A comparison of *Enhancement of Network Robustness and Efficiency through Evolutionary Computing, Statistical Computation and Social Network Analysis* (PhD dissertation by Hadi Rezadad), sections 2.2.1, 2.2.2 (p. 10-18)
(apparently based on *Ad Hoc Committee Report* (Wegman, Scott, Said) section 2.3, p.17-22)

and *Unattributed Sources on Social Networks Wikipedia, Wasserman & Faust and De Nooy,Mrvar & Batagelj)*

Regular font indicates substantially close wording between the two sources, *italic* represent paraphrased sections, **bold** represents significant departures of Wegman et al from sources, and **bold underline** represent points of outright contradiction. Paragraphs have been reformatted for easy comparison. Within sections of close wording, identical phrases (ID) are highlighted in cyan, trivial changes (TC) with yellow. Changes resulting in issues are underlined.

Notes:

Passages with identifiable antecedents are derived from a reduction of section 2.3 of the Wegman Report; such passages are identified with the appropriate headers.

Deviations or additions in Rezazad are noted as follows:

Square brackets **[~~with strikeout~~]** denote phrases in Wegman et al, but **not** in Rezazad.

Curly brackets **{}** denote phrases found in Rezazad, but not in Wegman et al.

Rezazad Section 2.2.1, p. 10
{Networks are useful mechanisms for modeling and understanding the existing relationships in the world.}

Wegman et al – Section 2.3, p. 18 paragraph 2 – Rezazad, p. 10
Networks operate anywhere that energy and information are exchanged: between neurons and cells, computers and people, genes and proteins, atoms and atoms, and people and people. {Wasserman, 1999) }

Social network analysis assumes that interpersonal ties matter, whether they exist among individuals, organizations or countries. Interpersonal connections matter because they are conduits for the transmission of information, goods, behavior and attitudes.

Ties and connections form networks, which can be analyzed. The main goal of social network analysis is the detection and interpretation of patterns of social ties among people, nations, or organizations involved in social relationships.

[**No antecedent found.]**

[**No antecedent found.]**

Exploratory Social Network Analysis with Pajek, Series: Structural Analysis in the Social Sciences (No. 27), by Wouter de Nooy, Andrej Mrvar and Vladimir Batagelj (Cambridge University Press, 2005)

1.1 Introduction, p. 3

… Social network analysts assume that interpersonal ties matter, as do ties among organizations or countries, because they transmit behavior, attitudes, information, or goods….

Part 1 – Fundamentals (Header), p. 1
… Social network analysis focuses on ties among, for example, people, groups of people, organizations, and countries. These ties combine to form networks, which we will learn to analyze.

1.3 Exploratory Social Network Analysis, p. 5
In this book, the word actor refers to a person, organization, or nation that is involved in a social relation. …

The main goal of social network analysis is detecting and interpreting patterns of social ties among actors…

Wegman et al – p. 18-19, para. 3 (definitions) – Rezazad, p. 11

There are several key concepts at the heart of network analysis.

[~~We outline these concepts next and then define a social network.~~]

{The following are a number of these concepts as well as a definition of a social network.}

Actor: Social network analysis is concerned with understanding the linkages among social entities and the implications of these linkages. The social entities are referred to as actors. Actors do not necessarily have the desire or the ability to act. Most social network applications consider a collection of actors that are all of the same type. These are known as one-mode networks.

{ In the domain of computer networks, an actor is a network component, which may be a server, hub, a router, or a workstation.}

Relational Tie: Social ties link actors to one another. The range and type of social ties can be quite extensive. A tie establishes a linkage between a pair of actors.
Examples of ties include the
evaluation of one person by another (such as expressed friendship, liking, respect),
transfer of material resources (such as business transactions, lending or borrowing things),
association or affiliation (such as jointly attending the same social event or belonging to the same social club),
behavioral interaction (talking together, sending messages),
movement between places or statues (migration, social or physical mobility),
physical connection (a road, river, bridge connecting two points),
formal relations such as authority and
biological relationships such as kinship or descent.

Stanley Wasserman and Katherine Faust, Social Network Analysis: Methods and Applications. New York, Cambridge University Press, 1994.
Section 1.3 – Fundamental Concepts in network analysis, p. 17-20

There are several key concepts at the heart of network analysis …

we define some of these key concepts and discuss the different levels of analysis in social networks.

