

# Visualizing SQL Join Types with Venn Diagrams

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## Abstract

Joining two or more tables of data is a powerful feature in the relational model. The SQL procedure enables users to join tables of information quickly and easily. Linking one piece of information with another piece of information is made possible when at least one column is common to each table. This paper describes several join types including the importance of joins, the difference between the various join types (inner and outer), the creation of outer (left, right, and full) joins, the importance of the WHERE / ON clause(s) in creating and subsetting rows of data, the purpose of creating and using table aliases to minimize the number of keystrokes, and the application of set operators.

## Introduction

A powerful and essential PROC SQL programming technique that all SAS users should be aware of, and comfortable performing, is the process of joining (or combining) two or more tables of data. Specific topics include describing the join process, what a join is, the preparation requirements for each table being specified in a join, the join syntax, the various types of joins available to SAS users, conventional (symmetrical) and unconventional PROC SQL join programming techniques essential concepts, syntax, and programming techniques.

## Example Tables

The examples used throughout this paper utilize a database of two tables. (A relational database is a collection of tables.) The data used in all the examples in this paper consists of a selection of movies that I've viewed over the years. The Movies table consists of six columns: title, length, category, year, studio, and rating. Title, category, studio, and rating are defined as character columns with length and year being defined as numeric columns. The data stored in the Movies table is depicted below.

### MOVIES Table

	Title	Length	Category	Year	Studio	Rating
1	Brave Heart	177	Action Adventure	1995	Paramount Pictures	R
2	Casablanca	103	Drama	1942	MGM / UA	PG
3	Christmas Vacation	97	Comedy	1989	Warner Brothers	PG-13
4	Coming to America	116	Comedy	1988	Paramount Pictures	R
5	Dracula	130	Horror	1993	Columbia TriStar	R
6	Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R
7	Forrest Gump	142	Drama	1994	Paramount Pictures	PG-13
8	Ghost	127	Drama Romance	1990	Paramount Pictures	PG-13
9	Jaws	125	Action Adventure	1975	Universal Studios	PG
10	Jurassic Park	127	Action	1993	Universal Pictures	PG-13
11	Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R
12	Michael	106	Drama	1997	Warner Brothers	PG-13
13	National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG-13
14	Poltergeist	115	Horror	1982	MGM / UA	PG
15	Rocky	120	Action Adventure	1976	MGM / UA	PG
16	Scarface	170	Action Cops & Robber	1983	Universal Studios	R
17	Silence of the Lambs	118	Drama Suspense	1991	Orion	R
18	Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG
19	The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG
20	The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R
21	The Wizard of Oz	101	Adventure	1939	MGM / UA	G
22	Titanic	194	Drama Romance	1997	Paramount Pictures	PG-13

## Visualizing SQL Join Types with Venn Diagrams, continued

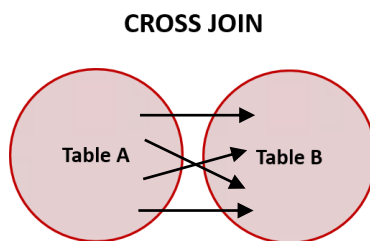
The data stored in the ACTORS table consists of three columns: title, actor\_leading, and actor\_supporting, all of which are defined as character columns. The data stored in the Actors table is illustrated below.

### ACTORS Table

	Title	Actor_Leading	Actor_Supporting
1	Brave Heart	Mel Gibson	Sophie Marceau
2	Christmas Vacation	Chevy Chase	Beverly D'Angelo
3	Coming to America	Eddie Murphy	Arsenio Hall
4	Forrest Gump	Tom Hanks	Sally Field
5	Ghost	Patrick Swayze	Demi Moore
6	Lethal Weapon	Mel Gibson	Danny Glover
7	Michael	John Travolta	Andie MacDowell
8	National Lampoon's Vacation	Chevy Chase	Beverly D'Angelo
9	Rocky	Sylvester Stallone	Talia Shire
10	Silence of the Lambs	Anthony Hopkins	Jodie Foster
11	The Hunt for Red October	Sean Connery	Alec Baldwin
12	The Terminator	Arnold Schwarzenegger	Michael Biehn
13	Titanic	Leonardo DiCaprio	Kate Winslet

## Cross Join or Cartesian Product

A CROSS JOIN or Cartesian Product represents all rows in Table A multiplied by all rows in Table B. Due to this multiplier effect, the results can be quite large. The results are shown in the shaded area in the Venn diagram.



```
LIBNAME MYDATA "/home/kirklafler/Data Sources" ;
```

```
PROC SQL ;  
SELECT *  
FROM MYDATA.Movies M,  
      MYDATA.Actors A ;  
QUIT ;
```

