



ISSN NO. 2320-5407

*Journal homepage: <http://www.journalijar.com>*  
*Journal DOI: [10.21474/IJAR01](https://doi.org/10.21474/IJAR01)*

**INTERNATIONAL JOURNAL  
OF ADVANCED RESEARCH**

## RESEARCH ARTICLE

### STATISTICAL STUDY OF SOME GROUPS OF GALAXIES

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#### **Manuscript Info**

##### **Manuscript History:**

Received: 18 February 2016  
 Final Accepted: 26 March 2016  
 Published Online: April 2016

##### **Key words:**

galaxies, groups, catalog, cluster analysis.

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#### **Abstract**

In this paper, we apply a clustering technique on de Carvalho et al. catalog of compact groups of galaxies (2005) to test the physical reality of each group. The method is applied on the groups that contain five members only to classify the relation between each two galaxies in the same group and if they belong to the group or not.

The results showed that most of the members are real members in groups while some groups (36 groups) contain one or more attribute discordant galaxies and 20 groups contain 2 sub-groups.

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#### **Introduction:-**

The majority of the galaxies in the universe tend to aggregate in groups (Tully 1987). Groups of galaxies range from loose groups to compact groups. The loose groups of galaxies contain less number of galaxies than clusters. The compact groups of galaxies are so dense with separation distances of a galaxy's diameter. The first observed compact groups were Stephan's Quintet (1877) and Seyfert's Sextet (1948).

Searching for compact groups has been started by Shakhbazyan in 1973, after she has found a group of 17 faint red objects which were thought to be a cluster of stars (Shakhbazyan 1957). The first systematic search for compact groups of galaxies was held by Rose (1977) by setting criteria that the number of galaxies is 3 or more with a total surface equals or brighter than 17.5 mag arcsec<sup>-2</sup>. He has found a total number of 205 compact groups of galaxies. The second systematic search was held by Hickson (1982) after adopting different criteria that the number of galaxies is 3 or more with 3 mag difference from the brightest member, the total surface brightness is equal to or brighter than 26.0 mag arcsec<sup>-2</sup> and the isolation criterion by setting a large circle that is 3 times a small circle passing through the centers of the galaxies in the group to isolate the members of the same group from the field. He has found 100 compact groups of galaxies (HCGs). Studies on HCGs showed that 8 groups have galaxies with a discordant redshift (Hickson et al. 1992).

Other searching techniques were introduced using different criteria (Prandoni et al. 1992, Garcia et al. 1995, Barton et al. 1996, Iovino et al. 1999, Allam & Tucker 2000, Lee et al. 2000, Focardi & Kelm 2002, de Carvalho et al. 2005, Deng et al. 2007, McConnachie et al. 2009 and Diaz-Gimenez et al. 2012).

The paper is organized as follows: section 2 describes the data used and method while section 3 describes the results obtained and discussion.

## Data and Method:-

### The Data:-

In 2005, de Carvalho et al. searched the Digitalized Palomar Observatory sky survey (DPOSS) for compact groups of galaxies, within an area of 6260 deg. sq. including the northern and a part of the southern sky. They adopted the following criteria:

1.  $N \geq 4$  with magnitude difference  $\leq 2$
2.  $R_{\text{isol}} \geq 3R_{\text{gr}}$
3.  $\mu_{gr} < 24.0 \text{ mag arcsec}^{-2}$
4.  $|b| > 40^\circ$  to avoid stars contamination

Where  $N$  is the number of galaxies in a group,  $R_{\text{gr}}$  is the angular diameter of the smallest circle,  $R_{\text{isol}}$  is the angular diameter of the greatest circle,  $\mu_{gr}$  is the mean surface brightness in the r band and  $b$  is the galactic latitude.

They found a total of 459 groups of galaxies with 4 or more members.

### The Method:-

We applied the clustering technique which we choose because of its simplicity and direct calculations on the groups that contain 5 members from de Carvalho et al catalog (2005). Before we start, we assume that galaxies in the same group are not connected and we try to find if their physical attributes will show any similarity.

Galaxies in the same group are supposed to have similar properties that connect them together. The method uses the physical attributes of the galaxies in each group to test the relation between all galaxies in the same group and knowing if galaxies are real member or should be discarded from the group. By calculating the astrophysical Euclidean separation coefficient between each two galaxies, one can find the similarities and dissimilarities between the galaxies.

We use a Hierarchical clustering method which is UPGMA (Unweighted Pair Group Method using Arithmetic Average) method, Romesburg (1984). The UPGMA method is an Agglomerative clustering that starts with galaxies as being individual clusters and merges galaxies with similar attributes by averaging similarities of each two galaxies and forms a tree-like structure in a bottom-up way which can be cut off at any level.

The method starts with a data matrix which contains the galaxies in one column and their attributes that we think show similarities if the galaxies are from the same group in one row. The second step is to build the resemblance matrix by using a clustering method and calculating the resemblance coefficient to find if there is a similarity or dissimilarity between different galaxies' attributes.

We then calculate the resemblance coefficient to obtain the value of dissimilarities between each two galaxies. The larger value of the Euclidean coefficient, the more dissimilar are the galaxies that means that they don't belong to the same group, and the smaller the value, the more similar and connected are the galaxies which concludes that they lie in the same group.

The astrophysical Euclidean coefficient for  $n$  attributes is calculated as:

$$e_{jk} = \sqrt{\sum_{i=1}^n (X_{ij} - X_{ik})^2}$$

Where  $j$  and  $k$  are two galaxies and  $i$  is the attribute.

Calculating the average Euclidean coefficient as:

$$e_{av} = \frac{\sum e_i}{N}$$

With the following criteria used by Sabry et al. (2009) and Sabry et al. (2012), one can define the separation between each two galaxies:

1. If  $e_{jk} < e_{av} - \sigma$

The galaxies are regarded as a Twin (T)

2. If  $e_{jk} < e_{av}$

The galaxies are regarded as a Pair (P)

3. If  $e_{av} \leq e_{jk} \leq e_{av} + \sigma$

The galaxies are regarded as a Member (M)

4. If  $e_{jk} > e_{av} + \sigma$

The galaxies have a discordant attribute and are regarded as an Attribute Discordant (AD)

We calculated the astrophysical Euclidean coefficient of each two members in the same group using the total magnitude of the group in the r band and the g-r color index.

### Results:-

The following tables show the results as follows:

Column (1): the galaxy symbol (G), column (2): the total magnitude of the first galaxy in the r band, column (3): the total magnitude of the second galaxy in the r band, column (4): the g-r color index of the first galaxy, column (5): the g-r color index of the second galaxy, column (6): the Astrophysical Euclidean coefficient between every 2 galaxies in the group, column (7): the average astrophysical Euclidean coefficient in each group, column (8): the standard deviation in each group, column (9): the classification of every two galaxies regarding each other and column (10): the comments.

