FA6

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Question 1: Quartiles of the Distribution

Explanation:

The total number of students is 120.

- Quartiles are calculated based on the cumulative student frequencies:

Q1 (25th percentile) is at the position 0.25 * 120 = 30.

Q2 (50th percentile, median) is at 0.50 * 120 = 60.

Q3 (75th percentile) is at 0.75 * 120 = 90.

```
grades <- c(90, 80, 70, 60, 50, 40, 30)
students <- c(9, 32, 43, 21, 11, 3, 1)

#frequency table
freq_table <- data.frame(Grade = grades, Number_of_Students = students)

# Cumulative frequencies
freq_table$Cumulative_Students <- cumsum(students)


knitr::kable(freq_table, caption = "Frequency Distribution of Grades")
```

Frequency Distribution of Grades

Grade	Number_of_Students	Cumulative_Students
90	9	9
80	32	41
70	43	84
60	21	105
50	11	116
40	3	119
30	1	120

```
total_students <- sum(students)

# Quartiles calculation
Q1 <- 0.25 * total_students
Q2 <- 0.50 * total_students
Q3 <- 0.75 * total_students


Q1
```

```
## [1] 30
```

```
Q2
```

```
## [1] 60
```

```
Q3
```

```
## [1] 90
```

Question 2: Absolute and Relative Dispersion Explanation:

- Absolute Dispersion is just the standard deviation:

For Statistics: SD = 8

For Algebra: SD = 7.6

- Relative Dispersion (coefficient of variation):

For Statistics: CV= 8/78 ≈ 0.1026

For Algebra: CV= 7.6/73 ≈ 0.1041

```
means <- c(78, 73)
sds <- c(8, 7.6)
subjects <- c("Statistics", "Algebra")

# Absolute dispersion is just the standard deviation
absolute_dispersion <- sds

# Relative dispersion (Coefficient of variation = standard deviation / mean)
relative_dispersion <- sds / means

#data frame
dispersion_df <- data.frame(Subject = subjects, Mean = means, Standard_Deviation = sds,
                            Absolute_Dispersion = absolute_dispersion,
                            Relative_Dispersion = relative_dispersion)


knitr::kable(dispersion_df, caption = "Dispersion Comparison between Statistics and Algebra")
```

Dispersion Comparison between Statistics and Algebra

Subject	Mean	Standard_Deviation	Absolute_Dispersion	Relative_Dispersion
Statistics	78	8.0	8.0	0.1025641
Algebra	73	7.6	7.6	0.1041096

Question 3: Proving the Mean and Standard Deviation of Standard Scores

```
data_set <- c(6, 2, 8, 7, 5)

#mean and standard deviation of the set
mean_set <- mean(data_set)
std_set <- sd(data_set)

# Convert to standard scores
standard_scores <- (data_set - mean_set) / std_set

# data frame
standard_scores_df <- data.frame(Original_Score = data_set, Standard_Score = standard_scores)


knitr::kable(standard_scores_df, caption = "Standard Scores of the Data Set")
```

Standard Scores of the Data Set

Original_Score	Standard_Score
6	0.1737489
2	-1.5637401
8	1.0424934
7	0.6081211
5	-0.2606233

```
# Mean and standard deviation of the standard scores
mean_standard_scores <- mean(standard_scores)
std_standard_scores <- sd(standard_scores)


list(Mean_of_Standard_Scores = mean_standard_scores, SD_of_Standard_Scores = std_standard_scores)
```

```
## $Mean_of_Standard_Scores
## [1] 1.387779e-16
##
## $SD_of_Standard_Scores
## [1] 1
```

Question 4: Mean and Standard Deviation of Mass

```
masses <- c(20.48, 35.97, 62.34)
mass_sds <- c(0.21, 0.46, 0.54)


mass_df <- data.frame(Mass = masses, SD = mass_sds)


knitr::kable(mass_df, caption = "Masses and their Standard Deviations")
```

Masses and their Standard Deviations

Mass	SD
20.48	0.21
35.97	0.46
62.34	0.54

```
# Mean of the sum of masses
mean_sum_mass <- sum(masses)

# Standard deviation of the sum of masses (square root of sum of variances)
std_sum_mass <- sqrt(sum(mass_sds^2))


list(Mean_of_Sum = mean_sum_mass, SD_of_Sum = std_sum_mass)
```

```
## $Mean_of_Sum
## [1] 118.79
##
## $SD_of_Sum
## [1] 0.7397973
```

Question 5: Credit Hour Distribution

- Mean (Expected value): $E(X)$=6(0.1)+9(0.2)+12(0.4)+15(0.2)+18(0.1)=12
- Variance: Var(X)=(6−12)^2(0.1) + (9−12)^2(0.2) + (12−12)^2(0.4) + (15−12)^2(0.2) + (18−12)^2(0.1)=9

```
#credit hour distribution
x <- c(6, 9, 12, 15, 18)
p_x <- c(0.1, 0.2, 0.4, 0.2, 0.1)


credit_df <- data.frame(Credit_Hours = x, Probability = p_x)


knitr::kable(credit_df, caption = "Credit Hour Distribution")
```

Credit Hour Distribution

Credit_Hours	Probability
6	0.1
9	0.2
12	0.4
15	0.2
18	0.1

```
# Mean (Expected value) of credit hours
mean_x <- sum(x * p_x)

# Variance of credit hours
var_x <- sum((x - mean_x)^2 * p_x)

# Display results
list(Mean = mean_x, Variance = var_x)
```

```
## $Mean
## [1] 12
##
## $Variance
## [1] 10.8
```