### Results for Inner Join:

Title	Length	Category	Year	Studio	Rating	Title	Actor_Leading	Actor_Supporting
Brave Heart	177	Action Adventure	1995	Paramount Pictures	R	Brave Heart	Mel Gibson	Sophie Marceau
Casablanca	103	Drama	1942	MGM / UA	PG	Brave Heart	Mel Gibson	Sophie Marceau
Christmas Vacation	97	Comedy	1989	Warner Brothers	PG13	Brave Heart	Mel Gibson	Sophie Marceau
Coming to America	116	Comedy	1988	Paramount Pictures	R	Brave Heart	Mel Gibson	Sophie Marceau
Dracula	130	Horror	1993	Columbia TriStar	R	Brave Heart	Mel Gibson	Sophie Marceau
Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R	Brave Heart	Mel Gibson	Sophie Marceau
Forrest Gump	142	Drama	1994	Paramount Pictures	PG13	Brave Heart	Mel Gibson	Sophie Marceau
Ghost	127	Drama Romance	1990	Paramount Pictures	PG13	Brave Heart	Mel Gibson	Sophie Marceau
Jaws	125	Action Adventure	1975	Universal Studios	PG	Brave Heart	Mel Gibson	Sophie Marceau
Jurassic Park	127	Action	1993	Universal Pictures	PG13	Brave Heart	Mel Gibson	Sophie Marceau
Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R	Brave Heart	Mel Gibson	Sophie Marceau
Michael	106	Drama	1997	Warner Brothers	PG13	Brave Heart	Mel Gibson	Sophie Marceau
National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG13	Brave Heart	Mel Gibson	Sophie Marceau
Poltergeist	115	Horror	1982	MGM / UA	PG	Brave Heart	Mel Gibson	Sophie Marceau
Rocky	120	Action Adventure	1976	MGM / UA	PG	Brave Heart	Mel Gibson	Sophie Marceau
Scarface	170	Action Cops & Robber	1983	Universal Studios	R	Brave Heart	Mel Gibson	Sophie Marceau
Silence of the Lambs	118	Drama Suspense	1991	Orion	R	Brave Heart	Mel Gibson	Sophie Marceau
Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG	Brave Heart	Mel Gibson	Sophie Marceau
The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG	Brave Heart	Mel Gibson	Sophie Marceau
The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R	Brave Heart	Mel Gibson	Sophie Marceau
The Wizard of Oz	101	Adventure	1939	MGM / UA	G	Brave Heart	Mel Gibson	Sophie Marceau
Titanic	194	Drama Romance	1997	Paramount Pictures	PG13	Brave Heart	Mel Gibson	Sophie Marceau

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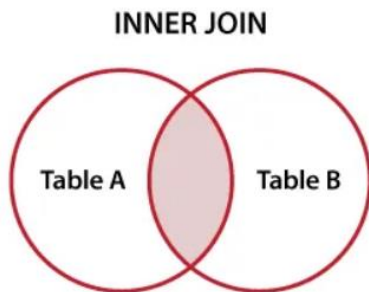
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## Visualizing SQL Join Types with Venn Diagrams, continued