Actor. … [S]ocial network analysis is concerned with understanding the linkages among social entities and the implications of these linkages. The social entities are referred to as actors. Our use of the term “actor" does not imply that these entities necessarily have volition or the ability to "act". Further, most social network applications focus on collections of actors that are all of the same type …. We call such collections one·mode networks…

Relational tie. Actors are linked to one another by social ties. …[T]he range and type of ties can be quite extensive. The defining feature of a tie is that it establishes a linkage between a pair of actors. Some of the more common examples of ties employed in network analysis are:

- Evaluation of one person by another (for example expressed friendship, liking, or respect)
- Transfers of material resources (for example business transactions, lending or borrowing things)
- Association or affiliation (for example jointly attending a social event, or belonging to the same social club)
- Behavioral interaction (talking together, sending messages)
- Movement between places or statuses (migration, social or physical mobility)
- Physical connection {a road. river, or bridge connecting two points}
- Formal relations (for example authority)
- Biological relationship (kinship or descent)

Wegman et al – p. 19, Definitions cont. – Rezazad p. 11

Dyad: A linkage or relationship establishes a tie at the most basic level between a pair of actors. The tie is an inherent property of the pair. Many kinds of network analysis are concerned with understanding ties among pairs and are based on the dyad as the unit of analysis

Triad: The analysis of a subset of three actors (a triad) and the possible ties among them is motivated and informed by balance theory. Balance theory asks whether or not a triad is transitive or balanced. A transitive triad is characterized by transitive relations such as [if actor i likes actor j, and actor j likes actor k, then actor i also likes actor k. A balanced triad means that if actors i and j like each other, then i and j should have similar evaluations of a third actor, whereas if they dislike each other then they are expected to differ in their evaluations].

{ relations such as if actor *i* has a specific link to actor *j*, and actor *j* has the same type of linkage to actor *k*, then actor *i* also has the same type of linkage to actor *k*. A balanced triad means that if actors *i* and *j* have a certain type of linkage to each other, then *i* and *j* should have similar linkage to a third actor, whereas if they are disjointed from each other then they are expected to be disjointed from the third actor.**}**

Subgroup: [~~Dyads are pairs of actors and associated ties, triads are triples of actors and associated ties. We can define a subgroup of actors as any subset among actors with associated ties~~.]

{A subgroup of actors can be defined as any subset among actors with associated ties.**}**

Locating and studying these subgroups using specific criteria is one of the primary objectives of social network analysis.

Group: [Network analysis is not only concerned with collections of dyads, triads, or subgroups.] Social network analysis has the ability to model the relationships among systems of actors. A group is a collection of actors on which ties are measured.

Wasserman & Faust (cont.)

Dyad. At the most basic level, a linkage or relationship establishes a tie between two actors. The tie is inherently a property of the pair … Many kinds of network analysis are concerned with understanding ties among pairs. All of these approaches take the dyad as the unit of analysis

Triad. … . Many important social network methods and models focus on the triad; a subset of tbree actors and tbe (possible) tie(s) among them. Balance theory has informed and motivated many triadic analyses. Of particular interest are whether the triad is transitive (if actor i "Iikes" actor j and actor j in turn "likes" actor k. then actor i will also “like” actor k), and whether the triad is balanced (if actors i and j like each other, then i and j should be similar in their evaluation of a third actor k, and if i and j dislike each otber, tben they should differ in their evaluation of a third actor, k).

Subgroup. Dyads are pairs of actors and associated ties, triads are triples of actors and associated ties. It follows that we can define a subgroup of actors as any subset or actors, and a1l ties among them.

Locating and studying subgroups using specific criteria has been an important concern in social network analysis.

Group. Network analysis is not simply concerned with collections of dyads, or triads, or subgroups. To a large extent, power of network analysis lies in the ability to model the relationships among systems of actors…. For our purposes, a group is the collection of all actors on which ties are to be measured.

Wegman et al – p. 19 continued – Rezazad cont.

Relation: The collection of ties of a specific kind among members of a group is called a relation, for example, the set of friendships among pairs of **[**~~children~~] {students**}** in a classroom or the set of formal diplomatic ties maintained by pairs of nations in the world. A relation refers to the collection of ties of a given kind measured on pairs of actors from a specified actor set. **{**For computer networks, an example could be the set of applications that retrieve and exchange data from a database on a specific server.**}**

Wegman et al p. 40
(Clique:} A clique is a fully connected sub-graph, meaning everyone in the clique interacts with everyone else in the clique. **{**Within a clique of a computer network, all of the network nodes connect to each other.**}**

Social Network: [~~We are now in a position to define a social network.~~**]** A social network consists of a finite set or sets of actors and the relation or relations defined on them. The presence of relational information is a significant feature of a social network.

Wegman p. 19 – Rezazad, p. 13-4 (Section 2.2.2)
Computational Facets of Social Network Analysis [Section]

The main goal of social network analysis is the detection and interpretation of patterns of social ties among actors.

Social network analysis may be viewed as a broadening or generalization of standard data analytic techniques and applied statistics that focus on observational units and their characteristics. Complex network data sets may contain information about the characteristics of the actors **[**~~(such as the gender of people in a group or the GNP of nations of the world)~~**]** as well as structural variables.

