Formative Assessment 6

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Problem 1

Table 1 shows a frequency distribution of grades on a final examination in college algebra. Find the quartiles of the distribution.

Grade	Number of Students
90-99	9
80-89	32
70-79	43
60-69	21
50-59	11
40-49	3
30-39	1
Total	*120*

```
grades <- c(rep(95, 9), rep(85, 32), rep(75, 43), rep(65, 21), rep(55, 11), rep(45, 3), rep(35, 1))

quartiles <- quantile(grades, probs = c(0.25, 0.5, 0.75))
quartiles
```

```
## 25% 50% 75%
##  65  75  85
```

Problem 2

On a final examination in statistics, the mean grade of a group of 150 students was 78 and the standard deviation was 8.0. In algebra, however, the mean final grade of the group was 73 and the standard deviation was 7.6. In which subject was there the greater:

Data

We have the following data for the final grades:

- **Statistics**
  - Mean: 78
  - Standard Deviation: 8.0
- **Algebra**
  - Mean: 73
  - Standard Deviation: 7.6

a. absolute dispersion and (b) relative dispersion The standard deviation values are:

```
sd_statistics <- 8.0
sd_algebra <- 7.6

sd_statistics
```

```
## [1] 8
```

```
sd_algebra
```

```
## [1] 7.6
```

```
mean_statistics <- 78
mean_algebra <- 73

cv_statistics <- (sd_statistics / mean_statistics) * 100
cv_algebra <- (sd_algebra / mean_algebra) * 100

cv_statistics
```

```
## [1] 10.25641
```

```
cv_algebra
```

```
## [1] 10.41096
```

Problem 3

Prove that the mean and standard deviation of a set of standard scores are equal to 0 and 1, respectively. Use the following problem to illustrate this: Convert the set 6, 2, 8, 7, 5 into standard scores.

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

mean_values <- mean(values)
std_dev_values <- sd(values)

z_scores <- (values - mean_values) / std_dev_values

mean_z_scores <- mean(z_scores)
std_dev_z_scores <- sd(z_scores)

mean_values
```

```
## [1] 5.6
```

```
std_dev_values
```

```
## [1] 2.302173
```

```
z_scores
```

```
## [1]  0.1737489 -1.5637401  1.0424934  0.6081211 -0.2606233
```

```
mean_z_scores
```

```
## [1] 1.387779e-16
```

```
std_dev_z_scores
```

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

The mean of z-scores:

- The z-scores are centered around the mean, which is 0 by definition.
- The mean of the z-scores should be 0, as for any set of z-scores, the sum of the differences from the mean divided by the standard deviation always equals 0.

Problem 4

Three masses are measured as 20.48, 35.97, and 62.34 g, with standard deviations of 0.21, 0.46, and 0.54 g, respectively. Find the:

a. mean

```
## [1] 118.79
```

b. standard deviation of the sum of the masses.

```
## [1] 0.7397973
```

Problem 5

The credit hour distribution at Metropolitan Technological College is as follows: Find μ and $\sigma 2$. Give the 25 (with replacement) possible samples of size 2, their means, and their probabilities.

x	6	9	12	15	18
p(x)	0.1	0.2	0.4	0.2	0.1

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

mu <- sum(x * p_x)
mu
```

```
## [1] 12
```

```
variance <- sum((x - mu)^2 * p_x)
variance
```

```
## [1] 10.8
```

```
samples <- expand.grid(x, x)
means <- rowMeans(samples)
probabilities <- expand.grid(p_x, p_x)
sample_probabilities <- probabilities[,1] * probabilities[,2]

results <- data.frame(Sample1 = samples[,1], Sample2 = samples[,2],
                      Mean = means, Probability = sample_probabilities)
results
```

```
##    Sample1 Sample2 Mean Probability
## 1        6       6  6.0        0.01
## 2        9       6  7.5        0.02
## 3       12       6  9.0        0.04
## 4       15       6 10.5        0.02
## 5       18       6 12.0        0.01
## 6        6       9  7.5        0.02
## 7        9       9  9.0        0.04
## 8       12       9 10.5        0.08
## 9       15       9 12.0        0.04
## 10      18       9 13.5        0.02
## 11       6      12  9.0        0.04
## 12       9      12 10.5        0.08
## 13      12      12 12.0        0.16
## 14      15      12 13.5        0.08
## 15      18      12 15.0        0.04
## 16       6      15 10.5        0.02
## 17       9      15 12.0        0.04
## 18      12      15 13.5        0.08
## 19      15      15 15.0        0.04
## 20      18      15 16.5        0.02
## 21       6      18 12.0        0.01
## 22       9      18 13.5        0.02
## 23      12      18 15.0        0.04
## 24      15      18 16.5        0.02
## 25      18      18 18.0        0.01
```

```
sorted_results <- results[order(results$Mean), ]
sorted_results
```

```
##    Sample1 Sample2 Mean Probability
## 1        6       6  6.0        0.01
## 2        9       6  7.5        0.02
## 6        6       9  7.5        0.02
## 3       12       6  9.0        0.04
## 7        9       9  9.0        0.04
## 11       6      12  9.0        0.04
## 4       15       6 10.5        0.02
## 8       12       9 10.5        0.08
## 12       9      12 10.5        0.08
## 16       6      15 10.5        0.02
## 5       18       6 12.0        0.01
## 9       15       9 12.0        0.04
## 13      12      12 12.0        0.16
## 17       9      15 12.0        0.04
## 21       6      18 12.0        0.01
## 10      18       9 13.5        0.02
## 14      15      12 13.5        0.08
## 18      12      15 13.5        0.08
## 22       9      18 13.5        0.02
## 15      18      12 15.0        0.04
## 19      15      15 15.0        0.04
## 23      12      18 15.0        0.04
## 20      18      15 16.5        0.02
## 24      15      18 16.5        0.02
## 25      18      18 18.0        0.01
```