4.58

a. $P(0 \leq Z \leq 1.2)$

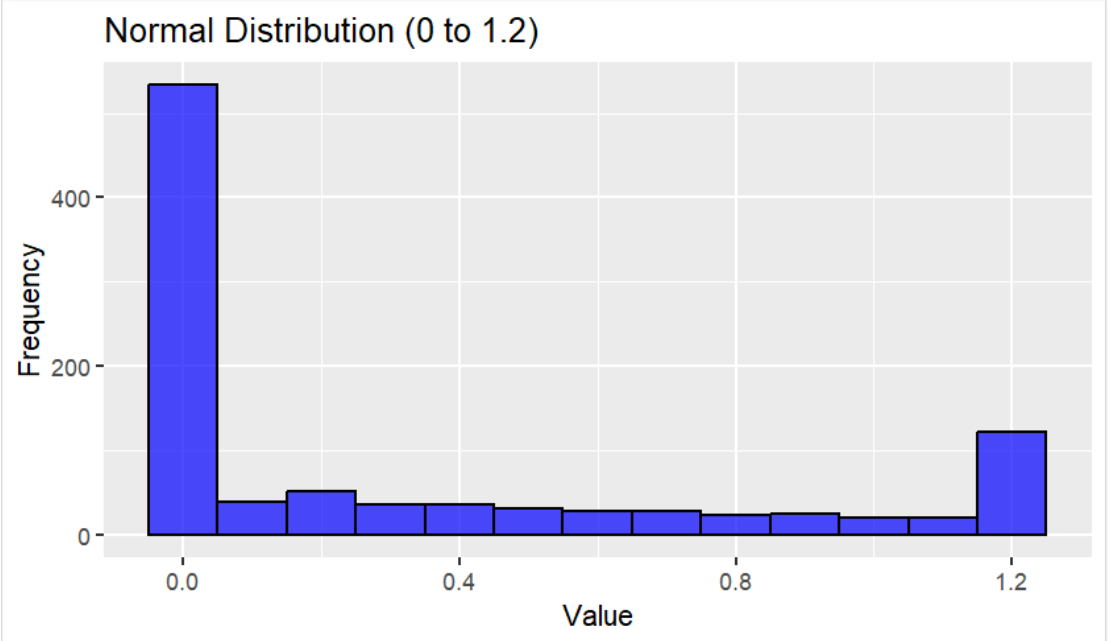
```r
# 生成1000個來自平均值為0，標準差為1的常態分佈的隨機數
random_numbers <- rnorm(1000, mean = 0, sd = 1)

# 將生成的 Z 值限制在0到1.2之間
random_numbers <- pmax(0, pmin(1.2, random_numbers))

# 繪製直方圖
library(ggplot2)

ggplot(data.frame(x = random_numbers), aes(x)) +
  geom_histogram(binwidth = 0.1, fill = "blue", color = "black", alpha = 0.7) +
  ggtitle("Normal Distribution (0 to 1.2)") +
  xlab("Value") +
  ylab("Frequency")


```



b. $P(-0.9 \leq Z \leq 0)$

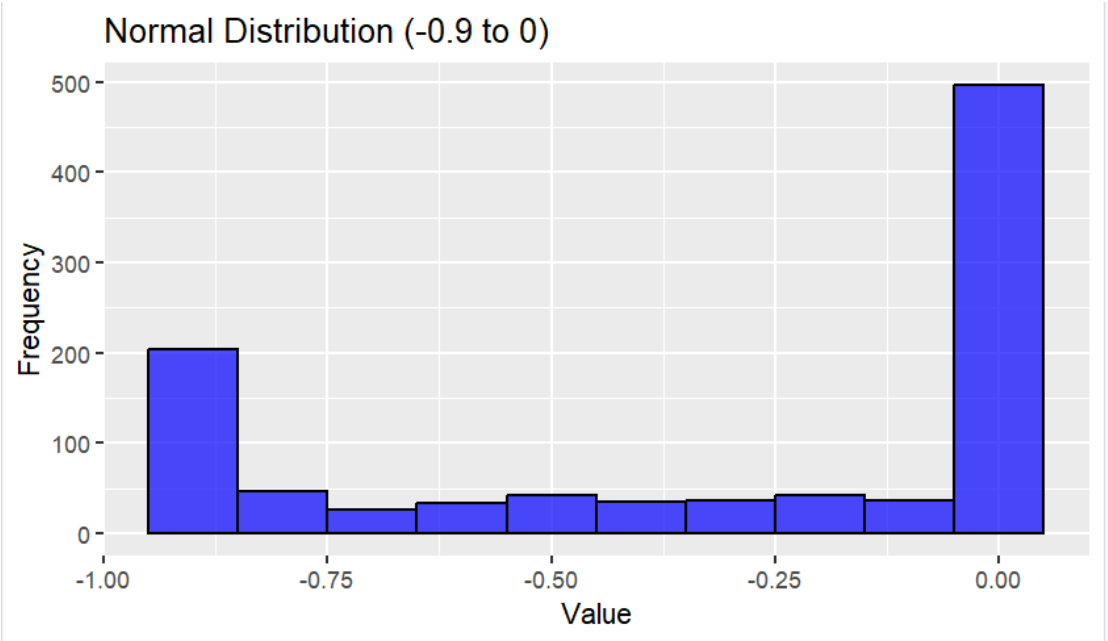
```r
# 生成1000個來自平均值為0，標準差為1的常態分佈的隨機數
random_numbers <- rnorm(1000, mean = 0, sd = 1)

# 將生成的 Z 值限制在-0.9到0之間
random_numbers <- pmax(-0.9, pmin(0, random_numbers))

# 繪製直方圖
library(ggplot2)

ggplot(data.frame(x = random_numbers), aes(x)) +
  geom_histogram(binwidth = 0.1, fill = "blue", color = "black", alpha = 0.7) +
  ggtitle("Normal Distribution (-0.9 to 0)") +
  xlab("Value") +
  ylab("Frequency")


```



c. $P(0.3 \leq Z \leq 1.56)$

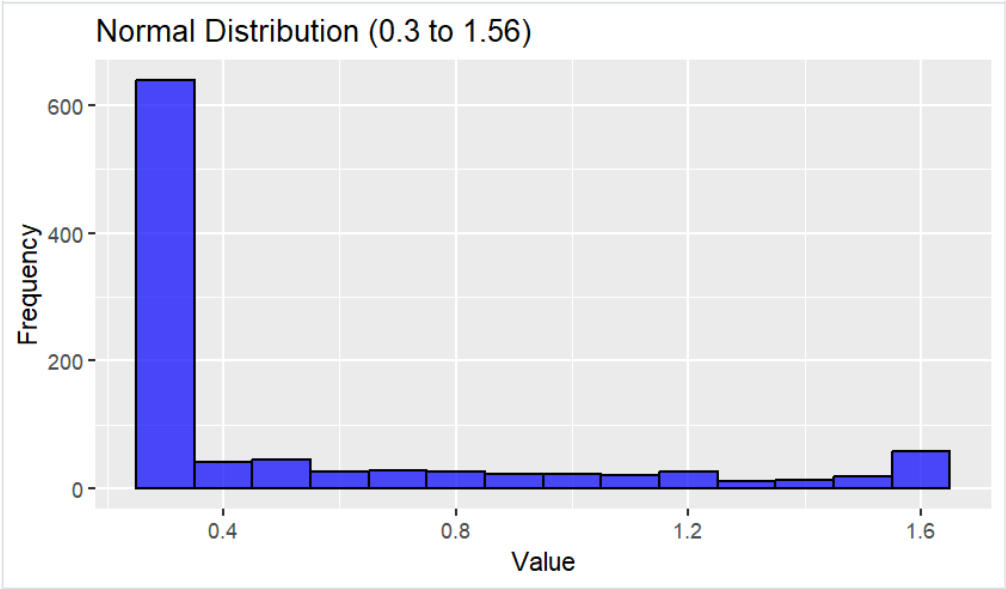
```r
# 生成1000個來自平均值為0，標準差為1的常態分佈的隨機數
random_numbers <- rnorm(1000, mean = 0, sd = 1)

# 將生成的 Z 值限制在0.3到1.56之間
random_numbers <- pmax(0.3, pmin(1.56, random_numbers))

# 繪製直方圖
library(ggplot2)

ggplot(data.frame(x = random_numbers), aes(x)) +
  geom_histogram(binwidth = 0.1, fill = "blue", color = "black", alpha = 0.7) +
  ggtitle("Normal Distribution (0.3 to 1.56)") +
  xlab("Value") +
  ylab("Frequency")