Group 085756+383340									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.601	16.791	0.016	0.558	0.574338	0.713594	0.319102	P	G <sub>12</sub> make a pair.
G <sub>13</sub>	16.601	17.223	0.016	0.303	0.68502			P	G <sub>13</sub> make a pair.
G <sub>14</sub>	16.601	17.377	0.016	0.195	0.796377			M	G <sub>23</sub> make a pair.
G <sub>15</sub>	16.601	17.898	0.016	0.381	1.34738			AD	G <sub>24</sub> make a pair.
G <sub>23</sub>	16.791	17.223	0.558	0.303	0.501646			P	G <sub>34</sub> make a twin.
G <sub>24</sub>	16.791	17.377	0.558	0.195	0.689322			P	G <sub>35</sub> make a pair.
G <sub>25</sub>	16.791	17.898	0.558	0.381	1.121061			AD	G <sub>45</sub> make a pair.
G <sub>34</sub>	17.223	17.377	0.303	0.195	0.188096			T	
G <sub>35</sub>	17.223	17.898	0.303	0.381	0.679492			P	
G <sub>45</sub>	17.377	17.898	0.195	0.381	0.553206			P	
Group 091524+213038									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.941	17.717	0.622	0.313	0.835259	0.519267	0.348545	M	G <sub>23</sub> make a pair.
G <sub>13</sub>	16.941	17.751	0.622	0.539	0.814241			M	G <sub>24</sub> make a pair.
G <sub>14</sub>	16.941	17.806	0.622	0.529	0.869985			AD	G <sub>25</sub> make a pair.
G <sub>15</sub>	16.941	17.952	0.622	0.183	1.102199			AD	G <sub>34</sub> make a twin.
G <sub>23</sub>	17.717	17.751	0.313	0.539	0.228543			P	G <sub>35</sub> make a pair.
G <sub>24</sub>	17.717	17.806	0.313	0.529	0.233617			P	G <sub>45</sub> make a pair.
G <sub>25</sub>	17.717	17.952	0.313	0.183	0.268561			P	G <sub>1</sub> may have a discordant attribute.
G <sub>34</sub>	17.751	17.806	0.539	0.529	0.055902			T	
G <sub>35</sub>	17.751	17.952	0.539	0.183	0.408824			P	
G <sub>45</sub>	17.806	17.952	0.529	0.183	0.375542			P	

Group 092831+634736									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.639	16.85	0.464	0.605	0.253775	0.504881	0.251499	P	G <sub>12</sub> make a pair.
G <sub>13</sub>	16.639	16.979	0.464	0.642	0.383776			P	G <sub>13</sub> make a pair.
G <sub>14</sub>	16.639	17.278	0.464	0.437	0.63957			M	G <sub>23</sub> make a twin.
G <sub>15</sub>	16.639	17.616	0.464	0.375	0.981045			AD	G <sub>24</sub> make a pair.
G <sub>23</sub>	16.85	16.979	0.605	0.642	0.134201			T	G <sub>34</sub> make a pair.
G <sub>24</sub>	16.85	17.278	0.605	0.437	0.459791			P	G <sub>45</sub> make a pair.
G <sub>25</sub>	16.85	17.616	0.605	0.375	0.799785			AD	
G <sub>34</sub>	16.979	17.278	0.642	0.437	0.362527			P	
G <sub>35</sub>	16.979	17.616	0.642	0.375	0.690694			AD	
G <sub>45</sub>	17.278	17.616	0.437	0.375	0.343639			P	
Group 094316+392308									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.98	18.002	0.393	-0.025	1.104178	0.747002	0.407185	M	G <sub>23</sub> make a pair.
G <sub>13</sub>	16.98	18.061	0.393	0.543	1.091357			M	G <sub>24</sub> make a pair.
G <sub>14</sub>	16.98	18.201	0.393	0.408	1.221092			AD	G <sub>25</sub> make a pair.
G <sub>15</sub>	16.98	18.382	0.393	0.055	1.442168			AD	G <sub>34</sub> make a twin.
G <sub>23</sub>	18.002	18.061	-0.025	0.543	0.571056			P	G <sub>35</sub> make a pair.
G <sub>24</sub>	18.002	18.201	-0.025	0.408	0.47654			P	G <sub>45</sub> make a pair.
G <sub>25</sub>	18.002	18.382	-0.025	0.055	0.38833			P	G <sub>1</sub> may have a discordant attribute.
G <sub>34</sub>	18.061	18.201	0.543	0.408	0.194487			T	
G <sub>35</sub>	18.061	18.382	0.543	0.055	0.58411			P	
G <sub>45</sub>	18.201	18.382	0.408	0.055	0.396699			P	
Group 101328-005522									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.78	18.002	0.062	0.507	1.300503	0.916366	0.508782	M	G <sub>23</sub> make a twin.
G <sub>13</sub>	16.78	18.148	0.062	0.324	1.392863			M	G <sub>24</sub> make a twin.
G <sub>14</sub>	16.78	18.187	0.062	0.795	1.586486			AD	G <sub>25</sub> make a pair.
G <sub>15</sub>	16.78	18.381	0.062	-0.139	1.613568			AD	G <sub>34</sub> make a pair.
G <sub>23</sub>	18.002	18.148	0.507	0.324	0.234105			T	G <sub>35</sub> make a pair.
G <sub>24</sub>	18.002	18.187	0.507	0.795	0.3423			T	G <sub>1</sub> may have a discordant attribute.
G <sub>25</sub>	18.002	18.381	0.507	-0.139	0.748971			P	
G <sub>34</sub>	18.148	18.187	0.324	0.795	0.472612			P	
G <sub>35</sub>	18.148	18.381	0.324	-0.139	0.518322			P	
G <sub>45</sub>	18.187	18.381	0.795	-0.139	0.953935			AD	
Group 111622+420044									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.061	17.13	0.026	0.258	1.093885	0.818999	0.449043	M	G <sub>23</sub> make a pair.
G <sub>13</sub>	16.061	17.251	0.026	-0.193	1.209984			M	G <sub>24</sub> make a twin.
G <sub>14</sub>	16.061	17.394	0.026	0.295	1.359871			AD	G <sub>25</sub> make a pair.
G <sub>15</sub>	16.061	17.738	0.026	0.055	1.677251			AD	G <sub>34</sub> make a pair.
G <sub>23</sub>	17.13	17.251	0.258	-0.193	0.46695			P	G <sub>35</sub> make a pair.
G <sub>24</sub>	17.13	17.394	0.258	0.295	0.26658			T	G <sub>45</sub> make a pair.
G <sub>25</sub>	17.13	17.738	0.258	0.055	0.640994			P	G <sub>1</sub> may have a discordant attribute.
G <sub>34</sub>	17.251	17.394	-0.193	0.295	0.50852			P	
G <sub>35</sub>	17.251	17.738	-0.193	0.055	0.54651			P	
G <sub>45</sub>	17.394	17.738	0.295	0.055	0.419447			P	

Group 112356+355924									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.069	16.728	0.085	0.075	0.659076	0.914629	0.494901	P	G <sub>12</sub> make a pair.
G <sub>13</sub>	16.069	17.218	0.085	0.342	1.177391			M	G <sub>23</sub> make a pair.
G <sub>14</sub>	16.069	17.375	0.085	0.308	1.324902			M	G <sub>24</sub> make a pair.
G <sub>15</sub>	16.069	17.984	0.085	0.297	1.926699			AD	G <sub>34</sub> make a twin.
G <sub>23</sub>	16.728	17.218	0.075	0.342	0.558022			P	G <sub>35</sub> make a pair.
G <sub>24</sub>	16.728	17.375	0.075	0.308	0.687676			P	G <sub>45</sub> make a pair.
G <sub>25</sub>	16.728	17.984	0.075	0.297	1.275469			AD	
G <sub>34</sub>	17.218	17.375	0.342	0.308	0.160639			T	
G <sub>35</sub>	17.218	17.984	0.342	0.297	0.767321			P	
G <sub>45</sub>	17.375	17.984	0.308	0.297	0.609099			P	
Group 114333+215356									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.85	16.865	-0.003	0.227	0.230489	0.996795	0.572029	T	G <sub>12</sub> make a twin.
G <sub>13</sub>	16.85	18.016	-0.003	0.272	1.19799			M	G <sub>34</sub> make a twin.
G <sub>14</sub>	16.85	18.087	-0.003	0.279	1.268737			M	G <sub>35</sub> make a pair.
G <sub>15</sub>	16.85	18.656	-0.003	0.237	1.821877			AD	G <sub>45</sub> make a pair.
G <sub>23</sub>	16.865	18.016	0.227	0.272	1.151879			M	G <sub>1</sub> and G <sub>2</sub> may have a discordant attribute.
G <sub>24</sub>	16.865	18.087	0.227	0.279	1.223106			M	
G <sub>25</sub>	16.865	18.656	0.227	0.237	1.791028			AD	
G <sub>34</sub>	18.016	18.087	0.272	0.279	0.071344			T	
G <sub>35</sub>	18.016	18.656	0.272	0.237	0.640956			P	
G <sub>45</sub>	18.087	18.656	0.279	0.237	0.570548			P	
Group 115120+273803									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.214	16.585	0.015	0.211	0.419591	0.932219	0.490704	T	G <sub>12</sub> make a twin.
G <sub>13</sub>	16.214	17.144	0.015	0.313	0.976578			M	G <sub>23</sub> make a pair.
G <sub>14</sub>	16.214	17.372	0.015	0.397	1.21938			M	G <sub>24</sub> make a pair.
G <sub>15</sub>	16.214	18.08	0.015	0.113	1.868572			AD	G <sub>34</sub> make a twin.
G <sub>23</sub>	16.585	17.144	0.211	0.313	0.56823			P	G <sub>45</sub> make a pair.
G <sub>24</sub>	16.585	17.372	0.211	0.397	0.808681			P	
G <sub>25</sub>	16.585	18.08	0.211	0.113	1.498209			AD	
G <sub>34</sub>	17.144	17.372	0.313	0.397	0.242981			T	
G <sub>35</sub>	17.144	18.08	0.313	0.113	0.957129			AD	
G <sub>45</sub>	17.372	18.08	0.397	0.113	0.762837			P	
Group 115517+232335									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.992	17.157	0.364	0.426	0.176264	0.493549	0.259143	T	G <sub>12</sub> make a twin.
G <sub>13</sub>	16.992	17.363	0.364	0.477	0.387827			P	G <sub>13</sub> make a pair.
G <sub>14</sub>	16.992	17.58	0.364	0.301	0.591365			M	G <sub>23</sub> make a twin.
G <sub>15</sub>	16.992	17.979	0.364	0.334	0.987456			AD	G <sub>24</sub> make a pair.
G <sub>23</sub>	17.157	17.363	0.426	0.477	0.212219			T	G <sub>34</sub> make a pair.
G <sub>24</sub>	17.157	17.58	0.426	0.301	0.441083			P	G <sub>45</sub> make a pair.
G <sub>25</sub>	17.157	17.979	0.426	0.334	0.827132			AD	
G <sub>34</sub>	17.363	17.58	0.477	0.301	0.279401			P	
G <sub>35</sub>	17.363	17.979	0.477	0.334	0.63238			AD	
G <sub>45</sub>	17.58	17.979	0.301	0.334	0.400362			P	

Group 115655+241600									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.191	16.341	0.417	0.143	0.312372	0.716237	0.364682	T	G <sub>12</sub> make a twin. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> and G <sub>2</sub> may have a discordant attribute.
G <sub>13</sub>	16.191	17.162	0.417	0.254	0.984586			M	
G <sub>14</sub>	16.191	17.326	0.417	0.311	1.139939			AD	
G <sub>15</sub>	16.191	17.407	0.417	0.404	1.216069			AD	
G <sub>23</sub>	16.341	17.162	0.143	0.254	0.82847			M	
G <sub>24</sub>	16.341	17.326	0.143	0.311	0.999224			M	
G <sub>25</sub>	16.341	17.407	0.143	0.404	1.097487			AD	
G <sub>34</sub>	17.162	17.326	0.254	0.311	0.173623			T	
G <sub>35</sub>	17.162	17.407	0.254	0.404	0.287272			P	
G <sub>45</sub>	17.326	17.407	0.311	0.404	0.123329			P	
Group 115942+254940									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.656	17.437	0.392	0.674	0.830352	0.833751	0.450966	P	G <sub>12</sub> make a pair. G <sub>23</sub> make a twin. G <sub>24</sub> make a pair. G <sub>34</sub> make a pair. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.656	17.744	0.392	0.786	1.157143			M	
G <sub>14</sub>	16.656	18.147	0.392	0.824	1.552322			AD	
G <sub>15</sub>	16.656	18.317	0.392	0.764	1.702147			AD	
G <sub>23</sub>	17.437	17.744	0.674	0.786	0.326792			T	
G <sub>24</sub>	17.437	18.147	0.674	0.824	0.725672			P	
G <sub>25</sub>	17.437	18.317	0.674	0.764	0.88459			AD	
G <sub>34</sub>	17.744	18.147	0.786	0.824	0.404788			P	
G <sub>35</sub>	17.744	18.317	0.786	0.764	0.573422			P	
G <sub>45</sub>	18.147	18.317	0.824	0.764	0.180278			P	
Group 122157+080524									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.074	16.435	0.347	0.41	0.366456	0.865215	0.444999	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a pair. G <sub>23</sub> make a twin. G <sub>24</sub> make a pair. G <sub>34</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.074	16.628	0.347	0.246	0.563131			P	
G <sub>14</sub>	16.074	17.287	0.347	0.496	1.222117			M	
G <sub>15</sub>	16.074	17.771	0.347	0.357	1.697029			AD	
G <sub>23</sub>	16.435	16.628	0.41	0.246	0.253269			T	
G <sub>24</sub>	16.435	17.287	0.41	0.496	0.856329			P	
G <sub>25</sub>	16.435	17.771	0.41	0.357	1.337051			AD	
G <sub>34</sub>	16.628	17.287	0.246	0.496	0.704827			P	
G <sub>35</sub>	16.628	17.771	0.246	0.357	1.148377			AD	
G <sub>45</sub>	17.287	17.771	0.496	0.357	0.503564			P	
Group 122859+272547									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.155	16.323	0.366	0.317	0.175	0.635118	0.279339	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a pair. G <sub>23</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.155	16.573	0.366	0.032	0.535051			P	
G <sub>14</sub>	16.155	17.144	0.366	0.401	0.989619			AD	

