# About SetManipulator

SetManipulator is a command-line program that allows composers and analysts to work with pitches and pitch-classes. Everything this program does can be calculated manually on paper, but the process is tedious for everyone and onerous to most (or all) who wish to learn it. With this program, you can work with speed and accuracy; the time saved enables you to analyze more music or introduce more rigorous pitch relationships into compositions. There are a variety of standard nomenclatures and practices in the world of contemporary music theory. This program follows the conventions of Robert Morris's *Composition with Pitch Classes*, including the prime form calculation strategy (which differs slightly from Forte's). Also, this program refers to all row forms by the TTOs used to produce the form. Therefore, transpositions are notated as T*n* rather than P*n*, and so forth.

Here is a list of features currently available:

- Unordered pcsets
  - Set-class prime forms, Forte names, Carter names, interval-class vectors, and subsets. Pcsets can range in size from 0 to 12 elements, rather than being limited to 3-9 elements.
  - Transformations: transposition, inversion, and multiplication. Note that multiplication does not necessarily produce a pcset from the same set-class.
  - Set-class complexes K and Kh from Forte
  - Search set transformations T and I for provided pcs
  - Calculate the interval angle between pcsets. This is a similarity measure.
- Ordered pcsets
  - Transformations: transposition, inversion, multiplication, retrogression, and rotation
  - Twelve-tone matrices
  - Interval order list

- Unordered and ordered psets

  - Transformations: transposition, inversion, multiplication, retrogression, and rotation

# How to Get SetManipulator

You can download SetManipulator here: https://jeffreymartincomposer.com/software/

SetManipulator runs on Windows, MacOS, and Linux.

# Command List

Commands are displayed in verbose form, followed by a short form in parentheses. Obviously, a user will prefer the short form for efficiency. If you use a command that is unavailable, the program will display an error message. (For example, you cannot display an interval-class vector for an ordered pcseg, or a twelve-tone matrix for an unordered pcset.)

Pitch classes are displayed in integer notation (0123456789AB). While the program always displays A and B in uppercase, pitch-class input is not case-sensitive. Pitches are displayed as integers, where middle C is 0, pitches below middle C are negative, and pitches above middle C are positive. When entering pitch-classes, individual pcs should not be separated by space or comma. When entering pitches, individual pitches should be separated by a comma and no space. For example, `59B` is a pc-string and `-5,0,10,15` is a p-string.

When working with unordered pitch-class collections, pcsets do not need to be in the prime form for their set-classes. However, all transformations are performed on the current pcset. If you want all transformations to be relative to the prime form of a set-class, you will need to load a prime form either by entering it manually using the `Load` command, or automatically using the `Load Prime` command.

Commands marked with a * may be followed by a pc-string or p-string. The only commands that change the collection currently in memory are the Load commands; therefore, a command like `info 015` will not change the set that is currently being stored.

## Commands for All Collections

`*Info (N)`                Displays the current collection.

`*Load (L)`                Input new collection.

`*Search (H)`              Input pitches or pitch-classes to find all transformations that produce a collection with the provided pitches or pitch-classes. Order only matters for pcsegs and psegs. If you include a pitch (or pitches) after the "Search" command, it will search for the provided input. Otherwise, you will enter continuous search mode, where you can perform multiple searches – type 'q' to quit.

## Commands for Csegs

`*Matrix (MX)`             Display COM matrix. If no parameters are provided, the COM matrix will compare the current cseg with itself. If one parameter is provided, that cseg will be compared with the current cseg. If two parameters are provided, those two csegs will be compared with each other.

`*Load Prime (LP)`         Convert current cseg to cseg-class prime form. If you include pitches after the LP command, the LP command loads a new cseg and converts it to the prime form of its cseg-class.

## Commands for Ordered Collections

`*Complement (C)`          Display complement (pcsegs only). Complements are provided as unordered pcsets.

`*Intervals (INT)`         Displays the interval sequence of the collection. This command may be followed by a transformation name to get the interval sequence of that transformation.

`*Subsegs (S)`             Display all subsegs of the current collection.

