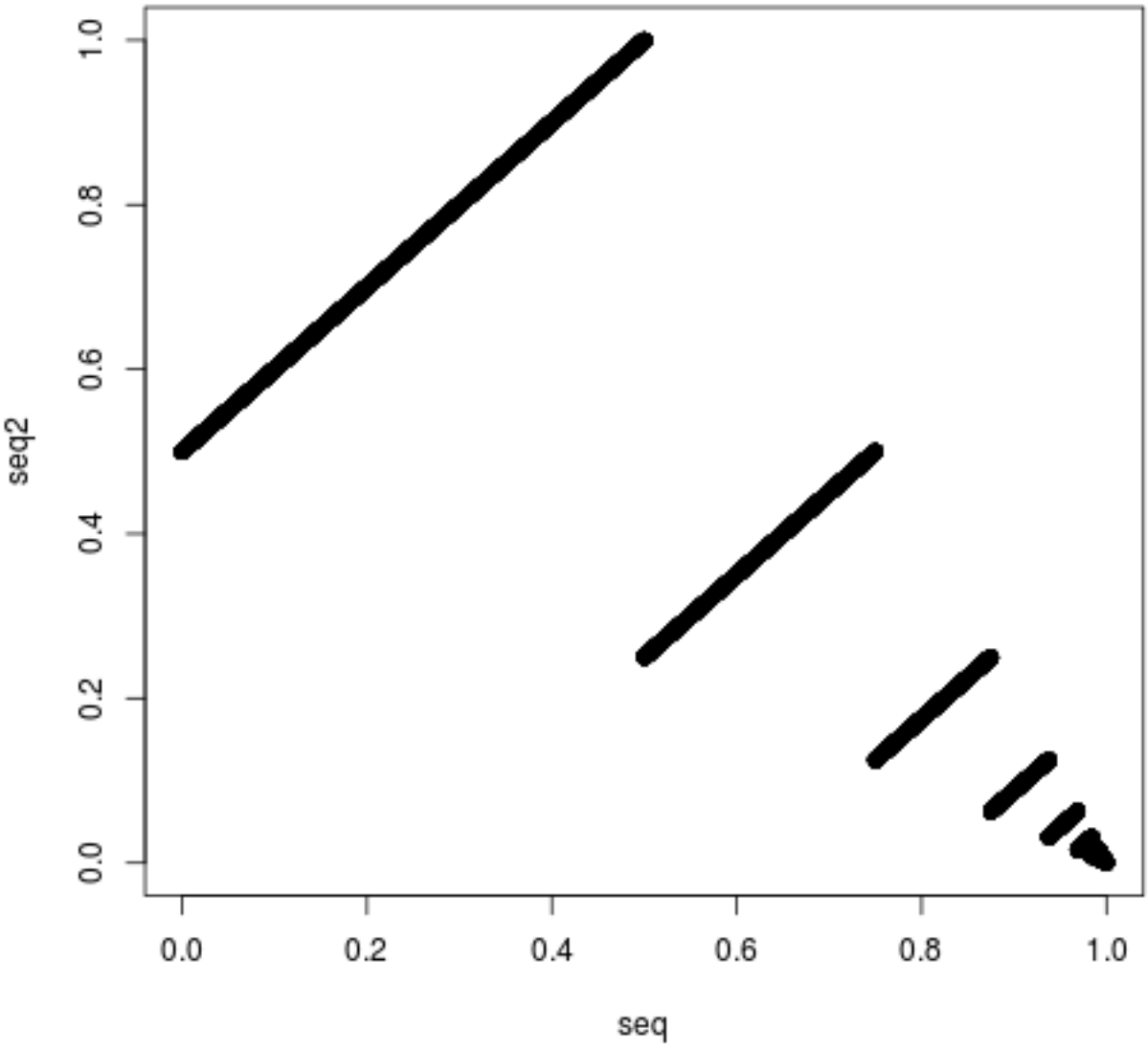
```
1
2  seq=NULL;
3  for(i in 1:101){
4     p=NULL;
5     res <- 0;
6     num=i;
7     for(j in 1:8){
8        p[j]=num%%2;
9        num=num%/%2;
10    }
11    for(k in 1:8){
12       res=res+p[k]*2^(-k);
13    }
14    seq[i]=res;
15 }
16 #Making 2-D pairs.
17 seq2=NULL;
18 for(s in 1:100){
19    seq2[s]=seq[s+1];
20 }
21 length(seq) <- 100;
22
23 pk=c(0,1);
24 plot(seq,seq2, xlim=pk, ylim=pk);
```


seq2
0.0
0.2
0.4
0.6
0.8
1.0
seq
0.0
0.2
0.4
0.6
0.8
1.0

Question 1(d): The Code to implement this Question is as follows:

R Code

```
1
2  seq=NULL;
3  for(i in 1:100001){
4     p=NULL;
5     res <- 0;
6     num=i;
7     for(j in 1:18){
8        p[j]=num%%2;
9        num=num%/%2;
10    }
11    for(k in 1:18){
12       res=res+p[k]*2^(-k);
13    }
14    seq[i]=res;
15 }
16 #Making 2-D pairs.
17 seq2=NULL;
18 for(s in 1:100000){
19    seq2[s]=seq[s+1];
20 }
21 length(seq) <- 100000;
22
23 pk=c(0,1);
24 plot(seq,seq2, xlim=pk, ylim=pk);
```

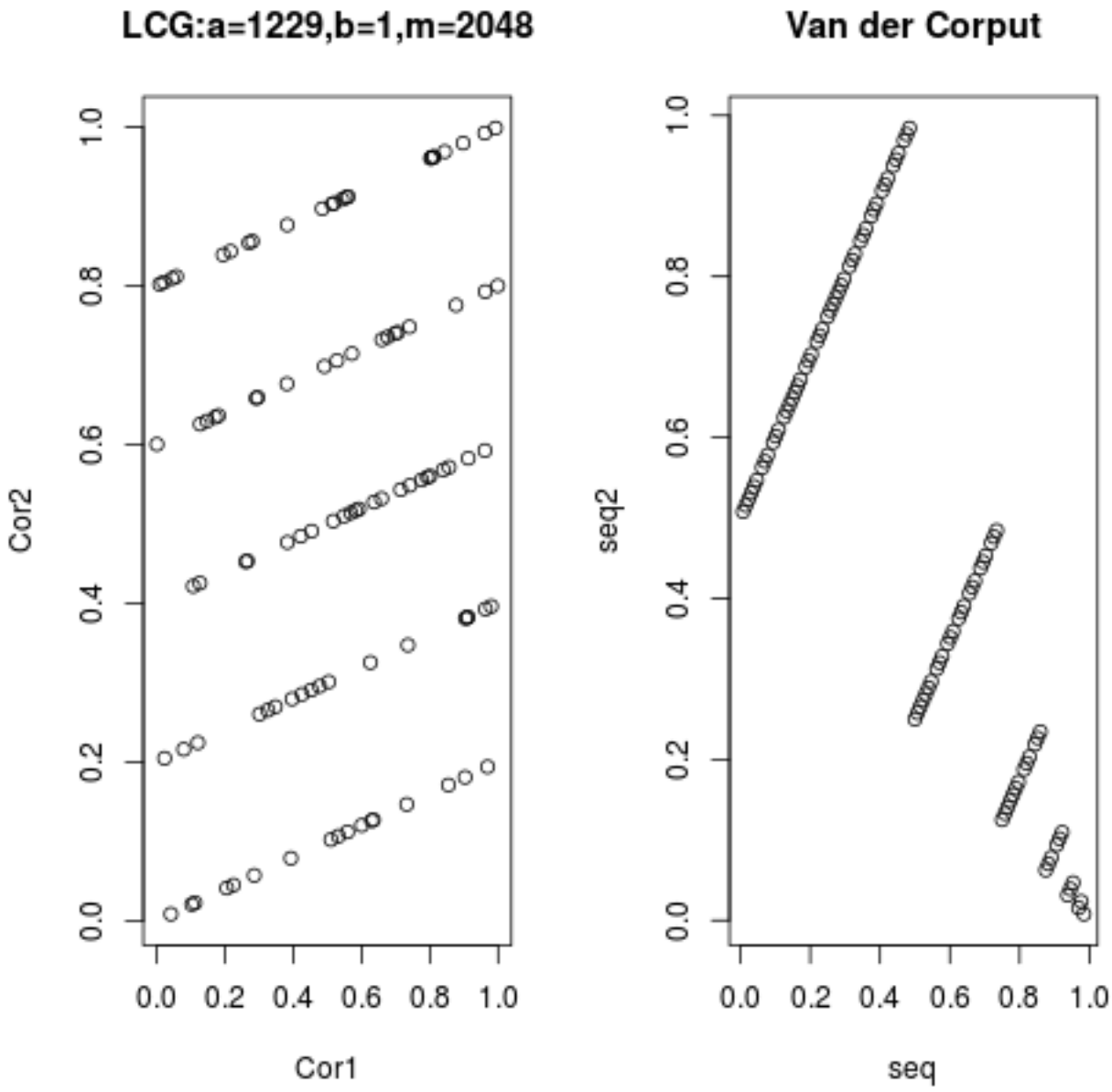

seq2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
seq

Question 1(e): The Code to implement this Question is as follows:

R Code

```
1
2  a <- 1229;
3  b <- 1;
4  m <- 2048;
5  x <- 0;
6  x <- (a*x+b)%%m;
7  u <- x/m;
8  Cor1=NULL;
9  Cor2=NULL;
10
11 for(i in 1:100)
12 {
13    x <- (a*x+b)%%m;
14    Cor1[i]=u;
15    u <- x/m;
16    Cor2[i] <- u;
17 }
18
19
20 seq=NULL;
21 for(i in 1:101){
22    p=NULL;
23    res <- 0;
24    num=i;
25    for(j in 1:8){
26       p[j]=num%%2;
27       num=num%/%2;
28    }
29    for(k in 1:8){
30       res=res+p[k]*2^(-k);
31    }
32    seq[i]=res;
33 }
34 #Making 2-D pairs.
35 seq2=NULL;
36 for(s in 1:100){
37    seq2[s]=seq[s+1];
38 }
39 length(seq) <- 100;
40
41 pk=c(0,1);
42
43 old.par <- par(mfrow=c(1, 2));
```

```
44 plot(Cor1, Cor2, main="LCG:a=1229,b=1,m=2048");
45 plot(seq, seq2, main="Van der Corput");
46 par(old.par);
```

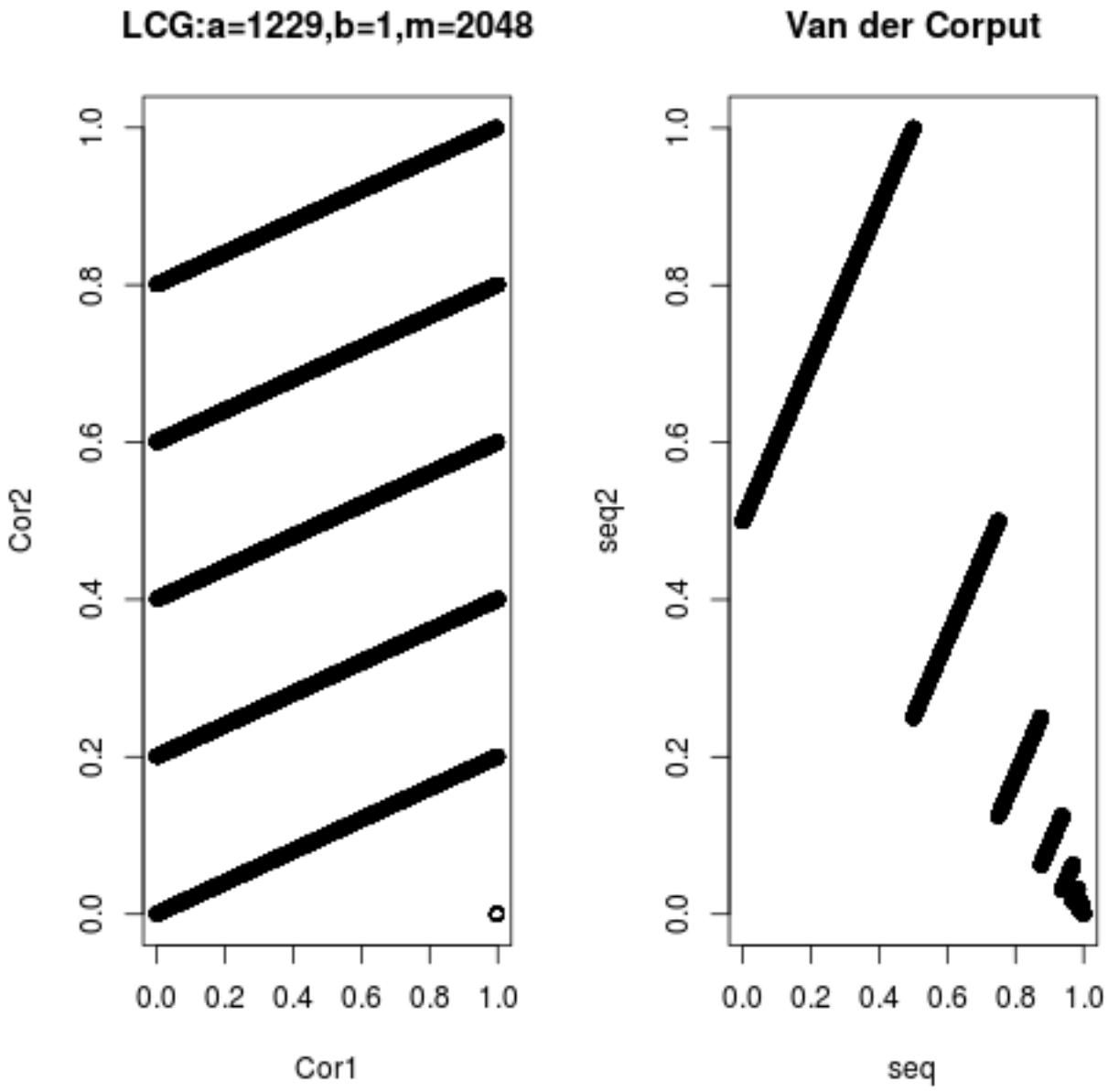


Question 1(f): The Code to implement this Question is as follows:

R Code

```
1
2  a <- 1229;
3  b <- 1;
4  m <- 2048;
5  x <- 0;
6  x <- (a*x+b)%%m;
7  u <- x/m;
8  Cor1=NULL;
9  Cor2=NULL;
10
11 for(i in 1:100000)
12 {
13    x <- (a*x+b)%%m;
14    Cor1[i]=u;
15    u <- x/m;
16    Cor2[i] <- u;
17 }
18
19
20 seq=NULL;
21 for(i in 1:100001){
22    p=NULL;
23    res <- 0;
24    num=i;
25    for(j in 1:18){
26       p[j]=num%%2;
27       num=num%/%2;
28    }
29    for(k in 1:18){
30       res=res+p[k]*2^(-k);
31    }
32    seq[i]=res;
33 }
34 #Making 2-D pairs.
35 seq2=NULL;
36 for(s in 1:100000){
37    seq2[s]=seq[s+1];
38 }
39 length(seq) <- 100000;
40
41 pk=c(0,1);
42
43 old.par <- par(mfrow=c(1, 2));
```