Network problems naturally give rise to graphs.

The structural and compositional variables necessary for social network analysis often result in complicated data sets that must be modeled with sophisticated graph theoretic, algebraic and statistical methods.

Wasserman & Faust (cont.)

Relation. The collection of ties of a specific kind among members of a group is called a relation. For example, the set of friendships among pairs of children in a classroom, or the set of formal diplomatic ties maintained by pairs of nations in the world, are ties that define relations… It is important to note that a relation refers to the collection of ties of a given kind measured on pairs of actors from a specified actor set…

Social Network. Having defined actor, group, and relation we can now give a more explicit definition of social network. A social network consists of a finite set or sets of actors and the relation or relations defined on them. The presence of relational information is a critical and defining feature of a social network ...

De Nooy et al, Social Network Analysis with Pajek, 1.3, p.5

The main goal of social network analysis is detecting and interpreting patterns of social ties among actors.

Wasserman & Faust (cont.), Section 1.4, p. 21

Social network analysis may be viewed as a broadening or generalization of standard data analytic techniques and applied statistics which usually focus on observational units and their characteristics …
Complex network data sets may contain information about the characteristics of the actors (such as the gender of people in a group or the GNP of nations of the world) as well as structural variables.

[Antecedent not found]

Wasserman & Faust (cont.), Section 1.4, p. 22
But the fact that one has not only structural, but also compositional variables, very complicated data sets that can be approached only with sophisticated graph theoretic, algebraic and/or statistical methods.

Wegman et al – p. 20; Rezazad, p. 14
Computational Facets of Social Network Analysis [cont.]

The underlying mathematical frameworks used to build social network models are called graphs. A graph is a discrete structure consisting of vertices (nodes) and edges (links), where the vertices correspond to the objects, and the edges to the relations of the structure to be modeled.

A network consists of a graph and additional information on the vertices or lines of the graphs. Names of people or businesses or countries represent additional information on vertices. Line values are numbers for arcs and edges that indicate the strength of relationships between actors.

This flexible definition allows a wide variety of empirical phenomena to be modeled as networks.

Properties of vertices are used to find and interpret patterns of ties in a network. Social networks are often complicated and may be large. Partitions are used to reduce a network so that different facets can be studied.

Partitions – A partition of a network is a classification or clustering of the vertices in the network so that each vertex is assigned to exactly one class or cluster.

Partitions may specify some property that depends on attributes of the vertices.

Partitions divide the vertices of a network into a number of mutually exclusive subsets. That is, a partition splits a network into parts.

We can produce a local view defined by a selected class of vertices that consists of all of the structural ties between nodes in the selected class of vertices. Partitions are also sometimes called blocks or blockmodels. These are essentially a way to cluster actors together in groups that behave in a similar way.

[Antecedent not found]

De Nooy, Mrvar and Batagelj
Section 1.3.1, p. 7
A network consists of a graph and additional information on the vertices or lines of the graph. In the dining-table partners network, the names of the girls represent additional information on the vertices that turns the graph into a network. The numbers printed near the arcs and edges offer additional information on the links …They are called line values, and they usually indicate the strength of a relation.

Section 1.5, p. 24
This flexible definition permits a wide variety of empirical phenomena …

Section 2.7, p.51
[W]e used properties of vertices to find and interpret patterns of ties in a network … Social networks are often large and complicated. To understand network structure, it helps to study reductions of the network first. Partitions can be used to reduce a network ….

Section 2.3, p. 31
… A partition of a network is a classification or clustering of the vertices in the network such that each vertex is assigned to exactly one class or cluster.

Partitions may specify a structural property …. We call the latter attributes of vertices.

Section 2.4, p. 36
Partitions divide the vertices of a network into a number of mutually exclusive subsets. In other words, a partition splits a network into parts.

[Antecedent not found]

Wegman et al – p. 20 continued; Rezazad – p.15-16

Allegiance – Allegiance measures the support that an actor provides for the structure of his block.An actor supports his block by having internal block edges.A measure of this is the total number of edges that an actor has internal to his block. An actor supports his block by not having external edges from the block to other actors or blocks. A measure of this is the total number of possible external edges minus the total number of existing external edges. The allegiance for a block is a weighted sum of a measure of internal allegiance and a measure of external allegiance. The overall allegiance for a social network is the sum of the allegiances for the individual blocks. If the overall allegiance is positive then a good partition was made. The partitioning continues recursively until a new partition no longer contributes to a positive allegiance.

Global View – **[**~~We may want a global view of a network that allows us to study relationships among classes~~.**]**
{A global view of a network allows the study of the relationships among classes.**}**

Cohesion – **[**~~Solidarity, shared norms, identity, collective behavior, and social cohesion are considered to emerge from social relations~~**]**. The **[**~~first~~**]** **{**main**}** concern of social analysis is to investigate **[** ~~who is related and who is not~~**]** **{**which actors are related and which are not**}**. The general hypothesis assumes that people who match on social characteristics will interact more often and people who interact regularly will foster a common attitude or identity.