Brave Heart	177	Action Adventure	1995	Paramount Pictures	R	Titanic	Leonardo DiCaprio	Kate Winslet
Casablanca	103	Drama	1942	MGM / UA	PG	Titanic	Leonardo DiCaprio	Kate Winslet
Christmas Vacation	97	Comedy	1989	Warner Brothers	PG13	Titanic	Leonardo DiCaprio	Kate Winslet
Coming to America	116	Comedy	1988	Paramount Pictures	R	Titanic	Leonardo DiCaprio	Kate Winslet
Dracula	130	Horror	1993	Columbia TriStar	R	Titanic	Leonardo DiCaprio	Kate Winslet
Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R	Titanic	Leonardo DiCaprio	Kate Winslet
Forrest Gump	142	Drama	1994	Paramount Pictures	PG13	Titanic	Leonardo DiCaprio	Kate Winslet
Ghost	127	Drama Romance	1990	Paramount Pictures	PG13	Titanic	Leonardo DiCaprio	Kate Winslet
Jaws	125	Action Adventure	1975	Universal Studios	PG	Titanic	Leonardo DiCaprio	Kate Winslet
Jurassic Park	127	Action	1993	Universal Pictures	PG13	Titanic	Leonardo DiCaprio	Kate Winslet
Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R	Titanic	Leonardo DiCaprio	Kate Winslet
Michael	106	Drama	1997	Warner Brothers	PG13	Titanic	Leonardo DiCaprio	Kate Winslet
National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG13	Titanic	Leonardo DiCaprio	Kate Winslet
Poltergeist	115	Horror	1982	MGM / UA	PG	Titanic	Leonardo DiCaprio	Kate Winslet
Rocky	120	Action Adventure	1976	MGM / UA	PG	Titanic	Leonardo DiCaprio	Kate Winslet
Scarface	170	Action Cops & Robber	1983	Universal Studios	R	Titanic	Leonardo DiCaprio	Kate Winslet
Silence of the Lambs	118	Drama Suspense	1991	Orion	R	Titanic	Leonardo DiCaprio	Kate Winslet
Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG	Titanic	Leonardo DiCaprio	Kate Winslet
The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG	Titanic	Leonardo DiCaprio	Kate Winslet
The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R	Titanic	Leonardo DiCaprio	Kate Winslet
The Wizard of Oz	101	Adventure	1939	MGM / UA	G	Titanic	Leonardo DiCaprio	Kate Winslet
Titanic	194	Drama Romance	1997	Paramount Pictures	PG13	Titanic	Leonardo DiCaprio	Kate Winslet

## Inner Join

An INNER JOIN joins (or merges) ONLY the matching rows in BOTH tables. Results are found in the overlapping area as shown in the Venn diagram.



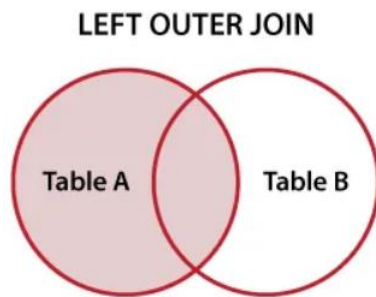
```
PROC SQL ;
SELECT *
FROM MYDATA.Movies M
INNER JOIN
MYDATA.Actors A
ON M.Title = A.Title ;
QUIT ;
```

## Results for Inner Join:

Title	Length	Category	Year	Studio	Rating	Title	Actor_Leading	Actor_Supporting
Brave Heart	177	Action Adventure	1995	Paramount Pictures	R	Brave Heart	Mel Gibson	Sophie Marceau
Christmas Vacation	97	Comedy	1989	Warner Brothers	PG-13	Christmas Vacation	Chevy Chase	Beverly D'Angelo
Coming to America	116	Comedy	1988	Paramount Pictures	R	Coming to America	Eddie Murphy	Arsenio Hall
Forrest Gump	142	Drama	1994	Paramount Pictures	PG-13	Forrest Gump	Tom Hanks	Sally Field
Ghost	127	Drama Romance	1990	Paramount Pictures	PG-13	Ghost	Patrick Swayze	Demi Moore
Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R	Lethal Weapon	Mel Gibson	Danny Glover
Michael	106	Drama	1997	Warner Brothers	PG-13	Michael	John Travolta	Andie MacDowell
National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG-13	National Lampoon's Vacation	Chevy Chase	Beverly D'Angelo
Rocky	120	Action Adventure	1976	MGM / UA	PG	Rocky	Sylvester Stallone	Talia Shire
Silence of the Lambs	118	Drama Suspense	1991	Orion	R	Silence of the Lambs	Anthony Hopkins	Jodie Foster
The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG	The Hunt for Red October	Sean Connery	Alec Baldwin
The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R	The Terminator	Arnold Schwarzenegger	Michael Biehn
Titanic	194	Drama Romance	1997	Paramount Pictures	PG-13	Titanic	Leonardo DiCaprio	Kate Winslet

## Left Outer Join

A LEFT OUTER JOIN returns all rows from the left table (Table A) with the matching rows from the right table (Table B) or *null* as shown in the Venn diagram.



