Q1

1. The probability distribution of X, the number of imperfections per 10 meters of a synthetic fabric in continuous rolls of uniform width, is given as

x	0	1	2	3	4
$p(x)$	0.41	0.37	0.16	0.05	0.01

Find the average number of imperfections per 10 meters of this fabric.

(Try functions **sum( )**, **weighted.mean( )**, c(a **%*%** b) to find expected value/mean.

```
> #Q1
> # E ( X ) = μ = Σ x P ( x )
> x<-c(0,1,2,3,4)
> prob<-c(0.41,0.37,0.16,0.05,0.01)
> expec<-sum(x*prob)
> print(expec)
[1] 0.88
>
> expected<-weighted.mean(x,prob)
> print(expected)
[1] 0.88
>
> expected_val<-c(x%*%prob)
> print(expected_val)
[1] 0.88
> |
```

Q2

2. The time T, in days, required for the completion of a contracted project is a random variable with probability density function $f(t) = 0.1\ e^{(-0.1t)}$ for $t > 0$ and 0 otherwise. Find the expected value of T.
Use function **integrate( )** to find the expected value of continuous random variable T.

```
> #Q2
> f<-function(t){t*0.1*exp(-0.1*t)}
> expval<-integrate(f,lower=0,upper=Inf)
> print(expval)
10 with absolute error < 6.7e-05
>
> print(expval$value)
[1] 10
```

Q3

3. A bookstore purchases three copies of a book at \$6.00 each and sells them for \$12.00 each. Unsold copies are returned for \$2.00 each. Let X = {number of copies sold} and Y = {net revenue}. If the probability mass function of X is

x	0	1	2	3
$p(x)$	0.1	0.2	0.2	0.5

Find the expected value of Y.

```
> #Q3
> x<-c(0,1,2,3)
> prob<-c(0.1,0.2,0.2,0.5)
> #y<-12*x+2*(3-x)-6*x
> y<-10*x-12
> expectedVal<-sum(y*prob)
> print(expectedVal)
[1] 9
```

Q4

4. Find the first and second moments about the origin of the random variable X with probability density function $f(x) = 0.5e^{-|x|}$, $1 < x < 10$ and 0 otherwise. Further use the results to find Mean and Variance.
(kth moment = $E(X^k)$, Mean = first moment and Variance = second moment – Mean^2.

```
> #Q4
> f1<-function(x){x*0.5*exp(-abs(x))}
> moment1<-integrate(f1,lower=1,upper=10)
> print(moment1$value) # mean
[1] 0.3676297
>
> f2<-function(x){x^2*0.5*exp(abs(x))}
> moment2<-integrate(f2,lower=1,upper=10)
> print(moment2$value)
[1] 903083.7
>
> f3<-function(m1,m2){return (m2-m1*m1)}
> var=f3(moment1$value,moment2$value)
> print(var)#variance
[1] 903083.6
```

Q5

5. Let X be a geometric random variable with probability distribution

$$f(x) = \frac{3}{4}\left(\frac{1}{4}\right)^{x-1}, x = 1,2,3, \ldots$$

Write a function to find the probability distribution of the random variable $Y = X^2$ and find probability of Y for X = 3. Further, use it to find the expected value and variance of Y for X = 1,2,3,4,5.

```
> source("C:/Users/vans9/OneDrive/Desktop/R LAB/lab4.R")
[1] 0.88
[1] 0.88
[1] 0.88
10 with absolute error < 6.7e-05
[1] 10
[1] 9
[1] 0.3676297
[1] 903083.7
[1] 903083.6
enter the vaue of x 3
[1] 0.046875
[1] 0.750000000 0.187500000 0.046875000 0.011718750 0.002929688
[1] 2.182617
[1] 1.623002
```

```
> x<-c(1,2,3,4,5)
> y<-x^2
> proby<-fy(y)
> print(proby)
[1] 0.750000000 0.187500000 0.046875000 0.011718750 0.002929688
> expval<-sum(y*proby)
> print(expval)
[1] 2.182617
>
> m<-expval
> y1<-(y-m)^2
> proby1<-fy(y1)
> var<-sum(y1*proby1)
> print(var)
[1] 1.623002
>
```