Abstract
We live in a world of data – small data, big data, and data in every conceivable size between small and big. In today’s world data finds its way into our lives wherever we are. We talk about data, create data, read data, transmit data, receive data, and save data constantly during any given hour in a day, and we still want and need more. So, we collect even more data at work, in meetings, at home, using our smartphones, in emails, in voice messages, sifting through financial reports, analyzing profits and losses, watching streaming videos, playing computer games, comparing sports teams and favorite players, and countless other ways. Data is growing and being collected at such astounding rates all in the hopes of being able to better understand the world around us. As SAS professionals, the world of data offers many new and exciting opportunities, but also presents a frightening realization that data sources may very well contain a host of integrity issues that need to be resolved first. This presentation describes the available methods that are used to remove duplicate observations (or rows) from data sets (or tables) based on the row’s values and/or keys using SAS®.

Introduction
An issue found in some data sets is the presence of duplicate rows and/or duplicate keys. When found, SAS can be used to remove any unwanted data. Note: Before duplicates are removed, be sure to consult with your organization’s data analyst or subject matter expert to see if removal is necessary or permitted. It’s better to be safe than sorry. This paper will illustrate two very different approaches to remove duplicate observations (or rows) from data sets (or tables) based on the row’s values and/or keys using SAS®. Each example is illustrated using a single data set, MOVIES. The Movies data set contains 26 rows, and has a structure consisting of six columns. Title, Category, Studio, and Rating are defined as character columns; and Length and Year are defined as numeric columns. The Movies data set contains two duplicate rows – Brave Heart and Rocky; and two duplicate Title keys – Forrest Gump and The Wizard of Oz, shown below.
Method #1 – Using PROC SORT

The first method, and one that is popular with SAS professionals everywhere, uses PROC SORT to remove duplicates. The SORT procedure supports three options for the removal of duplicates: NODUPRECS, NODUPKEYS, and DUPOUT=.

The NODUPRECS (or NODUP) Option

By specifying the NODUPRECS (or NODUPREC) (or NODUP) option with PROC SORT, rows with identical values for all columns are removed from the output data set. The resulting output data set saw the removal of the duplicate rows for Brave Heart and Rocky because they have identical data for all columns.

```sas
PROC SORT DATA=Movies
    OUT=Movies_Sorted_NoDuprecs
    NODUPRECS;
    BY Title;
RUN;
```

The NODUPKEYS (or NODUPKEY) Option

By specifying the NODUPKEYS (or NODUPKEY) option with PROC SORT, rows with duplicate keys are automatically removed from the output data set. The resulting output data set saw the removal of all the duplicate rows for Brave Heart, Forrest Gump, Rocky and The Wizard of Oz because they have duplicate keys data for the column, Title.

```sas
PROC SORT DATA=Movies
    OUT=Movies_Sorted_NoDupkeys
    NODUPKEYS;
    BY Title;
RUN;
```

The DUPOUT= Option

A DUPOUT= option is specified with PROC SORT to identify duplicate rows before actually removing them from a data set. The DUPOUT= option is used with either the NODUPKEYS or NODUPRECS option to name a data set that will contain duplicate keys or duplicate rows. The DUPOUT= option is generally used when the data set is too large for visual inspection. In the next code example, the DUPOUT= and NODUPKEY option are specified. The resulting output data set contains the duplicate rows for Brave Heart, Forrest Gump, Rocky and The Wizard of Oz.

```sas
PROC SORT DATA=Movies
    DUPOUT=Movies_Sorted_Dupout_NoDupkey
    NODUPKEY;
    BY Title;
RUN;
```

In the next example, the DUPOUT= and NODUPRECS options are specified. The resulting output data set contains the duplicate rows for Brave Heart and Rocky because these rows have identical data for all columns.

```sas
PROC SORT DATA=Movies
    DUPOUT=Movies_Sorted_Dupout_NoDupreces
    NODUPRECS;
    BY Title;
RUN;
```

Note: Although the removal of duplicates using PROC SORT is popular with many SAS professionals, an element of care should be given to using this method when processing big data sets. Because sort operations are time consuming and CPU-intensive operations, requiring as much as three times the amount of space to sort a data set, excessive
demand is placed on system resources. Instead, SAS professionals may want to consider using PROC SUMMARY with the CLASS statement to avoid the need for sorting altogether, see Method #2.

**Method #2 – Using PROC SUMMARY with the CLASS Statement**

The second method of removing duplicates uses PROC SUMMARY with the CLASS statement. Using PROC SUMMARY with the CLASS statement provides SAS professionals with a more efficient alternative than PROC SORT, and other methods, by avoiding the need for sorting in advance. Without the sorting requirement, considerably less system resources are needed to identify duplicates. But two additional aspects make this method effective: the specification of a CLASS statement to collapse rows with the same column values and the creation of a _FREQ_ column containing the number of occurrences. As shown in the example, a WHERE statement, WHERE= data set option, or SQL WHERE-clause is specified to select rows with multiple occurrences (duplicates) with the WHERE-clause expression Dupkey > 1.

```sas
PROC SUMMARY DATA=Mydata.Movies_dups2 NWAY;
  CLASS Title;
  OUTPUT OUT=Movies_Summary_NoDupkey(DROP=_type_);
RUN;
PROC PRINT DATA=Movies_Summary_NoDupkey(RENAME=(_FREQ_ = Dupkey)) NOOBS;
  WHERE Dupkey > 1;
RUN;
```

**Conclusion**

While many users use PROC SORT to remove duplicate observations or rows from SAS data sets, using PROC SUMMARY with the CLASS statement provides a more efficient alternative. Because sorts can be expensive and time-consuming processes, it’s advisable to use approaches that reduce the utilization of system resources to remove duplicates, such as with PROC SUMMARY.

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