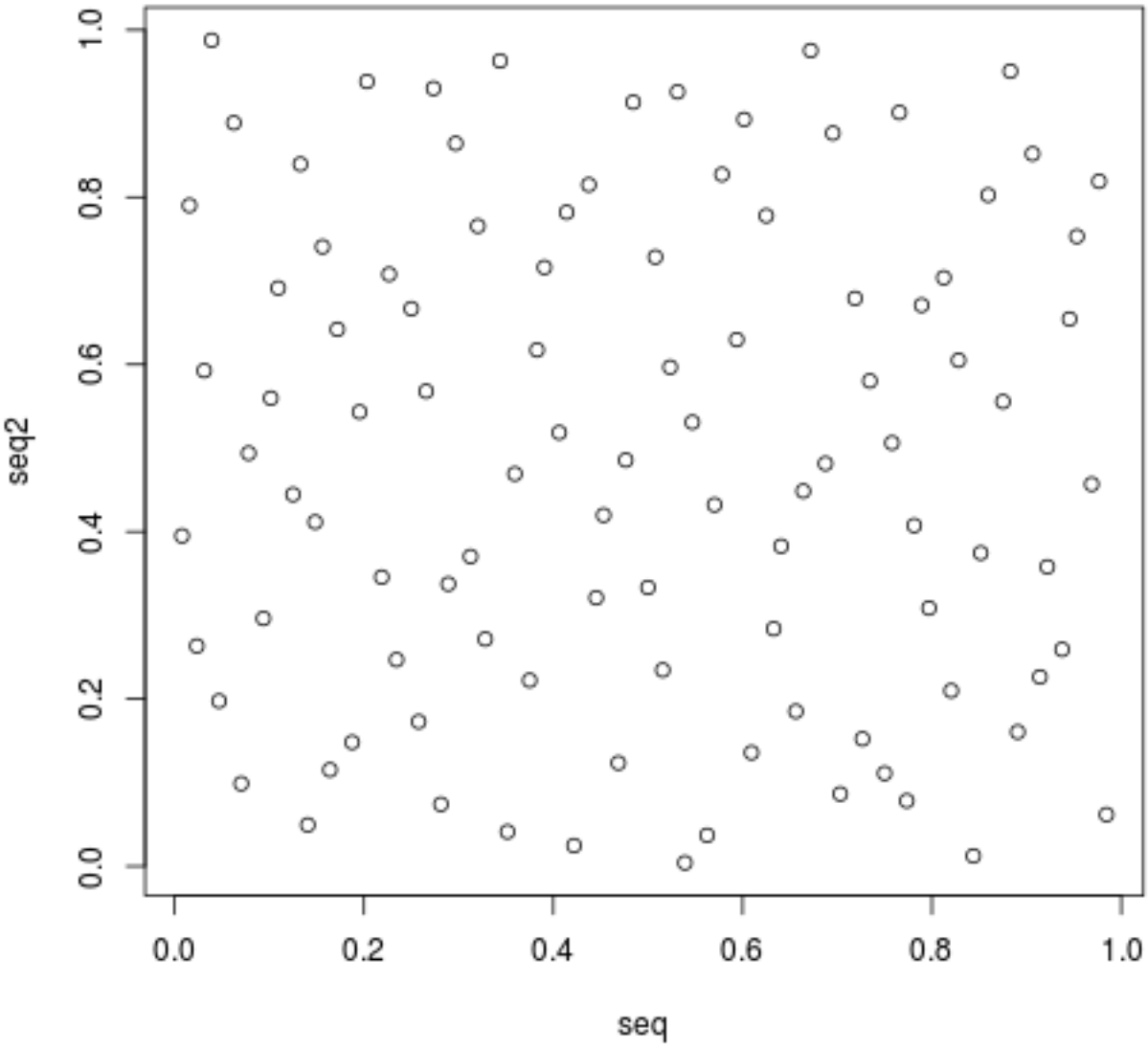
```
44 plot(Cor1, Cor2, main="LCG:a=1229,b=1,m=2048");
45 plot(seq, seq2, main="Van der Corput");
46 par(old.par);
```



Question 2(a): The Code to implement this Question is as follows:

R Code

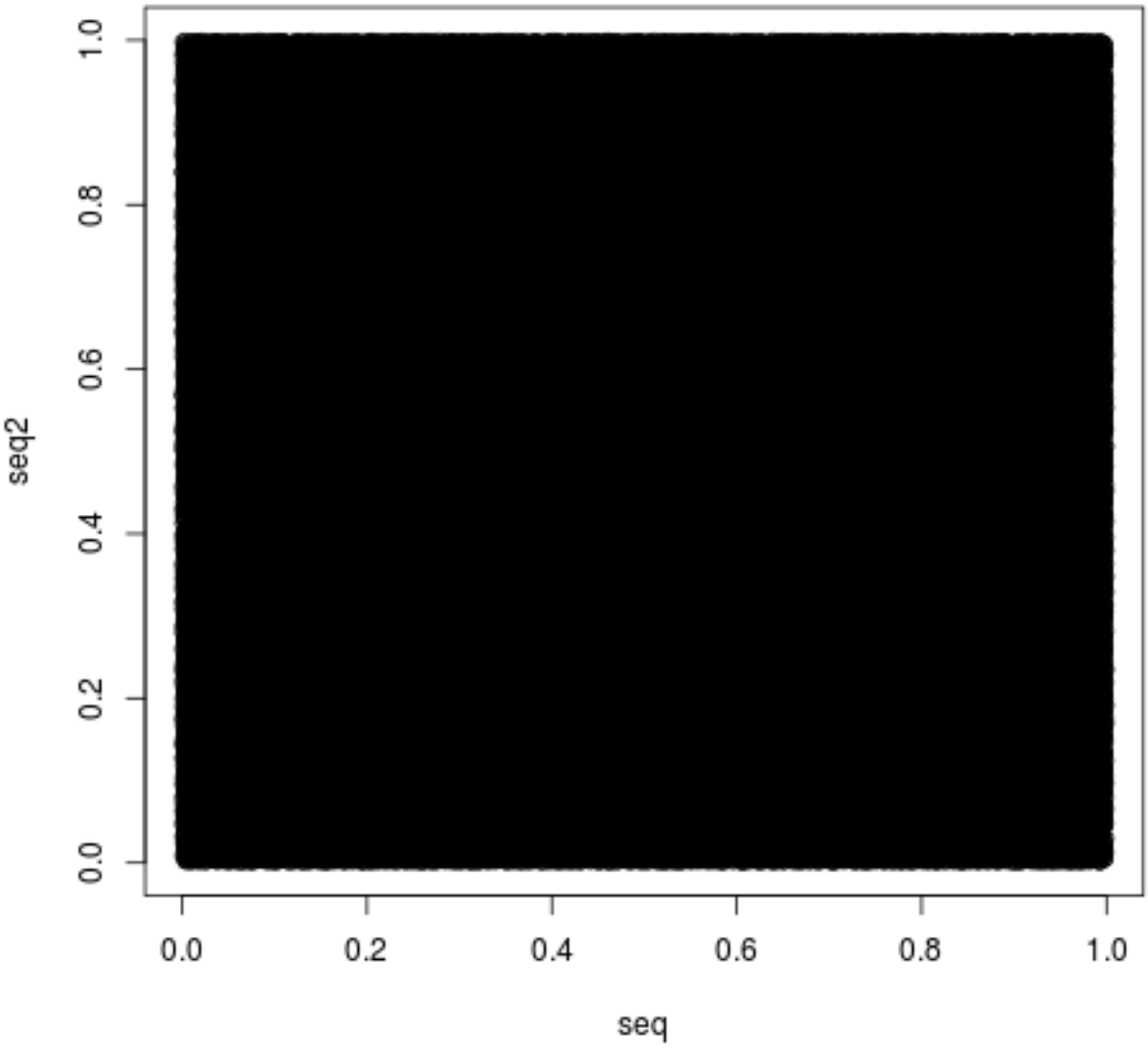
```
1
2  seq=NULL;
3  for(i in 1:100){
4     p=NULL;
5     res <- 0;
6     num=i;
7     for(j in 1:8){
8        p[j]=num%%2;
9        num=num%/%2;
10    }
11    for(k in 1:8){
12       res=res+p[k]*2^(-k);
13    }
14    seq[i]=res;
15 }
16 seq2=NULL;
17 for(i in 1:100){
18    p=NULL;
19    res <- 0;
20    num=i;
21    for(j in 1:5){
22       p[j]=num%%3;
23       num=num%/%3;
24    }
25    for(k in 1:5){
26       res=res+p[k]*3^(-k);
27    }
28    seq2[i]=res;
29 }
30 plot(seq,seq2);
```


seq2
0.0
0.2
0.4
0.6
0.8
1.0
seq
0.0
0.2
0.4
0.6
0.8
1.0

Question 2(b): The Code to implement this Question is as follows:

R Code

```
1
2  seq=NULL;
3  for(i in 1:100000){
4     p=NULL;
5     res <- 0;
6     num=i;
7     for(j in 1:18){
8        p[j]=num%%2;
9        num=num%/%2;
10    }
11    for(k in 1:18){
12       res=res+p[k]*2^(-k);
13    }
14    seq[i]=res;
15 }
16 seq2=NULL;
17 for(i in 1:100000){
18    p=NULL;
19    res <- 0;
20    num=i;
21    for(j in 1:11){
22       p[j]=num%%3;
23       num=num%/%3;
24    }
25    for(k in 1:11){
26       res=res+p[k]*3^(-k);
27    }
28    seq2[i]=res;
29 }
30 plot(seq,seq2);
```



We observe that Halton Sequence is uniformly distributed in the Real plane. The Generated sequence of 2-tuples are uniformly distributed all throughout [0,1]x[0,1].