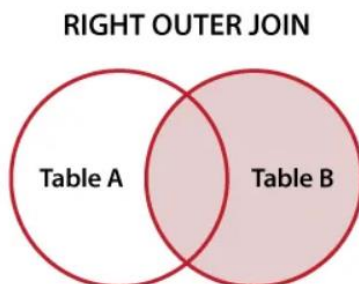
```
PROC SQL ;
SELECT *
FROM MYDATA.Movies M
LEFT JOIN
MYDATA.Actors A
ON M.Title = A.Title ;
QUIT ;
```

### Results for Left Outer Join:

Title	Length	Category	Year	Studio	Rating	Title	Actor_Leading	Actor_Supporting
Brave Heart	177	Action Adventure	1995	Paramount Pictures	R	Brave Heart	Mel Gibson	Sophie Marceau
Casablanca	103	Drama	1942	MGM / UA	PG			
Christmas Vacation	97	Comedy	1989	Warner Brothers	PG-13	Christmas Vacation	Chevy Chase	Beverly D'Angelo
Coming to America	116	Comedy	1988	Paramount Pictures	R	Coming to America	Eddie Murphy	Arsenio Hall
Dracula	130	Horror	1993	Columbia TriStar	R			
Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R			
Forrest Gump	142	Drama	1994	Paramount Pictures	PG-13	Forrest Gump	Tom Hanks	Sally Field
Ghost	127	Drama Romance	1990	Paramount Pictures	PG-13	Ghost	Patrick Swayze	Demi Moore
Jaws	125	Action Adventure	1975	Universal Studios	PG			
Jurassic Park	127	Action	1993	Universal Pictures	PG-13			
Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R	Lethal Weapon	Mel Gibson	Danny Glover
Michael	106	Drama	1997	Warner Brothers	PG-13	Michael	John Travolta	Andie MacDowell
National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG-13	National Lampoon's Vacation	Chevy Chase	Beverly D'Angelo
Poltergeist	115	Horror	1982	MGM / UA	PG			
Rocky	120	Action Adventure	1976	MGM / UA	PG	Rocky	Sylvester Stallone	Talia Shire
Scarface	170	Action Cops & Robber	1983	Universal Studios	R			
Silence of the Lambs	118	Drama Suspense	1991	Orion	R	Silence of the Lambs	Anthony Hopkins	Jodie Foster
Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG			
The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG	The Hunt for Red October	Sean Connery	Alec Baldwin
The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R	The Terminator	Arnold Schwarzenegger	Michael Biehn
The Wizard of Oz	101	Adventure	1939	MGM / UA	G			
Titanic	194	Drama Romance	1997	Paramount Pictures	PG-13	Titanic	Leonardo DiCaprio	Kate Winslet

## Right Outer Join

A RIGHT OUTER JOIN returns all rows from the right table (Table B) with the matching rows from the left table (Table A) or *null* as shown in the Venn diagram.



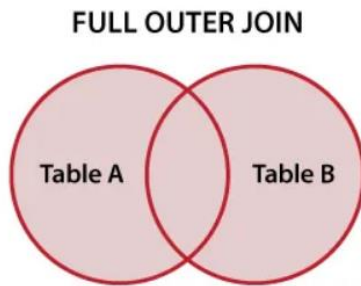
```
PROC SQL ;
SELECT *
FROM MYDATA.Movies M
RIGHT JOIN
MYDATA.Actors A
ON M.Title = A.Title ;
QUIT ;
```

**Results for Right Outer Join:**

Title	Length	Category	Year	Studio	Rating	Title	Actor_Leading	Actor_Supporting
Brave Heart	177	Action Adventure	1995	Paramount Pictures	R	Brave Heart	Mel Gibson	Sophie Marceau
Christmas Vacation	97	Comedy	1989	Warner Brothers	PG-13	Christmas Vacation	Chevy Chase	Beverly D'Angelo
Coming to America	116	Comedy	1988	Paramount Pictures	R	Coming to America	Eddie Murphy	Arsenio Hall
Forrest Gump	142	Drama	1994	Paramount Pictures	PG-13	Forrest Gump	Tom Hanks	Sally Field
Ghost	127	Drama Romance	1990	Paramount Pictures	PG-13	Ghost	Patrick Swayze	Demi Moore
Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R	Lethal Weapon	Mel Gibson	Danny Glover
Michael	106	Drama	1997	Warner Brothers	PG-13	Michael	John Travolta	Andie MacDowell
National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG-13	National Lampoon's Vacation	Chevy Chase	Beverly D'Angelo
Rocky	120	Action Adventure	1976	MGM / UA	PG	Rocky	Sylvester Stallone	Talia Shire
Silence of the Lambs	118	Drama Suspense	1991	Orion	R	Silence of the Lambs	Anthony Hopkins	Jodie Foster
The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG	The Hunt for Red October	Sean Connery	Alec Baldwin
The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R	The Terminator	Arnold Schwarzenegger	Michael Biehn
Titanic	194	Drama Romance	1997	Paramount Pictures	PG-13	Titanic	Leonardo DiCaprio	Kate Winslet

**Full Outer Join**

A FULL OUTER JOIN returns matched and unmatched rows from both tables (it's essentially a union of both tables) as shown in the Venn diagram.



