# **ASSIGNMENT-3**

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REG.NO: 21BCE7727

1. The serum cholesterol level X in 14-yearold boys has approximately a normal distribution with mean

170 and standard deviation 30. Plot the Normal Distribution diagram for each.

(a). Find the probability that the serum cholesterol level of a randomly chosen 14-Year old boy exceeds

230.

(b). In a middle school there are 300, 14-year-old boys. Find the probability that at Least 8 boys have

serum cholesterol level that exceeds 230.

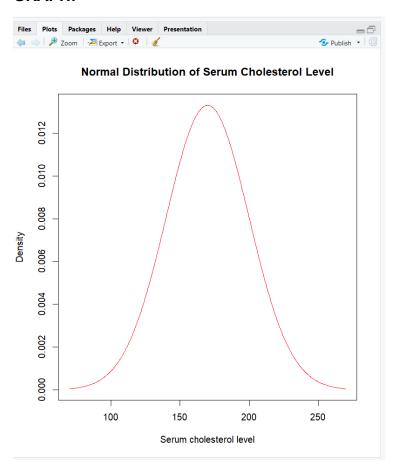
### CODE:

```
#21BCE7727
#M Gyanada Chowdary
x <- seq(70, 270, length = 1000);
y <- dnorm(x, mean = 170, sd = 30);
plot(x, y, type = "I", xlab = "Serum cholesterol level", ylab = "Density", main = "Normal Distribution of Serum Cholesterol Level",col='red');
#a)
1 - pnorm(230, mean = 170, sd = 30);
#b)
1 - pbinom(7, size = 300, prob = 0.02275);</pre>
```

```
#21BcE7727

#M Gyanada Chowdary
x <- seq(70, 270, length = 1000);
y <- dnorm(x, mean = 170, sd = 30);
plot(x, y, type = "l", xlab = "Serum cholesterol level", ylab = "Density", main = "Normal Distribution of Serum Cholesterol Level",col='red')
#a)
1 - pnorm(230, mean = 170, sd = 30);
#b)
1 - pbinom(7, size = 300, prob = 0.02275);
```

#### **GRAPH:**



# **OUTPUT:**

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> #21BCE7727

> #M Gyanada Chowdary

> x <- seq(70, 270, length = 1000);

> y <- dnorm(x, mean = 170, sd = 30);

> plot(x, y, type = "l", xlab = "Serum cholesterol level", ylab = "Density", main = "Normal Distribution of Serum Cholesterol Level",col='red');

> #a)

> 1 - pnorm(230, mean = 170, sd = 30);

[1] 0.02275013

> #b)

> #b)

1 - pbinom(7, size = 300, prob = 0.02275);

[1] 0.3749221
```

2. Lifetimes of batteries in a certain application are normally distributed with mean 50 hours and standard deviation 5 hours.

Find the probability that a randomly chosen battery lasts between 42 and 52 hours.

Plot the Normal Distribution diagram for the same.

# CODE:

```
#21BCE7727

#M Gyanada Chowdary

mu <- 50;

sigma <- 5;

x1 <- 42;

x2 <- 52;

# Calculate probability

prob <- pnorm(x2, mean = mu, sd = sigma) - pnorm(x1, mean = mu, sd = sigma);

prob

x <- seq(mu - 4*sigma, mu + 4*sigma, length.out = 100);

y <- dnorm(x, mean = mu, sd = sigma);

plot(x, y, type = "I", xlab = "Hours", ylab = "Density");

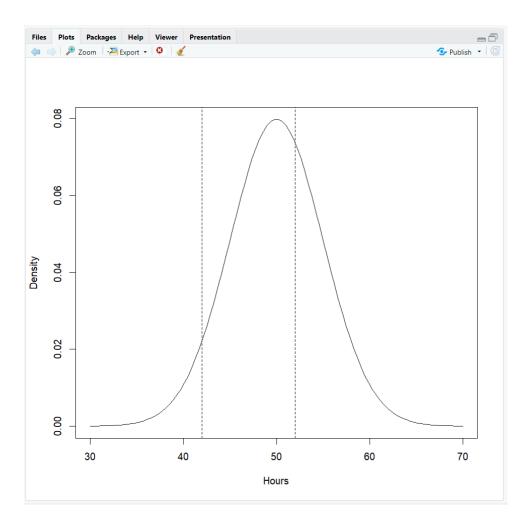
abline(v = c(x1, x2), lty = 2);
```

```
■ Untitled1* × ■ Untitled2* × ■ Untitled3* ×
2 #M Gyanada Chowdary
  3 mu <- 50;
  4 sigma <- 5;
  5 x1 <- 42;
6 x2 <- 52;
  8 # Calculate probability
  9 prob <- pnorm(x2, mean = mu, sd = sigma) - pnorm(x1, mean = mu, sd = sigma);</pre>
 10 prob
 11
 12 x \leftarrow seq(mu - 4*sigma, mu + 4*sigma, length.out = 100);
 13 y <- dnorm(x, mean = mu, sd = sigma);

14 plot(x, y, type = "l", xlab = "Hours", ylab = "Density");

15 abline(v = c(x1, x2), lty = 2);
 16
 17
 16:1 (Top Level) $
                                                                                              R Script $
```

### **GRAPH:**



### **OUTPUT:**

```
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> #21BCE7727

> #M Gyanada Chowdary

> mu <- 50;

> sigma <- 5;

> x1 <- 42;

> x2 <- 52;

> # Calculate probability

> prob <- pnorm(x2, mean = mu, sd = sigma) - pnorm(x1, mean = mu, sd = sigma);

> prob

[1] 0.6006224

> x <- seq(mu - 4*sigma, mu + 4*sigma, length.out = 100);

> y <- dnorm(x, mean = mu, sd = sigma);

> plot(x, y, type = "l", xlab = "Hours", ylab = "Density");

> abline(v = c(x1, x2), lty = 2);
```

- 3. Suppose that  $X \sim N(10, 2)$ . Find the values of
- (a)  $P(X \le 10.34)$
- (b)  $P(X \ge 11.98)$
- (c)  $P(7.67 \le X \le 9.90)$
- (d)  $P(|X 10| \le 3)$
- (e) The value of x for which  $P(X \le x) = 0.81$
- (g) The value of x for which  $P(X \ge x) = 0.04$
- (h) The value of x for which  $P(|X 10| \ge x) = 0.63$

### CODE:

```
#21BCE7727

#M Gyanada Chowdary

mu <- 10

sigma <- 2

# (a) P(X <= 10.34)
```

prob\_g <- 0.04

z8 <- qnorm(1 - prob\_g)

```
x_g <- z8 * sigma + mu
x_g
\# (h) X for P(|X - 10| >= x) = 0.63
prob h <- 0.63
z9 <- qnorm(1 - prob_h / 2)
x_h <- z9 * sigma
x h
   Source on Save A Save A
          4 sigma <- 2
          6 # (a) P(X <= 10.34)
7 z1 <- (10.34 - mu) / sigma
8 prob_a <- pnorm(z1)
                      prob_a
       11 # (b) P(X >= 11.98)
12 z2 <- (11.98 - mu) / sigma
13 prob_b <- 1 - pnorm(z2)
         14 prob_b
       16 # (c) P(7.67 <= X <= 9.90)

17 z3 <- (7.67 - mu) / sigma

18 z4 <- (9.90 - mu) / sigma

19 prob_c <- pnorm(z4) - pnorm(z3)
        22 # (d) P(|X - 10| <= 3)
23 z5 <- (-3) / sigma
24 z6 <- 3 / sigma
                     prob_d <- pnorm(z6) - pnorm(z5)
         26 prob_d
         28 # (e) X for P(X \le x) = 0.81
         29 prob_e <- 0.81
          30 z7 <- qnorm(prob_e)
         31 x_e \leftarrow z7 * sigma + mu
         32 x_e
         33
         34 # (g) X for P(X >= x) = 0.04
          35 prob_g <- 0.04
         x_g <- z8 * sigma + mu
         38 x_g
         40 # (h) X for P(|X - 10| >= x) = 0.63
      41 prob_h <- 0.63

42 z9 <- qnorm(1 - prob_h / 2)

43 x_h <- z9 * sigma
```

# **OUTPUT:**

```
> #21BCE7727
> #M Gyanada Chowdary
> mu <- 10
> sigma <- 2
> # (a) P(X <= 10.34)
> z1 <- (10.34 - mu) / sigma
> prob_a <- pnorm(z1)</pre>
> prob_a
[1] 0.5674949
> # (b) P(X >= 11.98)
> z2 <- (11.98 - mu) / sigma
> prob_b <- 1 - pnorm(z2)
 prob_b
[1] 0.1610871
> # (c) P(7.67 <= X <= 9.90)
> z3 <- (7.67 - mu) / sigma
> z4 <- (9.90 - mu) / sigma
> prob_c <- pnorm(z4) - pnorm(z3)</pre>
> prob_c
[1] 0.3580517
> # (d) P(|X - 10| <= 3)
> z5 <- (-3) / sigma
> z6 <- 3 / sigma
> prob_d <- pnorm(z6) - pnorm(z5)</pre>
> prob_d
[1] 0.8663856
> # (e) X for P(X <= X) = 0.81
> prob_e <- 0.81
> z7 <- qnorm(prob_e)</pre>
> x_e < -z7 * sigma + mu
> x_e
[1] 11.75579
> \# (g) X for P(X >= X) = 0.04
> prob_g <- 0.04
> z8 <- qnorm(1 - prob_g)
> x_g <- z8 * sigma + mu
> x_g
[1] 13.50137
> # (h) X for P(|X - 10| >= X) = 0.63
> prob_h <- 0.63
> z9 \leftarrow qnorm(1 - prob_h / 2)
> x_h <- z9 * sigma
> x_h
[1] 0.9634537
```

4. The resistance in milliohms of 1 meter of copper cable at a certain temperature is normally distributed

with mean  $\mu$  = 23.8 and variance  $\sigma$ 

- 2 = 1.28. Plot the Normal Distribution diagram for each.
- (a) What is the probability that a 1-meter segment of copper cable has a resistance less than 23.0?
- (b) What is the probability that a 1-meter segment of copper cable has a resistance greater than 24.0?
- (c) What is the probability that a 1-meter segment of copper cable has a resistance between 24.2 and

