

# How to Easily Calculate and Display IQR in SAS PROC MEANS

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While various complex methods exist for deriving specialized summary statistics within SAS, such as using custom functions combined with the OUTPUT statement to calculate metrics like the Interquartile Range (IQR) and outputting the results to a new dataset, most users prefer a more direct approach. The complex method often involves intricate data manipulation steps, including employing options like DROP=: to clean up the resulting dataset by excluding system-generated or unnecessary variables. However, for standard descriptive statistics analysis, PROC MEANS offers a much simpler, built-in solution for displaying the IQR directly in the output report, which we will explore in detail throughout this guide.

## Introduction to Interquartile Range (IQR) Analysis in SAS

The PROC MEANS procedure is one of the foundational tools used by analysts and statisticians working with SAS. Its primary function is to compute fundamental summary statistics for variables within a dataset, providing crucial insights into the central tendency, variability, and distribution of the data. Understanding these summary measures is essential for any preliminary data exploration.

One of the most robust measures of statistical dispersion is the Interquartile Range (IQR). Unlike the standard deviation, the IQR is less susceptible to the influence of outliers because it focuses solely on the middle 50% of the data. Specifically, the IQR is defined as the difference between the third quartile (Q3, or the 75th percentile) and the first quartile (Q1, or the 25th percentile). Utilizing the IQR is paramount when analyzing potentially skewed distributions or datasets known to contain extreme values, offering a more reliable measure of spread.

By default, when you execute a standard PROC MEANS statement, the output includes common statistics such as N, Mean, Standard Deviation (Std Dev), Minimum, and Maximum. However, the IQR is conspicuously absent from this default list. Fortunately, SAS provides a straightforward option, QRANGE, that allows users to seamlessly incorporate this critical measure into their output reports without requiring complex data steps or manual calculation.

## Enabling IQR Calculation with the QRANGE Statement

To instruct PROC MEANS to calculate and display the IQR, we simply need to specify the QRANGE keyword along with any other desired statistics in the procedure statement. This tells SAS to utilize its internal calculation methods to derive the difference between Q3 and Q1 for the specified variables.

The syntax below illustrates how to correctly incorporate QRANGE when requesting standard descriptive statistics. Note that we list all the statistics we wish to see explicitly after the dataset specification. This approach ensures that the resulting table is comprehensive and immediately

usable for reporting purposes, fulfilling the analyst's need for both central tendency and robust dispersion measures.

```
proc means data=my_data N Mean QRANGE Std Min Max;  
var points;  
run;
```

In this particular example, we are requesting a thorough analysis for the variable named `points`. The output will include the total number of observations (**N**), the arithmetic **Mean**, the **Interquartile Range** calculated via **QRANGE**, the **Standard Deviation** (Std), the **Minimum** value, and the **Maximum** value. This single procedure call efficiently provides a complete statistical profile of the variable, saving time compared to manually computing these statistics or using multiple procedures.

### Practical Example: Displaying IQR in PROC MEANS in SAS

To demonstrate the utility of the `QRANGE` option, let us work with a simple, illustrative dataset. Suppose we have compiled data on various basketball players, including their team affiliation, the number of points scored in a recent game, and their total assists. This kind of real-world data often benefits from IQR analysis, especially when scores (like points) might be highly variable due to star players or low scorers.

First, we create and view the dataset using the standard SAS data step structure. We use the `DATALINES` statement to input the sample player data directly, followed by a `PROC PRINT` step to verify the successful creation and structure of our new dataset named `my_data`.

```
/*create dataset*/  
data my_data;  
input team $ points assists;  
datalines;  
A 10 2  
A 17 5  
A 17 6  
A 18 3  
A 15 0  
B 10 2  
B 14 5  
B 13 4  
B 29 0  
B 25 2
```

```
C 12 1
C 30 1
C 34 3
C 12 4
C 11 7
;
run;

/*view dataset*/
proc print data=my_data;
```

Obs	team	points	assists
1	A	10	2
2	A	17	5
3	A	17	6
4	A	18	3
5	A	15	0
6	B	10	2
7	B	14	5
8	B	13	4
9	B	29	0
10	B	25	2
11	C	12	1
12	C	30	1
13	C	34	3
14	C	12	4
15	C	11	7

With the dataset confirmed, we are ready to proceed with the analysis. Our objective is to calculate the summary statistics specifically for the `points` variable, as this is often the most critical performance metric in sports data analysis. We will first run the default PROC MEANS command to establish a baseline output and highlight the missing IQR value.

