# 612303050 Deshmukh Mehmood Rehan's Assignment 4

Q1).Let X→B(12,0.4) FIND .P(X<=3), P(X>=8), P(4<=X<=6),P(X=6)

```
# (a) P(X <= 3)
p1 <- pbinom(3, 12, 0.4)
print(p1)

## [1] 0.2253373

# (b) P(X >= 8)
p2 <- 1 - pbinom(7, 12, 0.4)
print(p2)

## [1] 0.05730992

# (c) P(4 <= X <= 6)
p3 <- pbinom(6, 12, 0.4) - pbinom(3, 12, 0.4)
print(p3)

## [1] 0.6164504

# (d) P(X = 6)
p4 <- dbinom(6, 12, 0.4)
print(p4)

## [1] 0.1765791
```

Q2). Let X→B(n , p) such that E(X)=4 , V(X)=8/3 find P[X<=4] , P[X>=3] .Also Draw a random sample of size 5 from given binomial distribution.

```
#np = 4
#npq = 8/3
#q = 2/3
#p = 1/3

#np = 4
#n = 12

# (a) P(X <= 4)
p5 <- pbinom(4, 12, 1/3)
print(p5)

## [1] 0.6315207

# (b) P(X >= 3)
p6 <- 1 - pbinom(2, 12, 1/3)
print(p6)

## [1] 0.8188774
```

```r
# Random sample of size 5
sample <- rbinom(5, 12, 1/3)
print(sample)

## [1] 3 1 6 1 3
```

Q3).A machine produces screws of which 1% are defective, find the probability that in a box of 200 screws there are at least 2 defectives. Hint:(Using Poisson distribution).

```r
# P(at least 2 defectives in a box of 200 screws)
p7 <- 1 - ppois(1, lambda = 200 * 0.01)
print(p7)

## [1] 0.5939942
```

Q4).Let X →B(n=8, p=0.3) .Find k such that P[X<=k]=0.2552

```r
k <- qbinom(0.2552, 8, 0.3)
print(k)

## [1] 1
```

Q5).Draw a random sample of size 8 from Poisson distribution with mean 2.5.

```r
sample <- rpois(8, lambda = 2.5)
print(sample)

## [1] 2 5 5 1 1 2 3 1
```

Q6).If the probability that individual suffers from a bad reaction from injection of serum is 0.001,determine the probability that out of 2000 individuals injected 2 or more will suffer from a bad reaction.

```r
p8 <- 1 - ppois(1, lambda = 2000*0.001)
print(p8)

## [1] 0.5939942
```

Q7). In a certain industrial facility, accidents occur infrequently. It is known that the probability of an accident on any given day is 0.005 and accidents are independent of each other.

```r
# (a) Probability of an accident on any given day in a period of 400 days
p9a <- dpois(1, lambda = 400*0.005)
print(p9a)

## [1] 0.2706706

# (b) Probability of at most three days with an accident
p9b <- ppois(3, lambda = 400*0.005)
print(p9b)

## [1] 0.8571235
```

Q8). A pair of dice is rolled 420 times. What is the probability that a total of 8 occurs atleast 50 times? Between 70 and 90 times inclusive? Exactly 100 times? # Probability of total of 8 occurring at least 50 times

```
p10a <- 1 - ppois(49, lambda = 420 * 5/36)
print(p10a)

## [1] 0.8780491

# Probability of total between 70 and 90 times inclusive
p10b <- ppois(90, lambda = 420 * 5/36) - ppois(69, lambda = 420 * 5/36)
print(p10b)

## [1] 0.07488878

# Probability of total exactly 100 times
p10c <- dpois(100, lambda = 420 * 5/36)
print(p10c)

## [1] 1.940131e-07
```

Q9). The probability that a patient recovers from a rare disease is 0.4. If 100 people are known to have contracted this disease, what is probability that fewer than 30 survive? # P(fewer than 30 survive out of 100 with probability of survival 0.4)

```
#using normal approximation of binomial
p11 <- pnorm(29.5, 100*0.4, sqrt(100*0.4*0.6))
print(p11)

## [1] 0.01604437
```

Q10).Let X→N(μ=20,σ=2) Find P[X<=2] ,P[X<4] , P[X>7] and P[X=3]

```
# X ~ N(μ=20,σ=2)
# (a) P(X <= 2)
p12a <- pnorm(2, mean = 20, sd = 2)
print(p12a)

## [1] 1.128588e-19

# (b) P(X < 4)
p12b <- pnorm(4, mean = 20, sd = 2)
print(p12b)

## [1] 6.220961e-16

# (c) P(X > 7)
p12c <- 1 - pnorm(7, mean = 20, sd = 2)
print(p12c)

## [1] 1
```

```r
# (d) P(X = 3)
#as the normal distribution is continuous, the probability of X being exactly 
3 is  zero
p12d <- dnorm(3, mean = 20, sd = 2)
print(p12d)

## [1] 4.083118e-17
```

Q11).Let X→Exp(λ) with mean =0.1 ,then find P[X<=1] also generate a random sample of size 5.

```r
# P(X <= 1) for X ~ Exp(λ) with mean = 0.1
# λ = 1 / mean = 1 / 0.1 = 10
p13 <- pexp(1, 10)
print(p13)

## [1] 0.9999546
```

Generate random sample of size 5 from Exp(λ)

```r
sample <- rexp(5, 10)
print(sample)

## [1] 0.05698700 0.08739439 0.12626655 0.21619687 0.01438160
```