```
CODE:
#21BCE7727
#M Gyanada Chowdary
mu <- 23.8;
sigma2 <- 1.28;
sigma <- sqrt(sigma2);
# (a) Probability of resistance less than 23.0
x1 <- 23.0;
z1 <- (x1 - mu) / sigma;
prob_a <- pnorm(z1);</pre>
prob_a
# (b) Probability of resistance greater than 24.0
x2 <- 24.0;
z2 <- (x2 - mu) / sigma;
prob_b <- 1 - pnorm(z2);
prob_b
# (c) Probability of resistance between 24.2 and 24.5
x3 <- 24.2;
x4 <- 24.5;
z3 <- (x3 - mu) / sigma;
z4 <- (x4 - mu) / sigma;
prob_c <- pnorm(z4) - pnorm(z3);</pre>
```

```
prob_c <- pnorm(24) - pnorm(24) prob_c

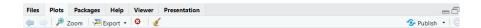
# Plot normal distribution

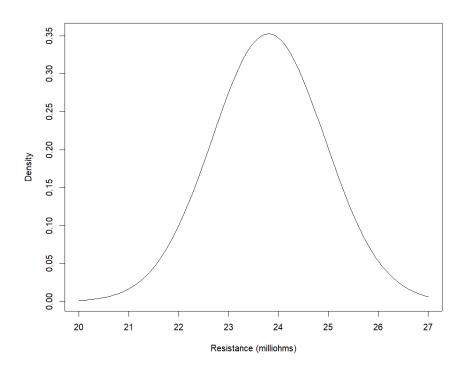
x <- seq(20, 27, length=100);
```

y <- dnorm(x, mean=mu, sd=sigma); plot(x, y, type="l", xlab="Resistance (milliohms)", ylab="Density");

```
1 #21BCE7727
2 #M Gyanada Chowdary
3 mu <- 23.8;
  4 sigma2 <- 1.28;
  5 sigma <- sqrt(sigma2);</pre>
  6
     # (a) Probability of resistance less than 23.0
  8 x1 <- 23.0;
9 z1 <- (x1 - mu) / sigma;
 10 prob_a <- pnorm(z1);</pre>
 11
 12
 13
     # (b) Probability of resistance greater than 24.0
 14 x2 <- 24.0;
 15 z2 <- (x2 - mu) / sigma;
 16 prob_b <- 1 - pnorm(z2);</pre>
 17
    prob_b
 18
 19
     # (c) Probability of resistance between 24.2 and 24.5
 20 x3 <- 24.2;
 21 x4 <- 24.5;
 22 z3 <- (x3 - mu) / sigma;
 23 z4 <- (x4 - mu) / sigma;
 24 prob_c <- pnorm(z4) - pnorm(z3);</pre>
 25
     prob_c
 26
 27 # Plot normal distribution
 28 x <- seq(20, 27, length=100);
 29 y <- dnorm(x, mean=mu, sd=sigma);</pre>
 plot(x, y, type="l", xlab="Resistance (milliohms)", ylab="Density");
 31
 32
```

#### **GRAPH:**





### **OUTPUT:**

```
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> #21BCE7727
> #M Gyanada Chowdary
> mu <- 23.8;
> sigma2 <- 1.28;</pre>
> sigma <- sqrt(sigma2);</pre>
> # (a) Probability of resistance less than 23.0
> x1 <- 23.0;
> z1 <- (x1 - mu) / sigma;
> prob_a <- pnorm(z1);
> prob_a
[1] 0.2397501
> # (b) Probability of resistance greater than 24.0
> x2 <- 24.0;
> z2 <- (x2 - mu) / sigma;
> prob_b <- 1 - pnorm(z2);
> prob_b
[1] 0.4298419
> # (c) Probability of resistance between 24.2 and 24.5
> x3 <- 24.2;
> x4 <- 24.5;
> z3 <- (x3 - mu) / sigma;
> z4 <- (x4 - mu) / sigma;
> prob_c <- pnorm(z4) - pnorm(z3);</pre>
> prob_c
[1] 0.09378587
> # Plot normal distribution
> # Plot Normal distribution
> x <- seq(20, 27, length=100);
> y <- dnorm(x, mean=mu, sd=sigma);
> plot(x, y, type="l", xlab="Resistance (milliohms)", ylab="Density");
```

END	