Question 1

R code:

```
#can freely adjust n
n=1000
y=0
for(i in 1:n){
 U1=runif(1)
 U2=runif(1)
 F=U1^2+U2^2
 if(F<1) y=y+1
}
pi=4*(y/n)
> pi
[1] 3.144

or
n=1000
u1=runif(n);u2=runif(n)
x=(u1^2+u2^2)
pi=4*mean(x<=1)
> pi
[1] 3.128
```

Question 2

R code:

```
n=1000
k=0
N=0
for(i in 1:n)
{
 u=runif(1)
 j=u
 k=0
 while(j>=exp(-5))
 {
  u=runif(1)
  j=j*u
  k=k+1
 }
 N[i]=k
}
```

```
#question2a
#expectation
mean(N)
[1] 5.087
#variance
var(N)
[1] 5.29873

#question2b
for(k in 0:7)
{prob[k+1]=mean(N==k)}
print(0:7)
[1] 0 1 2 3 4 5 6 7
prob
[1] 0.005 0.031 0.094 0.113 0.198 0.183
[7] 0.146 0.094
```

Question 3

Algorithm

Generate U=Uniform(0,1)
If U<0.45, set x=3 and stop
if U<0.70, set x=5 and stop
if U<0.90 set x=0 and stop
else set x=2

R code:

```
#adjust i accordingly to get the number of random variables of X you need
i=1
x=runif(i)
simulate3=function(a){ifelse(a<0.45,3,ifelse(a<0.70,5,ifelse(a<0.9,0,2)))}
simulate3(x)
```

Question 4

Algorithm

Generate Bernoulli with probability 0.35
#optional
If ber<0.35, set x= “yes” and stop
Else set x= “no”

R code:

```
#adjust i accordingly to get the number of random variables of X you need
library(LaplacesDemon)
i=100
#result 1 represent yes, 0 represent no
x=rbern(i,0.35)
```