## Commands for Pcsets

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|---|---|
| *Angle | Calculate the angle[1] between two pcsets. You can provide the two pcsets after the `Angle` command, separated by a space. Otherwise, you will be prompted to enter the pcsets. |
| Calculate (CC) | A continuous search mode for pcset-class prime forms. This feature is useful if you are not sure how to organize pitch-classes for analysis. Type 'q' to quit. The last pcset entered is stored in memory. |
| *Complement (C) | Display complement. |
| Complement Prime (CP) | Display complement set-class in prime form. |
| *K | Display set-class complex K. |
| *Kh | Display set-class complex Kh. |
| *Info (N) | For all pcsets, this command displays the prime form, Forte name, Carter name, interval-class vector, complement prime form, and Z-relation prime form (if any). |
| *Intersect Max (IX) | Displays the intersection of two sets. Rather than merely intersecting both sets, the second set will be transposed and/or inverted to create the largest intersection possible. |
| *Interval-Class Vector (ICV) | Display interval-class vector for current set. |

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[1] Damon Scott and Eric J. Isaacson, "The Interval Angle: A Similarity Measure for Pitch-Class Sets," *Perspectives of New Music* 36:2 (Summer, 1998), 107-142.

`*Load Prime (LP)`    Convert current pcset to set-class prime form. If you include pitches after the LP command, the LP command loads a new set and converts it to the prime form of its set-class. For example, LP 83B9 loads set-class (0137), one of the two all-interval tetrachord set-classes.

`*Subsets Prime (SP)`    Display the prime form of each set-class contained as a subset of the current pcset, along with the number of occurrences of each set-class.

`*Union Compact (UC)`    Displays the union of two sets. Rather than merely combining both sets, the second set will be transposed and/or inverted to create the most compact union possible.

`*Z-Relation (Z)`    Display Z-related set-class in prime form.

## Commands for Twelve-Pc Rows

`Load Random (LR)`    Loads a random twelve-tone pcseg (row).

`Load Random AIR (LAIR)`    Loads a random all-interval twelve-tone row.

`Matrix (MX)`    Display matrix of twelve-tone row.

## Commands for Unordered Collections

`*Intersect (IN)`    Displays the intersection of two sets. If only one set is provided with the command, that set is intersected with the current set. If two sets are provided, those two are intersected. If no sets are provided, you will be prompted to enter two sets to intersect.

`*Subsets (S)`    Display all subsets of the current collection.

`*Union (U)`                       Displays the union of two sets. If only one set is provided with the command, that set is combined with the current set. If two sets are provided, those two are combined. If no sets are provided, you will be prompted to enter two sets to combine.

## General Commands

`Mode C`                           Enter contour mode, for working with c-pitches. Contour mode automatically enables ordered mode as well.

`Mode F`                            Prefer Forte names for pc set-classes

`Mode N`                            Prefer prime form names for pc set-classes. The program defaults to this mode on startup.

`Mode O`                            Enter ordered mode.

`Mode P`                            Enter pitch mode.

`Mode PC`                           Enter pitch-class mode. The program defaults to this mode on startup.

`Mode U`                            Enter unordered mode. The program defaults to this mode on startup.

`Quit (Q)`                          Exit the program.

# Transformations (case-sensitive)

Transformations may be performed together as a command string. The last transformation in the string will be performed first, then the next-to-last transformation, and so forth. You must include an integer with the M and T transformations. M is not automatically interpreted as M5. For example, the transformation string `M7T9I` first inverts the collection, then transposes it by 9, and finally multiplies it by 7. If the collection is unordered, the result of the transformation will be displayed in sorted order. Also note that all transformations are performed mod 12. Therefore, `T85` produces the same result as `T1`. Transpositions of pcsets are performed on the provided set – if you intend to transform relative to the prime form of a set-class, you must load a prime form. Negative numbers are not supported.

Multiple transformation strings may be performed simultaneously. For example, if you enter `T5M5I   IM7T5I` at the prompt, both transformation strings will be evaluated individually, and the results will be displayed in a list. This is useful if you wish to compare the results of different transformation strings.

You can also provide a specific collection as the final item in a list of transformation strings. For example, `T5M5I   08A1` transforms `08A1` by `T5M5I`. If you are in unordered pc-mode, `08A1` will be evaluated as a pcset. In ordered pc-mode, `08A1` will be evaluated as a pcseg, and so forth. This feature makes it possible to transform subsidiary collections without changing what is currently stored in memory.

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|---|---|
| I | Invert (same as M11). This is a TTO. |
| M$n$[2] | Multiply. This is a TTO if the multiplier is 1, 5, 7, or 11. |
| R | Retrograde (ordered collections only) |
| r$n$ | Rotate (ordered collections only) |
| T$n$ | Transpose. This is a TTO. |

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[2] $n$ always refers to some integer.

# Bibliography

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