FA4

Kiana Marie Dizon

2024-09-20

1. First, second, third, and fourth moments for each set of data

```r
# Loading the necessary data for each set
normal <- c(67, 70, 63, 65, 68, 66, 60, 65, 68, 66, 66, 71, 64, 65, 61, 66, 65, 63, 67, 64, 67, 64, 67, 62, 65, 6
8, 66, 68, 64, 67,
            62, 65, 68, 65, 67, 64, 65, 63, 63, 66, 64, 66, 65, 65, 64, 67, 66, 63, 66, 63)

skewed_right <- c(69, 62, 43, 30, 66, 65, 60, 67, 46, 67, 26, 29, 65, 61, 60, 67, 26, 24, 65, 63, 67, 64, 26, 63,
68, 61, 34, 60,
                  65, 66, 63, 68, 29, 63, 68, 34, 62, 65, 30, 66, 64, 24, 65, 63, 66, 66, 35, 34, 33, 34)

skewed_left <- c(31, 40, 24, 29, 38, 26, 30, 38, 35, 40, 30, 26, 55, 29, 30, 26, 36, 40, 35, 26, 34, 40, 25, 28,
29, 26, 24, 28,
                 36, 38, 30, 27, 35, 33, 34, 31, 38, 28, 24, 34, 31, 35, 22, 24, 24, 36, 34, 25, 34, 28)

skewed_right <- c(102, 65, 70, 95, 73, 70, 84, 89, 85, 85, 75, 89, 60, 76, 89, 85, 76, 92, 93, 85, 10, 93, 58, 82
, 25, 43, 75,
                  55, 73, 84, 58, 82, 24, 20, 98, 77, 81, 43, 58, 85, 22, 85, 30, 58, 72, 79, 44, 65, 77)

uniform <- c(12.1, 11.6, 12.4, 11.7, 12.1, 11.8, 12.2, 11.8, 12.1, 11.9, 12.3, 12.0, 12.1, 11.9, 12.2, 12.0, 12.4
, 11.8, 12.3, 11.7,
             12.2, 12.0, 12.4, 11.9, 12.1, 11.8, 12.5, 11.7, 12.4, 12.0, 12.1, 11.9, 12.5, 12.0, 12.3, 12.1, 12.2
, 11.9, 12.4, 12.1,
             12.5, 12.3, 11.9, 12.5, 12.0, 12.4, 12.3, 12.1, 12.5, 12.0)

# Function to calculate moments
calculate_moments <- function(data) {
  n <- length(data)
  mean_value <- mean(data)
  m1 <- mean_value
  m2 <- mean((data - mean_value)^2)
  m3 <- mean((data - mean_value)^3)
  m4 <- mean((data - mean_value)^4)
  return(list(mean = m1, variance = m2, third_moment = m3, fourth_moment = m4))
}

# Calculate moments for each set of data
moments_normal <- calculate_moments(normal)
moments_skewed_right <- calculate_moments(skewed_right)
moments_skewed_left <- calculate_moments(skewed_left)
moments_uniform <- calculate_moments(uniform)

# Display results
moments_normal
```

```
## $mean
## [1] 65.3
##
## $variance
## [1] 4.57
##
## $third_moment
## [1] 0.72
##
## $fourth_moment
## [1] 68.5201
```

```r
moments_skewed_right
```

```
## $mean
## [1] 69.26531
##
## $variance
## [1] 504.8072
##
## $third_moment
## [1] -11416.44
##
## $fourth_moment
## [1] 801794.3
```

```
moments_skewed_left
```

```
## $mean
## [1] 31.58
##
## $variance
## [1] 37.1636
##
## $third_moment
## [1] 238.8402
##
## $fourth_moment
## [1] 7287.947
```

```
moments_uniform
```

```
## $mean
## [1] 12.108
##
## $variance
## [1] 0.059536
##
## $third_moment
## [1] -0.000509376
##
## $fourth_moment
## [1] 0.007333434
```

2. Moments about the mean are the same as moments computed above since they're calculated from the mean

3. Moments about the number 75 for the set of female height measurements

```r
# Calculate moments about 75
calculate_moments_about_75 <- function(data) {
  m1 <- mean(data - 75)
  m2 <- mean((data - 75)^2)
  m3 <- mean((data - 75)^3)
  m4 <- mean((data - 75)^4)
  return(list(first_moment = m1, second_moment = m2, third_moment = m3, fourth_moment = m4))
}

moments_about_75_normal <- calculate_moments_about_75(normal)

# Display results
moments_about_75_normal
```

```
## $first_moment
## [1] -9.7
##
## $second_moment
## [1] 98.66
##
## $third_moment
## [1] -1044.94
##
## $fourth_moment
## [1] 11473.46
```

4. Verify the relations between the moments

```
# Using the given formulas for m2, m3, and m4:
m1_prime <- moments_normal$mean
m2_prime <- moments_normal$variance
m3_prime <- moments_normal$third_moment
m4_prime <- moments_normal$fourth_moment

# Verify the relations
m2 <- m2_prime - m1_prime^2
m3 <- m3_prime - 3 * m1_prime * m2_prime + 2 * m1_prime^3
m4 <- m4_prime - 4 * m1_prime * m3_prime + 6 * m1_prime^2 * m2_prime - 3 * m1_prime^4

# Display results
list(m2 = m2, m3 = m3, m4 = m4)
```

```
## $m2
## [1] -4259.52
##
## $m3
## [1] 555995.6
##
## $m4
## [1] -54430589
```