```



4.86

a. Use the applet Gamma Probability and Quantiles to find P(Y<3.5)

```
20 # 計算 P(Y < 3.5)，其中 shape = 1.5, rate = 1/4
21 probability_less_than_3.5 <- pgamma(3.5, shape = 1.5, rate = 1/4)
22
23 # 輸出結果
24 print(probability_less_than_3.5)
25
26
```

29:1 (Top Level) R Script

Console Terminal Background Jobs

R 4.3.2 · C:/Users/user/Desktop/

```
> # 計算 P(Y < 3.5)，其中 shape = 1.5, rate = 1/4
> probability_less_than_3.5 <- pgamma(3.5, shape = 1.5, rate = 1/4)
> # 輸出結果
> print(probability_less_than_3.5)
[1] 0.3741245
>
```

b. Use the applet Gamma Probability and Quantiles to find P(W<1.75)

```
29 # 計算 P(W < 1.75)，使用 shape = 1.5, rate = 1/2
30 probability_gamma <- pgamma(1.75, shape = 1.5, rate = 1/2)
31
32 # 輸出結果
33 print(probability_gamma)
34
35 # 使用卡方分佈計算 P(W < 1.75)，自由度為 3
36 probability_chisq <- pchisq(1.75 , df = 3)
37
38 print(probability_chisq)
39
40
```

41:1 (Top Level) R Script

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```
> # 計算 P(W < 1.75)，使用 shape = 1.5, rate = 1/2
> probability_gamma <- pgamma(1.75, shape = 1.5, rate = 1/2)
> # 輸出結果
> print(probability_gamma)
[1] 0.3741245
> # 使用卡方分佈計算 P(W < 1.75)，自由度為 3
> probability_chisq <- pchisq(1.75 , df = 3)
> print(probability_chisq)
[1] 0.3741245
>
```

c. Compare your answer to parts(a) and (b)

兩者所的出的答案相同，因為卡方分配為 Gamma 分配的其中一個特例。

4.123

a. Find the value of k that makes f(y) a density function.

```r
# 定義積分方程
equation <- function(k) {
  integrand <- function(y) {
    return(k * y^3 * (1 - y)^2)
  }

  # 使用 integrate 函數計算積分結果
  integral_result <- integrate(integrand, lower = 0, upper = 1)$value

  # 返回方程結果減去1的值
  return(integral_result - 1)
}

# 使用 uniroot 函數解方程
solution <- uniroot(equation, interval = c(-100, 100))

# 輸出未知數的解
print(solution$root)
```

52:1 (Top Level) R Script

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```
+   # 返回方程結果減去1的值
+   return(integral_result - 1)
+ }
> # 使用 uniroot 函數解方程
> solution <- uniroot(equation, interval = c(-100, 100))
> # 輸出未知數的解
> print(solution$root)
[1] 60
>
```

b. Use the applet Beta Probabilities and Quantiles to find a humidity value that is exceeded only 5% of the time.

```r
# 定義 Beta 分佈的形狀參數和比率參數
shape1 <- 4
shape2 <- 3

# 計算 Beta 分佈在區間 [0, y] 內的積分等於 0.95
y <- qbeta(0.95, shape1, shape2)

# 輸出解
print(y)
```

63:1 (Top Level) R Scri

Console Terminal Background Jobs

R 4.3.2 · C:/Users/user/Desktop/

```
> # 定義 Beta 分佈的形狀參數和比率參數
> shape1 <- 4
> shape2 <- 3
> # 計算 Beta 分佈在區間 [0, y] 內的積分等於 0.95
> y <- qbeta(0.95, shape1, shape2)
> # 輸出解
> print(y)
[1] 0.8468389
>
```

Conclusion: When the humidity value is 0.8468 that is exceeded only 5% of the time.