## Reviewing the Default PROC MEANS Output

When executing PROC MEANS without specifying any statistical keywords, SAS automatically generates a standard set of descriptive statistics. This default set is usually sufficient for a quick

overview but lacks measures tailored for non-normal distributions.

```
/*calculate summary statistics for points variable*/
```

```
proc means data=my_data;
```

```
var points;
```

```
run;
```

The MEANS Procedure				
Analysis Variable : points				
N	Mean	Std Dev	Minimum	Maximum
15	17.8000000	7.8848861	10.0000000	34.0000000

As illustrated in the output table above, the default execution of `PROC MEANS` calculates the following essential descriptive measures:

**N:** This represents the total number of non-missing observations available for the `points` variable in the dataset.

**Mean:** The arithmetic average of the points scored, indicating the central tendency.

**Std Dev:** The standard deviation, which measures the typical deviation of points from the mean.

**Minimum:** The lowest recorded score in the dataset.

**Maximum:** The highest recorded score in the dataset.

Crucially, notice that the Interquartile Range is not present in this default output. To include this robust measure of variability, we must proceed to the next step and explicitly request it using the `QRANGE` keyword.

## Implementing the QRANGE Option

To successfully integrate the IQR into our summary table, we modify the `PROC MEANS` statement to include `QRANGE` along with the standard statistics we want to retain. This method ensures that the output is tailored precisely to our analytical needs, providing both conventional and quartile-based metrics of dispersion.

The revised syntax below specifies all desired statistics, ensuring that the `points` variable analysis is comprehensive. Note the inclusion of `QRANGE` in the list of keywords provided in the main procedure line. This small addition dramatically changes the utility of the resulting output table, especially when dealing with data that may violate assumptions of normality.

```
/*calculate summary statistics for points and include IQR*/
proc means data=my_data N Mean QRANGE Std Min Max;
var points;
run;
```

The MEANS Procedure					
Analysis Variable : points					
N	Mean	Quartile Range	Std Dev	Minimum	Maximum
15	17.8000000	13.0000000	7.8848861	10.0000000	34.0000000

Upon reviewing this enhanced output, we can clearly see the addition of the new column dedicated to the `QRANGE`. For our dataset, the calculated IQR value for the `points` variable is **13**. This tells us that the middle 50% of our basketball players scored within a range of 13 points. This measure is highly valuable for understanding the spread of typical performance, effectively isolating the impact of unusually high or low scoring games.

### Linking IQR to Percentiles: P25 and P75

As previously mentioned, the IQR fundamentally represents the difference between the 75th percentile (Q3) and the 25th percentile (Q1). Understanding the specific values of these two quartiles provides deeper context for interpreting the IQR statistic. If we want to see the specific boundaries that define the middle 50% of the data--that is, the Q1 and Q3 values--we can easily request them within the same PROC MEANS procedure.

To include these percentile values, we add the keywords `P25` (for the 25th percentile) and `P75` (for the 75th percentile) to our list of requested statistics. This augmentation provides a comprehensive picture, allowing analysts to verify the components used to calculate the IQR and better understand where the bulk of the data lies in absolute terms.

```
/*calculate summary statistics for points and include IQR, Q1, and Q3*/
proc means data=my_data N Mean P25 P75 QRANGE Std Min Max;
var points;
run;
```

### The MEANS Procedure

Analysis Variable : points							
N	Mean	25th Pctl	75th Pctl	Quartile Range	Std Dev	Minimum	Maximum
15	17.8000000	12.0000000	25.0000000	13.0000000	7.8848861	10.0000000	34.0000000

The resulting output now includes the **25th percentile** and the **75th percentile** values, flanking the Interquartile Range column. For the `points` variable, the 25th percentile is 12, and the 75th percentile is 25. As expected, subtracting the 25th percentile (12) from the 75th percentile (25) yields the IQR of 13, confirming the integrity of the calculation performed by SAS. This level of detail is extremely helpful for generating box plots or identifying potential outliers using the standard  $1.5 \times \text{IQR}$  rule.

## Conclusion and Further SAS Statistical Analysis

Calculating the Interquartile Range in SAS using PROC MEANS is a straightforward task, provided you remember to include the essential `QRANGE` keyword. This simple option transforms a basic descriptive analysis into a more robust exploratory data analysis, offering insights into data dispersion that are resistant to extreme values. The ability to easily include related percentile statistics (P25 and P75) further enhances the report's utility, giving analysts full control over their descriptive summaries.

Mastery of PROC MEANS is a cornerstone of effective data analysis in the SAS environment, and knowing how to customize its output for specialized metrics like the IQR is crucial for generating high-quality statistical reports. By following the examples and syntax provided, users can ensure their summary statistics are comprehensive and perfectly tailored to the characteristics of their dataset.

For those looking to expand their knowledge of statistical analysis using this powerful software, the following resources and tutorials explain how to perform other common statistical tasks and delve deeper into advanced SAS procedures: