



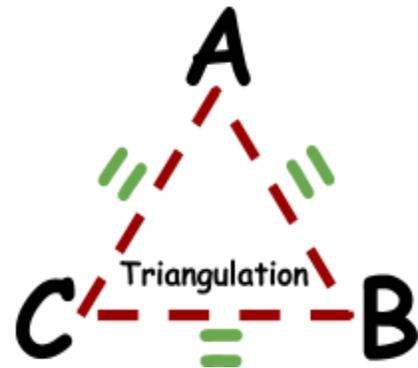
DNA Match Triangulation

What is DNA Match Triangulation?

Triangulation is a genetic genealogy process where three people (or more) are matched to each other at the same segment location. This indicates that all three inherited that portion of DNA from a common ancestor.

Just matching two people is not enough. Since you have pairs of chromosomes, you may match one person through your father and one person through your mother, hence no common ancestor. If you match two people on a segment of DNA and those two people also match each other, then the segment must be on either your paternal chromosome or your maternal chromosome.

A=B, B=C, C=A in the same place. Creating a DNA Triangulation Table to keep track of matches and group into common ancestor. Need list of matching segments (GEDmatch, 23andMe, MyHeritage, Family Tree DNA). Use the oldest direct relative you have to create the initial match table (they will have higher % shared with common matches, which will make triangulation easier).



Why use DNA Match Triangulation?

Confirm Paper Documentation - DNA is a record of relationships. It can be used as evidence like other genealogical records.

Identify Parent/Grandparent that Unknown Cousin is Related Through - Most of our matches start out as unknown how they are related to us. By using triangulation with known relatives, we can put matches into certain ancestral lines and focus our search for a common ancestor.

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DNA Match Triangulation



Creating DNA Match Triangulation Table with GEDmatch

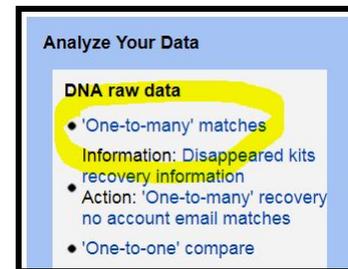
Use the following steps to

1. Sign in to website: <http://www.gedmatch.com>

This process goes through using the free tools to create a triangulation table. There is a paid Tier 1 utility called Triangulation which can be used.

2. Use the 'One-to-Many' tool to find a list of all of your matches (or the matches of another kit you manage - this will be the primary kit)

Typically, I choose the oldest relative (grandparent, parent, aunt, etc.) that I manage kits for. This is because they will share larger segments of DNA with matches and all of my matches will be in my parents match list or my grandparents match list.

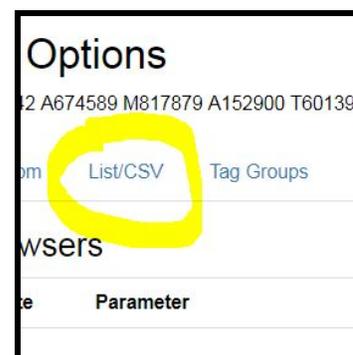


3. Click on several kits (up to 100) in the Select column that you want to examine matching segments and then click on the "Submit" button near the top of the page

The more matches you choose, the longer creating the table will take, but also the more triangulation groups you will develop. I try to exclude any close relatives (2nd cousins or closer) to decrease the overall size of my match list. This usually excludes everyone you share 175 cM or more with. Also, try to avoid duplicate individuals, people may have tested with multiple companies and have their kits uploaded, you only need to compare one kit per individual.

4. In the GEDmatch Visualization Options, click on the List/CSV tab, then click on Segment CSV File

This file will take a couple of minutes to create depending on how many matching segments you have.



5. Click the "HERE" link to download your match file

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Downloads are usually downloaded to the “Downloads” folder, but you may select where you want it downloaded.

6. Open downloaded CSV file in a spreadsheet program (Excel, Google Sheets, etc.)

Once opened, make sure the information was translated correctly. There should be columns with the kit number, name, chromosome, start location, end location, etc. Each of these lines is a segment that matches between the two people listed.

7. Remove duplicate lines using formula =countif(A\$2:A2,D2)

kit1	name1	email1	kit2	name2	email2	chr	start	end	cm
H373499	Paul Smith	paul@google.com	T936514	*Alice C76	alice@google.com	1	72017	22371352	47.9
T936514	*Alice C76	alice@google.com	H373499	Paul Ward	paul@google.com	1	72017	22371352	47.9
A982374	Patricia Jones	patricia@google.com	M533466	Karen Gomez	karen@google.com	1	72017	247178204	281.5
M533466	Karen Gomez	karen@google.com	A982374	Patricia Jones	patricia@google.com	1	72017	247178204	281.5

For each segment match there will be two lines, one with Person A as kit1 and one with Person B as kit1. These duplicates can be found and quickly removed using a formula.

8. Add columns for simplified location and round to nearest million

Having just a few digits will make it easier to visually see which segments match

9. Highlight all primary segments and change the background color

This will make it easier to identify potential triangulation groups after sorting

10. Sort spreadsheet by Chromosome Number, Start position, and End Position

11. All segments on a chromosome of the following type can be deleted:

- a. the primary kit has zero or only one matching segment on a chromosome
- b. the primary kit does not have any overlapping segments
- c. segments which end before the primary kit segment starts
- d. segments which begin after the primary kit ends
- e. segments which do not overlap any of the primary segments

a and **b** can be done with all 22 chromosomes initially. **c**, **d**, and **e** are easier to do with individual chromosome segment analysis. Individual chromosome analysis usually starts at 22 and works back to 1 because there are usually fewer matches on the smaller chromosomes.

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12. For each chromosome, identify triangulation groups using following rules:
- The primary kit must match at least two secondary kits across the same segment
 - The two kits must also match each other over the same segment
 - For more than two secondary kits, all kits must match each other

For 3 kit triangulation, you should have 3 segment lines. For 4 kit triangulation, you should have 6 lines. For 5 kit triangulation, you should have 10 lines. Etc.

13. If it triangulates, label with a group marker. If it doesn't triangulate, delete the segments.

kit1	name1	email1	kit2	name2	email2	chr	start	end	cm
T351172	David	david@google.com	H362341	Tricia	tricia@google.com	18	44393546	53292132	9.4
A163514	Bob	bob@google.com	T351172	David	david@google.com	18	44708046	58154336	17.6
A163514	Bob	bob@google.com	H362341	Tricia	tricia@google.com	18	44754451	52915412	8.4

14. Compare triangulation groups to close relatives (2nd cousins or closer) and known distant relatives to identify potential ancestral lines.

Triangulation groups can then be researched individually using other techniques. Some matches may have GEDmatch files or you may be able to find family trees on their parent database (Ancestry, 23andMe, Family Tree DNA). For larger Triangulation groups, DNA Treebuilding can be attempted if there is a significant amount of shared DNA between people.

Creating DNA Match Triangulation Table with 23andMe, MyHeritage or Family Tree DNA

A similar process can be done with the matching segment data from other websites, however, they only provide you with the segments you match. You do not get your matches matches which you need to complete triangulation. Individual matches can be compared with the 23andMe and MyHeritage chromosome browser to complete triangulation, but this will be time consuming. Family Tree does not have a triangulation tool so you would need to contact matches to gather more information to complete a triangulation table. Ancestry does not have segment data downloads so no triangulation can be done.

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