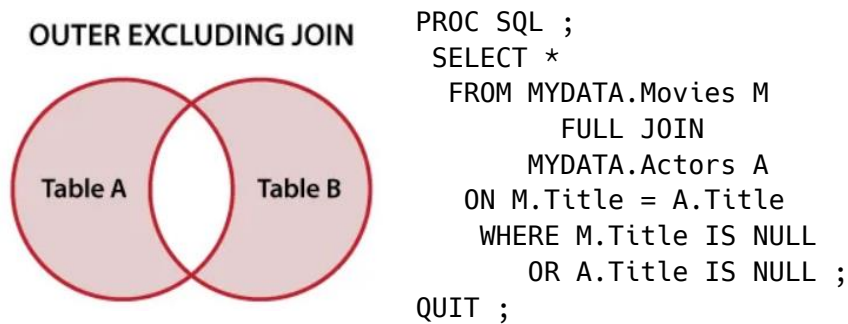
```
PROC SQL ;
SELECT *
FROM MYDATA.Movies M
FULL JOIN
MYDATA.Actors A
ON M.Title = A.Title ;
QUIT ;
```

**Results for Full Outer Join:**

Title	Length	Category	Year	Studio	Rating	Title	Actor_Leading	Actor_Supporting
Brave Heart	177	Action Adventure	1995	Paramount Pictures	R	Brave Heart	Mel Gibson	Sophie Marceau
Casablanca	103	Drama	1942	MGM / UA	PG			
Christmas Vacation	97	Comedy	1989	Warner Brothers	PG-13	Christmas Vacation	Chevy Chase	Beverly D'Angelo
Coming to America	116	Comedy	1988	Paramount Pictures	R	Coming to America	Eddie Murphy	Arsenio Hall
Dracula	130	Horror	1993	Columbia TriStar	R			
Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R			
Forrest Gump	142	Drama	1994	Paramount Pictures	PG-13	Forrest Gump	Tom Hanks	Sally Field
Ghost	127	Drama Romance	1990	Paramount Pictures	PG-13	Ghost	Patrick Swayze	Demi Moore
Jaws	125	Action Adventure	1975	Universal Studios	PG			
Jurassic Park	127	Action	1993	Universal Pictures	PG-13			
Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R	Lethal Weapon	Mel Gibson	Danny Glover
Michael	106	Drama	1997	Warner Brothers	PG-13	Michael	John Travolta	Andie MacDowell
National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG-13	National Lampoon's Vacation	Chevy Chase	Beverly D'Angelo
Poltergeist	115	Horror	1982	MGM / UA	PG			
Rocky	120	Action Adventure	1976	MGM / UA	PG	Rocky	Sylvester Stallone	Talia Shire
Scarface	170	Action Cops & Robber	1983	Universal Studios	R			
Silence of the Lambs	118	Drama Suspense	1991	Orion	R	Silence of the Lambs	Anthony Hopkins	Jodie Foster
Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG			
The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG	The Hunt for Red October	Sean Connery	Alec Baldwin
The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R	The Terminator	Arnold Schwarzenegger	Michael Biehn
The Wizard of Oz	101	Adventure	1939	MGM / UA	G			
Titanic	194	Drama Romance	1997	Paramount Pictures	PG-13	Titanic	Leonardo DiCaprio	Kate Winslet

## Outer Excluding Join

An OUTER EXCLUDING JOIN returns all rows in Table A and all rows in Table B that don't match as shown in the Venn diagram.

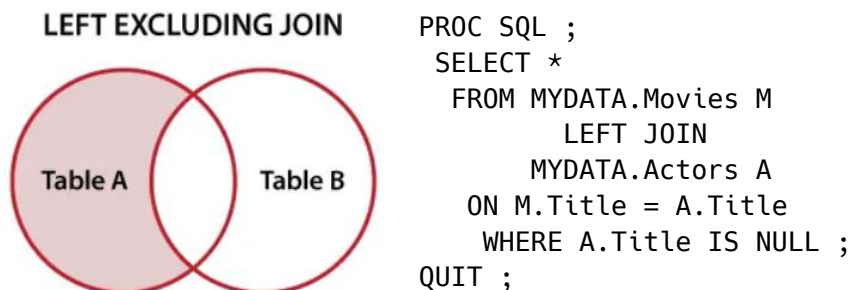


### Results for Outer Excluding Join:

Title	Length	Category	Year	Studio	Rating	Title	Actor_Leading	Actor_Supporting
Casablanca	103	Drama	1942	MGM / UA	PG			
Dracula	130	Horror	1993	Columbia TriStar	R			
Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R			
Jaws	125	Action Adventure	1975	Universal Studios	PG			
Jurassic Park	127	Action	1993	Universal Pictures	PG-13			
Poltergeist	115	Horror	1982	MGM / UA	PG			
Scarface	170	Action Cops & Robber	1983	Universal Studios	R			
Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG			
The Wizard of Oz	101	Adventure	1939	MGM / UA	G			