G <sub>15</sub>	16.155	17.218	0.366	0.36	1.063017			AD	G <sub>4</sub> and G <sub>5</sub> may have a discordant attribute.
G <sub>23</sub>	16.323	16.573	0.317	0.032	0.379111			P	
G <sub>24</sub>	16.323	17.144	0.317	0.401	0.825286			M	
G <sub>25</sub>	16.323	17.218	0.317	0.36	0.896032			AD	
G <sub>34</sub>	16.573	17.144	0.032	0.401	0.679854			M	
G <sub>35</sub>	16.573	17.218	0.032	0.36	0.723608			AD	
G <sub>45</sub>	17.144	17.218	0.401	0.36	0.084599			P	
Group 123439+234951									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.686	17.073	0.508	0.08	0.577021	0.921547	0.379633	P	G <sub>12</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.686	17.835	0.508	0.297	1.168213			M	
G <sub>14</sub>	16.686	18.038	0.508	-0.025	1.45327			AD	
G <sub>15</sub>	16.686	18.249	0.508	0.52	1.563046			AD	
G <sub>23</sub>	17.073	17.835	0.08	0.297	0.792296			P	
G <sub>24</sub>	17.073	18.038	0.08	-0.025	0.970696			M	
G <sub>25</sub>	17.073	18.249	0.08	0.52	1.255618			AD	
G <sub>34</sub>	17.835	18.038	0.297	-0.025	0.380648			T	
G <sub>35</sub>	17.835	18.249	0.297	0.52	0.470239			P	
G <sub>45</sub>	18.038	18.249	-0.025	0.52	0.584419			P	
Group 123813+501704									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.901	16.956	0.531	0.477	0.077078	0.581906	0.2772	T	G <sub>12</sub> make a twin. G <sub>23</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.901	17.51	0.531	0.382	0.626963			M	
G <sub>14</sub>	16.901	17.658	0.531	0.222	0.817637			M	
G <sub>15</sub>	16.901	17.819	0.531	0.699	0.933246			AD	
G <sub>23</sub>	16.956	17.51	0.477	0.382	0.562086			P	
G <sub>24</sub>	16.956	17.658	0.477	0.222	0.74688			M	
G <sub>25</sub>	16.956	17.819	0.477	0.699	0.891097			AD	
G <sub>34</sub>	17.51	17.658	0.382	0.222	0.217954			T	
G <sub>35</sub>	17.51	17.819	0.382	0.699	0.442685			P	
G <sub>45</sub>	17.658	17.819	0.222	0.699	0.503438			P	
Group 125835+062246									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.114	16.754	0.286	0.285	0.640001	1.008713	0.482853	P	G <sub>12</sub> make a pair. G <sub>13</sub> make a pair. G <sub>23</sub> make a twin. G <sub>34</sub> make a pair. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.114	17.067	0.286	0.29	0.953008			P	
G <sub>14</sub>	16.114	17.933	0.286	0.435	1.825092			AD	
G <sub>15</sub>	16.114	17.962	0.286	0.129	1.854657			AD	
G <sub>23</sub>	16.754	17.067	0.285	0.29	0.31304			T	

G <sub>24</sub>	16.754	17.933	0.285	0.435	1.188504			M	
G <sub>25</sub>	16.754	17.962	0.285	0.129	1.218031			AD	
G <sub>34</sub>	17.067	17.933	0.29	0.435	0.878055			P	
G <sub>35</sub>	17.067	17.962	0.29	0.129	0.909366			P	
G <sub>45</sub>	17.933	17.962	0.435	0.129	0.307371			P	
Group 134932+280017									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.102	17.365	0.312	0.296	1.263101	0.899066	0.536588	M	G <sub>23</sub> make a pair. G <sub>24</sub> make a pair. G <sub>25</sub> make a pair. G <sub>34</sub> make a pair. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> may have a discordant attribute.
G <sub>13</sub>	16.102	17.559	0.312	-0.176	1.536552			AD	
G <sub>14</sub>	16.102	17.839	0.312	0.271	1.737484			AD	
G <sub>15</sub>	16.102	17.84	0.312	0.374	1.739106			AD	
G <sub>23</sub>	17.365	17.559	0.296	-0.176	0.510314			P	
G <sub>24</sub>	17.365	17.839	0.296	0.271	0.474659			P	
G <sub>25</sub>	17.365	17.84	0.296	0.374	0.481362			P	
G <sub>34</sub>	17.559	17.839	-0.176	0.271	0.527455			P	
G <sub>35</sub>	17.559	17.84	-0.176	0.374	0.617625			P	
G <sub>45</sub>	17.839	17.84	0.271	0.374	0.103005			P	
Group 135426+265147									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.82	17.923	0.474	0.38	1.106998	0.929956	0.600096	M	G <sub>23</sub> make a pair. G <sub>24</sub> make a pair. G <sub>25</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> may have a discordant attribute.
G <sub>13</sub>	16.82	18.473	0.474	0.288	1.663432			AD	
G <sub>14</sub>	16.82	18.562	0.474	0.372	1.744984			AD	
G <sub>15</sub>	16.82	18.806	0.474	0.307	1.993009			AD	
G <sub>23</sub>	17.923	18.473	0.38	0.288	0.557641			P	
G <sub>24</sub>	17.923	18.562	0.38	0.372	0.63905			P	
G <sub>25</sub>	17.923	18.806	0.38	0.307	0.886012			P	
G <sub>34</sub>	18.473	18.562	0.288	0.372	0.122381			T	
G <sub>35</sub>	18.473	18.806	0.288	0.307	0.333542			P	
G <sub>45</sub>	18.562	18.806	0.372	0.307	0.252509			P	
Group 142520+471513									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.363	16.573	0.385	0.182	0.292077	1.02258	0.503931	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a pair. G <sub>45</sub> make a pair. G <sub>4</sub> and G <sub>5</sub> may have a discordant attribute.
G <sub>13</sub>	16.363	17.105	0.385	0.287	0.748444			P	
G <sub>14</sub>	16.363	18.025	0.385	0.236	1.668666			AD	
G <sub>15</sub>	16.363	18.097	0.385	-0.006	1.777537			AD	
G <sub>23</sub>	16.573	17.105	0.182	0.287	0.542263			P	
G <sub>24</sub>	16.573	18.025	0.182	0.236	1.453004			M	



G <sub>25</sub>	16.573	18.097	0.182	-0.006	1.535552			AD	
G <sub>34</sub>	17.105	18.025	0.287	0.236	0.921413			P	
G <sub>35</sub>	17.105	18.097	0.287	-0.006	1.034366			AD	
G <sub>45</sub>	18.025	18.097	0.236	-0.006	0.252484			P	
Group 143929+110605									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.078	17.074	0.314	0.414	1.001007	0.942773	0.503739	M	G <sub>23</sub> make a twin. G <sub>24</sub> make a pair. G <sub>25</sub> make a pair. G <sub>34</sub> make a pair. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> may have a discordant attribute.
G <sub>13</sub>	16.078	17.234	0.314	0.24	1.158366			M	
G <sub>14</sub>	16.078	17.861	0.314	0.452	1.788332			AD	
G <sub>15</sub>	16.078	17.977	0.314	0.25	1.900078			AD	
G <sub>23</sub>	17.074	17.234	0.414	0.24	0.236381			T	
G <sub>24</sub>	17.074	17.861	0.414	0.452	0.787917			P	
G <sub>25</sub>	17.074	17.977	0.414	0.25	0.917772			P	
G <sub>34</sub>	17.234	17.861	0.24	0.452	0.661871			P	
G <sub>35</sub>	17.234	17.977	0.24	0.25	0.743067			P	
G <sub>45</sub>	17.861	17.977	0.452	0.25	0.232938			P	
Group 145815+081912									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.731	16.942	0.316	0.402	0.227853	0.711941	0.375964	T	G <sub>12</sub> make a twin. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> and G <sub>2</sub> may have a discordant attribute.
G <sub>13</sub>	16.731	17.668	0.316	0.381	0.939252			M	
G <sub>14</sub>	16.731	17.844	0.316	0.452	1.121278			AD	
G <sub>15</sub>	16.731	18.041	0.316	0.342	1.310258			AD	
G <sub>23</sub>	16.942	17.668	0.402	0.381	0.726304			M	
G <sub>24</sub>	16.942	17.844	0.402	0.452	0.903385			M	
G <sub>25</sub>	16.942	18.041	0.402	0.342	1.100637			AD	
G <sub>34</sub>	17.668	17.844	0.381	0.452	0.189781			T	
G <sub>35</sub>	17.668	18.041	0.381	0.342	0.375033			P	
G <sub>45</sub>	17.844	18.041	0.452	0.342	0.22563			P	
Group 150457+070527									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.645	16.919	0.344	0.131	0.347052	0.429552	0.166155	P	G <sub>12</sub> make a pair. G <sub>23</sub> make a twin. G <sub>45</sub> make a pair. G <sub>4</sub> and G <sub>5</sub> may have a discordant attribute.
G <sub>13</sub>	16.645	16.955	0.344	0.023	0.446252			M	
G <sub>14</sub>	16.645	17.281	0.344	0.364	0.636314			AD	
G <sub>15</sub>	16.645	17.379	0.344	0.303	0.735144			AD	
G <sub>23</sub>	16.919	16.955	0.131	0.023	0.113842			T	
G <sub>24</sub>	16.919	17.281	0.131	0.364	0.430503			M	
G <sub>25</sub>	16.919	17.379	0.131	0.303	0.491105			AD	

G <sub>34</sub>	16.955	17.281	0.023	0.364	0.471759			M		
G <sub>35</sub>	16.955	17.379	0.023	0.303	0.50811			AD		
G <sub>45</sub>	17.281	17.379	0.364	0.303	0.115434			P		
Group 151037+061618										
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments	
G <sub>12</sub>	16.904	17.018	0.648	0.263	0.401523	0.743011	0.430969	P	G <sub>12</sub> make a pair. G <sub>13</sub> make a pair. G <sub>23</sub> make a pair. G <sub>24</sub> make a pair. G <sub>34</sub> make a twin. G <sub>5</sub> may have a discordant attribute.	
G <sub>13</sub>	16.904	17.246	0.648	0.534	0.3605			P		
G <sub>14</sub>	16.904	17.485	0.648	0.613	0.582053			P		
G <sub>15</sub>	16.904	18.376	0.648	0.606	1.472599			AD		
G <sub>23</sub>	17.018	17.246	0.263	0.534	0.354154			P		
G <sub>24</sub>	17.018	17.485	0.263	0.613	0.5836			P		
G <sub>25</sub>	17.018	18.376	0.263	0.606	1.400647			AD		
G <sub>34</sub>	17.246	17.485	0.534	0.613	0.251718			T		
G <sub>35</sub>	17.246	18.376	0.534	0.606	1.132291			AD		
G <sub>45</sub>	17.485	18.376	0.613	0.606	0.891027			AD		
Group 151558+264612										
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments	
G <sub>12</sub>	16.357	16.475	0.276	0.247	0.121511	1.103049	0.639375	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a twin. G <sub>23</sub> make a twin. G <sub>45</sub> make a pair. G <sub>4</sub> and G <sub>5</sub> may have a discordant attribute.	
G <sub>13</sub>	16.357	16.76	0.276	0.339	0.407895			T		
G <sub>14</sub>	16.357	18.034	0.276	0.206	1.67846			M		
G <sub>15</sub>	16.357	18.134	0.276	-0.318	1.87365			AD		
G <sub>23</sub>	16.475	16.76	0.247	0.339	0.299481			T		
G <sub>24</sub>	16.475	18.034	0.247	0.206	1.559539			M		
G <sub>25</sub>	16.475	18.134	0.247	-0.318	1.752571			AD		
G <sub>34</sub>	16.76	18.034	0.339	0.206	1.280923			M		
G <sub>35</sub>	16.76	18.134	0.339	-0.318	1.522999			AD		
G <sub>45</sub>	18.034	18.134	0.206	-0.318	0.533457			P		
Group 152313+310047										
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments	
G <sub>12</sub>	16.12	16.411	0.258	0.535	0.401759	0.46848	0.209074	P	G <sub>12</sub> make a pair. G <sub>13</sub> make a pair. G <sub>23</sub> make a twin. G <sub>24</sub> make a pair. G <sub>34</sub> make a pair. G <sub>45</sub> make a pair.	
G <sub>13</sub>	16.12	16.421	0.258	0.376	0.323303			P		
G <sub>14</sub>	16.12	16.786	0.258	0.397	0.680351			AD		
G <sub>15</sub>	16.12	16.973	0.258	0.599	0.918635			AD		
G <sub>23</sub>	16.411	16.421	0.535	0.376	0.159314			T		
G <sub>24</sub>	16.411	16.786	0.535	0.397	0.399586			P		
G <sub>25</sub>	16.411	16.973	0.535	0.599	0.565632			AD		
G <sub>34</sub>	16.421	16.786	0.376	0.397	0.365604			P		

G <sub>35</sub>	16.421	16.973	0.376	0.599	0.595343				AD	
G <sub>45</sub>	16.786	16.973	0.397	0.599	0.275269				P	
Group 152853+423546										
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ			Comments
G <sub>12</sub>	16.717	17.559	0.372	0.286	0.846381	0.66317	0.433068		M	G <sub>23</sub> make a twin. G <sub>24</sub> make a pair. G <sub>25</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> may have a discordant attribute.
G <sub>13</sub>	16.717	17.748	0.372	0.208	1.043962				M	
G <sub>14</sub>	16.717	17.872	0.372	0.304	1.157				AD	
G <sub>15</sub>	16.717	18.199	0.372	0.273	1.485303				AD	
G <sub>23</sub>	17.559	17.748	0.286	0.208	0.204463				T	
G <sub>24</sub>	17.559	17.872	0.286	0.304	0.313517				P	
G <sub>25</sub>	17.559	18.199	0.286	0.273	0.640132				P	
G <sub>34</sub>	17.748	17.872	0.208	0.304	0.156818				T	
G <sub>35</sub>	17.748	18.199	0.208	0.273	0.45566				P	
G <sub>45</sub>	17.872	18.199	0.304	0.273	0.328466				P	
Group 153322+493858										
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ			Comments
G <sub>12</sub>	16.789	17.245	0.567	-0.076	0.78828	0.944076	0.372005		P	G <sub>12</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.789	17.8	0.567	0.363	1.031376				M	
G <sub>14</sub>	16.789	18.286	0.567	0.375	1.509262				AD	
G <sub>15</sub>	16.789	18.407	0.567	0.127	1.67676				AD	
G <sub>23</sub>	17.245	17.8	-0.076	0.363	0.707634				P	
G <sub>24</sub>	17.245	18.286	-0.076	0.375	1.134496				M	
G <sub>25</sub>	17.245	18.407	-0.076	0.127	1.179599				AD	
G <sub>34</sub>	17.8	18.286	0.363	0.375	0.486148				T	
G <sub>35</sub>	17.8	18.407	0.363	0.127	0.651264				P	
G <sub>45</sub>	18.286	18.407	0.375	0.127	0.275944				P	
Group 154629+005120										
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ			Comments
G <sub>12</sub>	16.794	17.336	0.218	0.167	0.544394	0.738435	0.353629		P	G <sub>12</sub> make a pair. G <sub>23</sub> make a pair. G <sub>24</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.794	17.776	0.218	-0.125	1.040179				M	
G <sub>14</sub>	16.794	18.032	0.218	0.047	1.249754				AD	
G <sub>15</sub>	16.794	18.221	0.218	0.086	1.433092				AD	
G <sub>23</sub>	17.336	17.776	0.167	-0.125	0.528076				P	
G <sub>24</sub>	17.336	18.032	0.167	0.047	0.706269				P	
G <sub>25</sub>	17.336	18.221	0.167	0.086	0.888699				AD	
G <sub>34</sub>	17.776	18.032	-0.125	0.047	0.308415				T	
G <sub>35</sub>	17.776	18.221	-0.125	0.086	0.49249				P	

G <sub>45</sub>	18.032	18.221	0.047	0.086	0.192982			P	
Group 154748+364946									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.132	17.16	0.321	0.262	1.029692	1.013845	0.453827	M	G <sub>23</sub> make a twin. G <sub>24</sub> make a pair. G <sub>25</sub> make a pair. G <sub>34</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> may have a discordant attribute.
G <sub>13</sub>	16.132	17.408	0.321	-0.057	1.330812			M	
G <sub>14</sub>	16.132	17.713	0.321	0.641	1.61306			AD	
G <sub>15</sub>	16.132	17.997	0.321	0.82	1.930602			AD	
G <sub>23</sub>	17.16	17.408	0.262	-0.057	0.404061			T	
G <sub>24</sub>	17.16	17.713	0.262	0.641	0.67041			P	
G <sub>25</sub>	17.16	17.997	0.262	0.82	1.005949			P	
G <sub>34</sub>	17.408	17.713	-0.057	0.641	0.761728			P	
G <sub>35</sub>	17.408	17.997	-0.057	0.82	1.056433			AD	
G <sub>45</sub>	17.713	17.997	0.641	0.82	0.335704			P	
Group 155521+460427									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.681	16.943	0.252	0.367	0.286128	0.792875	0.372727	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.681	17.361	0.252	0.102	0.696348			P	
G <sub>14</sub>	16.681	17.82	0.252	0.329	1.1416			M	
G <sub>15</sub>	16.681	18.174	0.252	0.242	1.493033			AD	
G <sub>23</sub>	16.943	17.361	0.367	0.102	0.494923			P	
G <sub>24</sub>	16.943	17.82	0.367	0.329	0.877823			M	
G <sub>25</sub>	16.943	18.174	0.367	0.242	1.23733			AD	
G <sub>34</sub>	17.361	17.82	0.102	0.329	0.512064			P	
G <sub>35</sub>	17.361	18.174	0.102	0.242	0.824966			AD	
G <sub>45</sub>	17.82	18.174	0.329	0.242	0.364534			P	
Group 160905+311101									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.681	16.874	0.378	0.43	0.199882	1.178104	0.706027	T	G <sub>12</sub> make a twin. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> and G <sub>2</sub> may have a discordant attribute.
G <sub>13</sub>	16.681	18.435	0.378	0.236	1.759739			M	
G <sub>14</sub>	16.681	18.553	0.378	0.23	1.877841			M	
G <sub>15</sub>	16.681	18.652	0.378	-0.071	2.021495			AD	
G <sub>23</sub>	16.874	18.435	0.43	0.236	1.573009			M	
G <sub>24</sub>	16.874	18.553	0.43	0.23	1.69087			M	
G <sub>25</sub>	16.874	18.652	0.43	-0.071	1.847237			AD	
G <sub>34</sub>	18.435	18.553	0.236	0.23	0.118152			T	
G <sub>35</sub>	18.435	18.652	0.236	-0.071	0.375949			P	
G <sub>45</sub>	18.553	18.652	0.23	-0.071	0.316863			P	

Group 161348+232820									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.658	17.011	0.322	0.293	0.354189	0.839982	0.441222	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a pair. G <sub>23</sub> make a pair. G <sub>24</sub> make a pair. G <sub>34</sub> make a twin. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.658	17.418	0.322	0.384	0.762525			P	
G <sub>14</sub>	16.658	17.781	0.322	0.32	1.123002			M	
G <sub>15</sub>	16.658	18.367	0.322	0.362	1.709468			AD	
G <sub>23</sub>	17.011	17.418	0.293	0.384	0.417049			P	
G <sub>24</sub>	17.011	17.781	0.293	0.32	0.770473			P	
G <sub>25</sub>	17.011	18.367	0.293	0.362	1.357754			AD	
G <sub>34</sub>	17.418	17.781	0.384	0.32	0.368599			T	
G <sub>35</sub>	17.418	18.367	0.384	0.362	0.949255			AD	
G <sub>45</sub>	17.781	18.367	0.32	0.362	0.587503			P	
Group 161647+550218									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.295	16.507	0.224	0.185	0.215557	0.608445	0.237227	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.295	16.712	0.224	0.605	0.564845			P	
G <sub>14</sub>	16.295	17.14	0.224	0.28	0.846854			AD	
G <sub>15</sub>	16.295	17.326	0.224	0.461	1.057889			AD	
G <sub>23</sub>	16.507	16.712	0.185	0.605	0.46736			P	
G <sub>24</sub>	16.507	17.14	0.185	0.28	0.640089			M	
G <sub>25</sub>	16.507	17.326	0.185	0.461	0.864255			AD	
G <sub>34</sub>	16.712	17.14	0.605	0.28	0.53741			P	
G <sub>35</sub>	16.712	17.326	0.605	0.461	0.63066			AD	
G <sub>45</sub>	17.14	17.326	0.28	0.461	0.259532			P	
Group 163018+265636									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.36	16.562	0.177	0.612	0.479613	0.967046	0.395423	T	G <sub>12</sub> make a twin. G <sub>23</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.36	17.434	0.177	0.626	1.164078			M	
G <sub>14</sub>	16.36	17.692	0.177	0.195	1.332122			M	
G <sub>15</sub>	16.36	17.998	0.177	0.493	1.668203			AD	
G <sub>23</sub>	16.562	17.434	0.612	0.626	0.872112			P	
G <sub>24</sub>	16.562	17.692	0.612	0.195	1.204487			M	
G <sub>25</sub>	16.562	17.998	0.612	0.493	1.440922			AD	
G <sub>34</sub>	17.434	17.692	0.626	0.195	0.50232			T	
G <sub>35</sub>	17.434	17.998	0.626	0.493	0.57947			P	
G <sub>45</sub>	17.692	17.998	0.195	0.493	0.42713			P	

