Assignment – 1

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Part 1:

1.1 (a)

Sample space (Ω) = {'HH', 'HT', 'TH', 'TT'}

(b)

No. of all possible events = 2^4 = 16

Event space = {ϕ, {HH}, {HT}, {TH}, {TT}, {HH, TH}, {HH, HT}, {HH, TT}, {TH, HT}, {TH, TT}, {HT, TT}, {HH, HT, TH}, {HT, TH, TT}, {TH, TT, HH}, {TT, HH, HT}, Ω}

(c) (i)

P(HH) = P(HT) = P(TH) = P(TT)

and, P(HH) + P(HT) + P(TH) + P(TT) = 1

so, P(HH) = P(HT) = P(TH) = P(TT) = ¼

(ii)

P(at least one head) $= \mathrm{P(HH \cup HT \cup TH)}$

$$= \mathrm{P(HH) + P(HT) + P(TH)}$$

$$= 3/4$$

(iii)

P(exactly one head) $= \mathrm{P(HT \cup TH)}$

$$= \mathrm{P(HT) + P(TH)}$$

$$= 2/4$$

Part 2:

2.2

$$f(45, 50, 0.9) = \left(\frac{50!}{45! \times 5!}\right) \times (0.9)^{45} \times (0.1)^{5}$$

$$= 0.1849246$$

2.2 (a)

$$\text{P(zero road accidents in a day)} = 10^{0} \times \frac{e^{-10}}{0!}$$

$$= 0.0000454$$

(b)

$$\text{P(occurrence of more than 7 but less than 10 road accidents in a day)}$$
$$= f(8, 10) + f(9, 10)$$

$$= 10^{8} \times \frac{e^{-10}}{8!} + 10^{9} \times \frac{e^{-10}}{9!}$$

$$= 0.2139$$

(c)

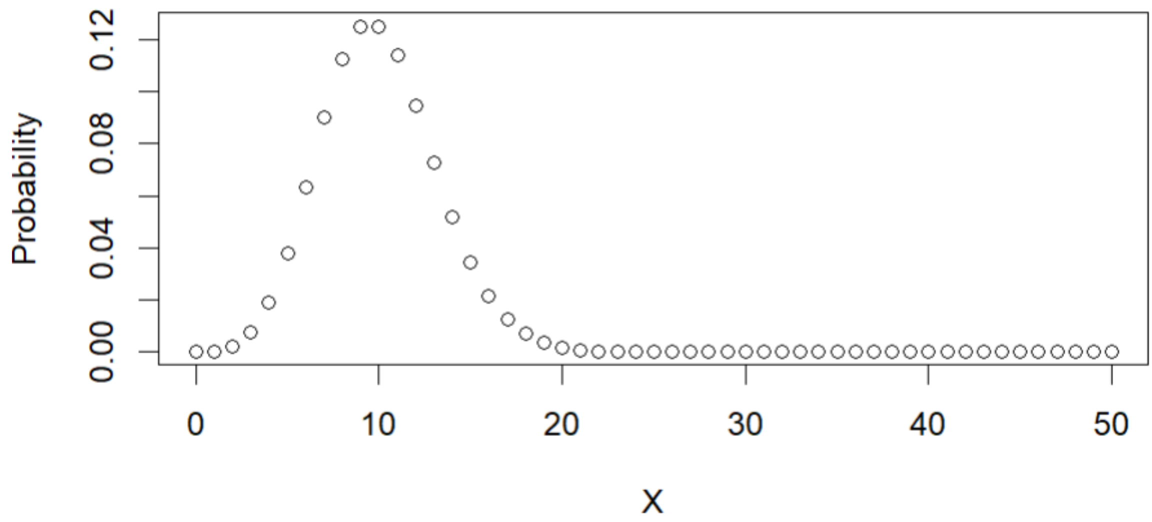
Code in R

```r
###################

# X = k = number of road accidents in a day
# lambda = avg road accident in a day
X <- 0:50
X
lambda <- 10
Probability = dpois(X, lambda)
plot(X, Probability, col = "black")

```

Plot



Part 3:

3.1 (a)

We have,

μ = 1, σ = 1, x = 0

$$f(0;1,1) = \frac{1}{\sqrt{(2\cdot\pi)}} \cdot e^{-\frac{(0-1)^2}{2\cdot(1)^2}}$$

$$= 0.249$$

(b)

We have,

μ = 0, σ = 1, x = 1

$$f(1;0,1) = \frac{1}{\sqrt{(2\cdot\pi)}} \cdot e^{-\frac{(1-0)^2}{2\cdot(1)^2}}$$

$$= 0.249$$

(c)

We have,

$P(x_1 <= X <= x_2) = \int_0^{x1} f \cdot dx - \int_0^{x2} f \cdot dx = 0.3$ ..eqn(1)

$P(x_1 <= X <= x_3) = \int_0^{x1} f \cdot dx - \int_0^{x3} f \cdot dx = 0.45$ .eqn(2)

eqn(2) – eqn(1),

$$\int_0^{x2} f \cdot dx - \int_0^{x3} f \cdot dx = 0.45 - 0.3$$

$P(x_2 <= X <= x_3) = 0.15$

Part 4:

4.1 (a)

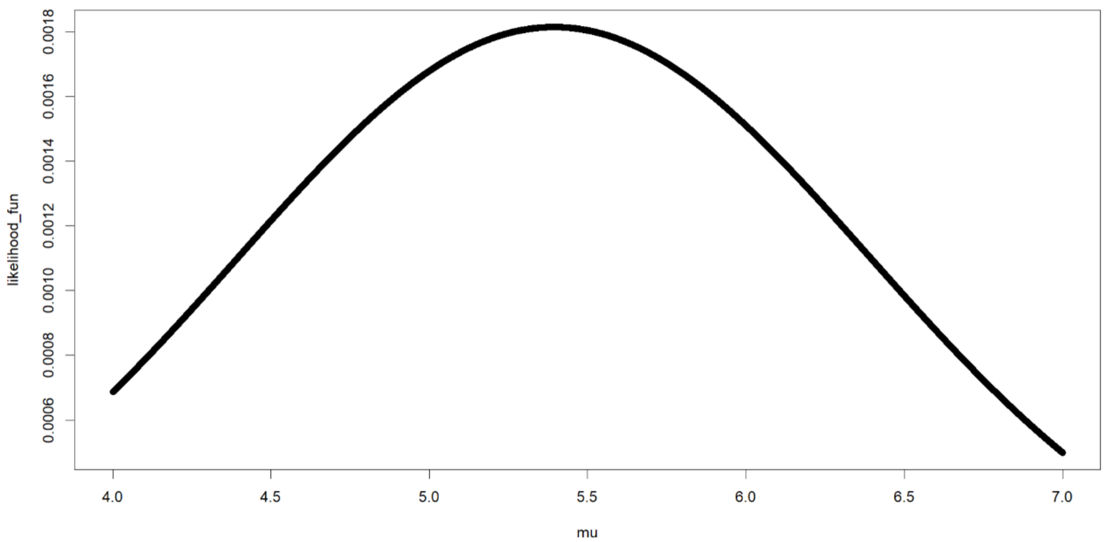
```
################

# given looks like log-normal distribution with
# x = 220 and sigma = 1

mu <- seq(4, 7, length=100000)
likelihood_fun <- dlnorm(220, mu, 1)
plot(mu, likelihood_fun)

```

Plot



(b)

Code in R

```
###############

```

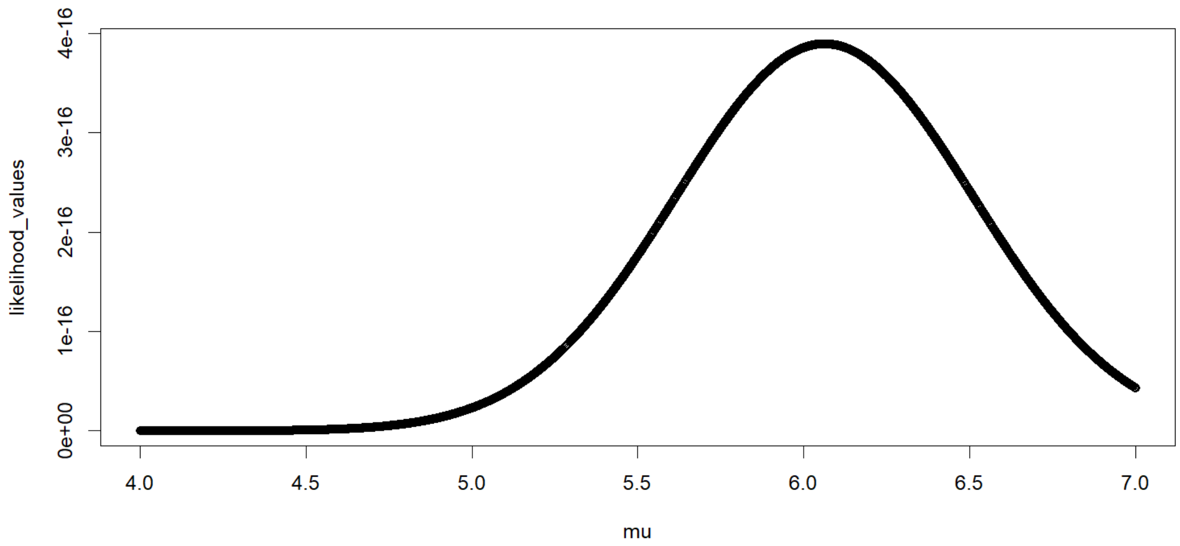
```r
x <- c(303.25, 443, 220, 560, 880)
x
mu <- seq(4, 7, length=10000)
likelihood_values = vector(length = 10000)
for (i in 1:10000) {

  likelihood_values[i] <- prod(dlnorm(x, meanlog = mu[i], sdlog = 1))
}

plot(mu, likelihood_values)

```

Plot



(c)

$$\mu = \frac{1}{n} \cdot \sum_{i=1}^{n} \ln{(xi)}$$

$$\mu = \frac{\ln(330)+\ln(443)+\ln(560)+\ln(220)+\ln(880)}{5}$$

$$\mu = 6.06$$