## Left Excluding Join

A LEFT EXCLUDING JOIN returns all rows in Table A that don't match any rows in Table B as shown in the Venn diagram.



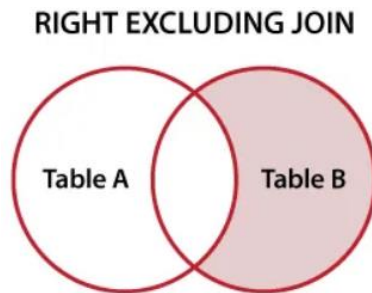


### Results for Left Excluding Join:

Title	Length	Category	Year	Studio	Rating	Title	Actor_Leading	Actor_Supporting
Casablanca	103	Drama	1942	MGM / UA	PG			
Dracula	130	Horror	1993	Columbia TriStar	R			
Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R			
Jaws	125	Action Adventure	1975	Universal Studios	PG			
Jurassic Park	127	Action	1993	Universal Pictures	PG-13			
Poltergeist	115	Horror	1982	MGM / UA	PG			
Scarface	170	Action Cops & Robber	1983	Universal Studios	R			
Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG			
The Wizard of Oz	101	Adventure	1939	MGM / UA	G			

### Right Excluding Join

A RIGHT EXCLUDING JOIN returns all rows in Table B that don't match any rows in Table A as shown in the Venn diagram.



```
PROC SQL ;
SELECT *
FROM MYDATA.Movies M
RIGHT JOIN
MYDATA.Actors A
ON M.Title = A.Title
WHERE M.Title IS NULL ;
QUIT ;
```

### Results for Right Excluding Join:

NOTE: No rows were selected.

### Conclusion

The objective of this paper was to illustrate the various types of join constructs with the relational model. The SQL procedure enables users to join tables of information quickly and easily. Linking one piece of information with another piece of information is made possible when at least one column is common to each table. Details about the join types were described including the importance of joins, the difference between the various join types (inner and outer), the creation of outer (left, right, and full) joins, the importance of the WHERE / ON clause(s) in creating and subsetting rows of data, the purpose of creating and using table aliases to minimize the number of keystrokes, and the application of set operators.

## References

Lafler, Kirk Paul (2025). "Visualizing SQL Join Types with Venn Diagrams," Proceedings of the 2025 Nebraska SAS Users Group (NebraskaSUG) Conference.

Lafler, Kirk Paul (2025). "Under the Hood: The Mechanics of SQL Query Optimization Techniques," Proceedings of the 2025 Iowa SAS Users Group (IowaSUG) Conference.

Lafler, Kirk Paul (2019). *PROC SQL: Beyond the Basics Using SAS, Third Edition*, SAS Institute Inc., Cary, NC, USA.

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## About the Author

**Kirk Paul Lafler** is a data scientist, consultant, developer, programmer, educator, and author who teaches Statistics, SAS Programming, and Data Management in the Department of Statistics at San Diego State University. Kirk also delivers project-based consulting and programming services to organizations across healthcare, life sciences, business, and other industries. As an experienced instructor, he teaches both *virtual* and *in-person* courses in SAS, SQL, Python, R, Database Management Systems (Oracle, SQL Server, Teradata, MySQL, MongoDB, PostgreSQL, AWS), Excel, cloud technologies, and other tools.

Kirk currently serves on the Western Users of SAS Software (WUSS) Executive Committee as the Open-Source Advocate and Coordinator, and he is actively engaged with multiple proprietary and open-source user groups and conference committees. As the author of several books, including the widely acclaimed *PROC SQL: Beyond the Basics Using SAS, Third Edition (SAS Press, 2019)*, Kirk is an invited speaker who has inspired audiences worldwide, educator, keynote, mentor, and is the proud recipient of 29 "Best" contributed paper, hands-on workshop, and poster awards.

Comments and suggestions are encouraged and can be sent to:

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