Group 000954+195825									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.861	17.421	0.341	0.174	0.584371	0.950246	0.478391	P	G <sub>12</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.861	18.174	0.341	0.384	1.313704			M	
G <sub>14</sub>	16.861	18.456	0.341	0.382	1.595527			AD	
G <sub>15</sub>	16.861	18.695	0.341	0.316	1.83417			AD	
G <sub>23</sub>	17.421	18.174	0.174	0.384	0.781735			P	
G <sub>24</sub>	17.421	18.456	0.174	0.382	1.055694			M	
G <sub>25</sub>	17.421	18.695	0.174	0.316	1.281889			AD	
G <sub>34</sub>	18.174	18.456	0.384	0.382	0.282007			T	
G <sub>35</sub>	18.174	18.695	0.384	0.316	0.525419			P	
G <sub>45</sub>	18.456	18.695	0.382	0.316	0.247946			P	
Group 003707+185546									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.492	17.452	0.128	0.486	1.02458	0.909819	0.497851	M	G <sub>23</sub> make a twin. G <sub>24</sub> make a pair. G <sub>25</sub> make a pair. G <sub>34</sub> make a pair. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> may have a discordant attribute.
G <sub>13</sub>	16.492	17.512	0.128	0.586	1.118107			M	
G <sub>14</sub>	16.492	18.146	0.128	0.323	1.665455			AD	
G <sub>15</sub>	16.492	18.266	0.128	0.643	1.847241			AD	
G <sub>23</sub>	17.452	17.512	0.486	0.586	0.116619			T	
G <sub>24</sub>	17.452	18.146	0.486	0.323	0.712885			P	
G <sub>25</sub>	17.452	18.266	0.486	0.643	0.829002			P	
G <sub>34</sub>	17.512	18.146	0.586	0.323	0.686385			P	
G <sub>35</sub>	17.512	18.266	0.586	0.643	0.756151			P	
G <sub>45</sub>	18.146	18.266	0.323	0.643	0.34176			P	
Group 003943+211056									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.828	16.874	-0.217	0.322	0.540959	1.283999	0.700139	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a twin. G <sub>23</sub> make a twin. G <sub>45</sub> make a pair. G <sub>4</sub> and G <sub>5</sub> may have a discordant attribute.
G <sub>13</sub>	16.828	17.001	-0.217	0.108	0.368177			T	
G <sub>14</sub>	16.828	18.724	-0.217	0.456	2.011901			AD	
G <sub>15</sub>	16.828	18.775	-0.217	0.062	1.966888			AD	
G <sub>23</sub>	16.874	17.001	0.322	0.108	0.248847			T	
G <sub>24</sub>	16.874	18.724	0.322	0.456	1.854847			M	
G <sub>25</sub>	16.874	18.775	0.322	0.062	1.918698			AD	
G <sub>34</sub>	17.001	18.724	0.108	0.456	1.757792			M	
G <sub>35</sub>	17.001	18.775	0.108	0.062	1.774596			AD	
G <sub>45</sub>	18.724	18.775	0.456	0.062	0.397287			P	
Group 005151+081326									

Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.352	17.154	0.389	0.691	0.856976	1.021251	0.541864	P	G <sub>12</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.352	17.961	0.389	0.377	1.609045			AD	
G <sub>14</sub>	16.352	18.177	0.389	0.375	1.825054			AD	
G <sub>15</sub>	16.352	18.329	0.389	0.515	1.981011			AD	
G <sub>23</sub>	17.154	17.961	0.691	0.377	0.865936			P	
G <sub>24</sub>	17.154	18.177	0.691	0.375	1.070694			M	
G <sub>25</sub>	17.154	18.329	0.691	0.515	1.188108			AD	
G <sub>34</sub>	17.961	18.177	0.377	0.375	0.216009			T	
G <sub>35</sub>	17.961	18.329	0.377	0.515	0.393024			P	
G <sub>45</sub>	18.177	18.329	0.375	0.515	0.206649			P	
Group 015402+013942									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.192	16.209	0.406	0.44	0.038013	0.332002	0.180962	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a pair. G <sub>45</sub> make a pair. G <sub>4</sub> and G <sub>5</sub> may have a discordant attribute.
G <sub>13</sub>	16.192	16.38	0.406	0.45	0.19308			P	
G <sub>14</sub>	16.192	16.696	0.406	0.484	0.51			M	
G <sub>15</sub>	16.192	16.763	0.406	0.422	0.571224			AD	
G <sub>23</sub>	16.209	16.38	0.44	0.45	0.171292			P	
G <sub>24</sub>	16.209	16.696	0.44	0.484	0.488984			M	
G <sub>25</sub>	16.209	16.763	0.44	0.422	0.554292			AD	
G <sub>34</sub>	16.38	16.696	0.45	0.484	0.317824			P	
G <sub>35</sub>	16.38	16.763	0.45	0.422	0.384022			AD	
G <sub>45</sub>	16.696	16.763	0.484	0.422	0.091285			P	
Group 025056+070049									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.992	17.05	0.419	0.336	0.101257	0.664446	0.38599	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a twin. G <sub>23</sub> make a twin. G <sub>34</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.992	17.261	0.419	0.394	0.270159			T	
G <sub>14</sub>	16.992	17.785	0.419	0.49	0.796172			M	
G <sub>15</sub>	16.992	18.229	0.419	0.187	1.258568			AD	
G <sub>23</sub>	17.05	17.261	0.336	0.394	0.218826			T	
G <sub>24</sub>	17.05	17.785	0.336	0.49	0.75096			M	
G <sub>25</sub>	17.05	18.229	0.336	0.187	1.188378			AD	
G <sub>34</sub>	17.261	17.785	0.394	0.49	0.532721			P	
G <sub>35</sub>	17.261	18.229	0.394	0.187	0.989885			AD	
G <sub>45</sub>	17.785	18.229	0.49	0.187	0.537536			P	
Group 025903+100636									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments

G <sub>12</sub>	16.473	16.764	0.375	0.281	0.305805	0.989383	0.454412	T	G <sub>12</sub> make a twin. G <sub>13</sub> make a pair. G <sub>23</sub> make a pair. G <sub>34</sub> make a pair. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.473	17.452	0.375	0.384	0.979041			P	
G <sub>14</sub>	16.473	17.904	0.375	-0.076	1.500387			AD	
G <sub>15</sub>	16.473	18.254	0.375	0.264	1.784456			AD	
G <sub>23</sub>	16.764	17.452	0.281	0.384	0.695667			P	
G <sub>24</sub>	16.764	17.904	0.281	-0.076	1.194592			M	
G <sub>25</sub>	16.764	18.254	0.281	0.264	1.490097			AD	
G <sub>34</sub>	17.452	17.904	0.384	-0.076	0.644906			P	
G <sub>35</sub>	17.452	18.254	0.384	0.264	0.810928			P	
G <sub>45</sub>	17.904	18.254	-0.076	0.264	0.487955			P	
Group 221414+002203									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.9	17.486	0.61	0.307	0.659701	0.761779	0.378351	P	G <sub>12</sub> make a pair. G <sub>23</sub> make a pair. G <sub>24</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.9	17.975	0.61	0.495	1.081134			M	
G <sub>14</sub>	16.9	18.222	0.61	0.409	1.337193			AD	
G <sub>15</sub>	16.9	18.376	0.61	0.548	1.477302			AD	
G <sub>23</sub>	17.486	17.975	0.307	0.495	0.523894			P	
G <sub>24</sub>	17.486	18.222	0.307	0.409	0.743034			P	
G <sub>25</sub>	17.486	18.376	0.307	0.548	0.922053			AD	
G <sub>34</sub>	17.975	18.222	0.495	0.409	0.261543			T	
G <sub>35</sub>	17.975	18.376	0.495	0.548	0.404487			P	
G <sub>45</sub>	18.222	18.376	0.409	0.548	0.207454			P	
Group 221442+012823									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.399	17.47	-0.112	0.615	1.294438	1.035617	0.58805	M	G <sub>23</sub> make a twin. G <sub>24</sub> make a pair. G <sub>25</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> may have a discordant attribute.
G <sub>13</sub>	16.399	17.858	-0.112	0.397	1.545238			M	
G <sub>14</sub>	16.399	18.131	-0.112	0.261	1.771709			AD	
G <sub>15</sub>	16.399	18.397	-0.112	0.714	2.162008			AD	
G <sub>23</sub>	17.47	17.858	0.615	0.397	0.445048			T	
G <sub>24</sub>	17.47	18.131	0.615	0.261	0.749825			P	
G <sub>25</sub>	17.47	18.397	0.615	0.714	0.932271			P	
G <sub>34</sub>	17.858	18.131	0.397	0.261	0.305			T	
G <sub>35</sub>	17.858	18.397	0.397	0.714	0.625308			P	
G <sub>45</sub>	18.131	18.397	0.261	0.714	0.525324			P	
Group 222450+071501									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.473	16.629	0.146	0.287	0.210278	1.111753	0.680205	T	G <sub>12</sub> make a twin.



G <sub>13</sub>	16.473	16.705	0.146	0.117	0.233805			T	G <sub>13</sub> make a twin. G <sub>23</sub> make a twin. G <sub>45</sub> make a pair. G <sub>4</sub> and G <sub>5</sub> may have a discordant attribute.
G <sub>14</sub>	16.473	18.111	0.146	0.075	1.639538			M	
G <sub>15</sub>	16.473	18.429	0.146	0.367	1.968445			AD	
G <sub>23</sub>	16.629	16.705	0.287	0.117	0.186215			T	
G <sub>24</sub>	16.629	18.111	0.287	0.075	1.497087			M	
G <sub>25</sub>	16.629	18.429	0.287	0.367	1.801777			AD	
G <sub>34</sub>	16.705	18.111	0.117	0.075	1.406627			M	
G <sub>35</sub>	16.705	18.429	0.117	0.367	1.742032			AD	
G <sub>45</sub>	18.111	18.429	0.075	0.367	0.431727			P	
Group 231910-022709									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.456	17.142	0.4	0.43	0.686656	0.566412	0.353209	M	G <sub>23</sub> make a pair. G <sub>24</sub> make a pair. G <sub>25</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair. G <sub>1</sub> may have a discordant attribute.
G <sub>13</sub>	16.456	17.409	0.4	0.358	0.953925			AD	
G <sub>14</sub>	16.456	17.572	0.4	0.331	1.118131			AD	
G <sub>15</sub>	16.456	17.644	0.4	0.31	1.191404			AD	
G <sub>23</sub>	17.142	17.409	0.43	0.358	0.276538			P	
G <sub>24</sub>	17.142	17.572	0.43	0.331	0.441249			P	
G <sub>25</sub>	17.142	17.644	0.43	0.31	0.516143			P	
G <sub>34</sub>	17.409	17.572	0.358	0.331	0.165221			T	
G <sub>35</sub>	17.409	17.644	0.358	0.31	0.239852			P	
G <sub>45</sub>	17.572	17.644	0.331	0.31	0.075			P	
Group 235439+032308									
Galaxies	(r) <sub>i</sub>	(r) <sub>j</sub>	(g-r) <sub>i</sub>	(g-r) <sub>j</sub>	e <sub>ij</sub>	e <sub>av</sub>	σ		Comments
G <sub>12</sub>	16.144	16.724	0.396	0.408	0.580124	0.753006	0.398291	P	G <sub>12</sub> make a pair. G <sub>23</sub> make a pair. G <sub>24</sub> make a pair. G <sub>34</sub> make a twin. G <sub>35</sub> make a pair. G <sub>45</sub> make a pair.
G <sub>13</sub>	16.144	17.197	0.396	0.445	1.054139			M	
G <sub>14</sub>	16.144	17.264	0.396	0.272	1.126843			M	
G <sub>15</sub>	16.144	17.716	0.396	0.357	1.572484			AD	
G <sub>23</sub>	16.724	17.197	0.408	0.445	0.474445			P	
G <sub>24</sub>	16.724	17.264	0.408	0.272	0.556863			P	
G <sub>25</sub>	16.724	17.716	0.408	0.357	0.99331			AD	
G <sub>34</sub>	17.197	17.264	0.445	0.272	0.185521			T	
G <sub>35</sub>	17.197	17.716	0.445	0.357	0.526408			P	
G <sub>45</sub>	17.264	17.716	0.272	0.357	0.459923			P	

Some members appeared to have a discordant attribute and some group contained sub groups, to inspect the reality of the results we applied the combined coefficient

$$e_{m(jk)} = \frac{1}{2} (e_{mj} + e_{mk})$$

Where m, j and k are galaxy members of the same group

Applying the UPGMA method on the 5 member groups showed that most of the galaxies are real members while 23 groups has a discordant attribute and should be discarded from their groups.

Group ID	Galaxy number
091524+213038	1
094316+392308	1
101328-005522	1
111622+420044	1
115942+254940	1
122859+272547	4
125835+062246	4
134932+280017	1
135426+265147	1
142520+471513	4
143929+110605	1
151037+061618	5
151558+264612	4
152853+423546	1
154748+364946	1
003707+185546	1
003943+211056	4
005151+081326	1
015402+013942	4
025903+100636	1
221442+012823	1
222450+071501	4
231910-022709	1

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