Social networks usually contain dense pockets of people who stick together. They are called cohesive subgroups and usually more than interaction joins the people involved. People who interact intensively are likely to consider themselves as a social group. This phenomenon is known as homophily:**[** ~~"birds of a feather flock together~~"**]**. **{**This is similar for computer networks; nodes on the network which interact more intensively are usually considered to be a part of a subnet (a partition of a network) or a local area network.**}**

There are several techniques that detect cohesive subgroups in social networks. All of these techniques are based on the ways in which the vertices are interconnected. These techniques are used to investigate whether a cohesive group represents an emergent or established social group.

[This paragraph on the concept of "allegiance" appears to be based on original work of John Rigsby, who is not a co-author, but whose contribution is acknowledged.

See: ACTOR ALLEGIANCE AND BLOCKMODEL STRENGTH by John Rigsby and Dr. Jeff Solka

http://www.interfacesymposia.org/I04/I2004Proceedings/RigsbyJohn/RigsbyJohn.paper.pdf]

De Nooy, Mrvar and Batagelj Section 2.4.2, p. 39

…[W]e may also zoom out to obtain a global view. Now, we are no longer interested in each individual vertex but we want to study relations between classes …

Part II – Cohesion, p. 59
Solidarity, shared norms, identity, collective behavior, and social cohesion are considered to emerge from social relations. Therefore, the first concern of social network analysis is to investigate who is related and who is not… The general hypothesis here states that people who match on social characteristics will interact more often and people who interact regularly will foster a common attitude or identity.

Section 3.1, p. 61
Social networks usually contain dense pockets of people who "stick together." We call them cohesive subgroups and we hypothesize that the people involved are joined by more than interaction. … people who interact intensively are likely to consider themselves a social group…. This phenomenon is called homophily: birds of a feather flock together…

[W]e present a number of techniques to detect cohesive subgroups in social networks, all of which are based on the ways in which vertices are interconnected. These techniques [have as] ultimate goal... to test whether structurally delineated subgroups differ with respect to other social characteristics,for instance, norms, behavior, or identity… May we conclude that a *cohesive* subgroup represents an emergent or established social group?

Wegman et al – p. 21; Rezazad, p. 16

Social cohesion is used to describe structural concepts of density and connectedness. Density refers to the number of links between vertices. A network is strongly connected if it contains paths between all of its vertices and is weakly connected when semi-paths connect all of its vertices. Connected networks and networks with high average degree are thought to be more cohesive. **[**~~There are several techniques to detect cohesive subgroups based on density and connectedness~~.**]**

Affiliations – Membership in an organization or participation in an event is a source of social ties. An affiliation **[**~~is~~**] {**may be**}** a relationship between people and an organization **{**or a relationship between nodes in a network and a part of that network or another network**}**.
[~~Affiliations are often institutional or structural and tend to be less personal as they result from private choices to a lesser degree than sentiments and friendship~~.**]**

Brokerage – Social relations can be considered to be channels that transport information, services, or goods between people or organizations. From a bird's eye view, social structure helps to explain how information, goods or even attitudes and behavior diffuses within a social system. Network analysis reveals social structure and helps to trace the routes that goods and information may follow. Some social structures permit rapid diffusion of information, whereas others contain sections that are difficult to reach. **[**We can also**] {**There may be a **}** focus on the position of specific people **{**, nodes**}** or organizations within the network. In general, being well connected is advantageous. Contacts are necessary to have access to information and **[**help**] {** support **}**. The number and intensity of **{**a person's**] {**an actor's**}** ties are called **{**his or her**} [**its**]** sociability or social capital.

[~~Social capital is known to correlate positively to age and education in Western societies~~.**] {** Social capital correlates positively to various characteristics about the actors.**}**
Some **[**~~people~~**] {**actors**}** occupy central or strategic positions within the system of channels and are crucial for the transmission process.

Section 3.7, p. 77

[S]ocial cohesion was linked to the structural concepts of density and connectedness. Density refers to the number of links between vertices. A network is strongly connected if it contains paths between all of its vertices and it is weakly connected when all of its vertices are connected by semipaths. Connected networks and networks with high average degree are thought to be more cohesive. ….There are several techniques to detect cohesive subgroups based on density and connectedness …

Section 5.1, p. 101

Membership of an organization or participation in an event is a source of social ties… Note that we studied relations among actors of one kind: relations between people or between organizations, but not between people and organizations. Now, we focus on the latter type, which is called an affiliation. Affiliations are often institutional or "structural,"… They are less personal and result from private choices to a lesser degree than sentiments and friendship.

Part III, p. 121

In quite a few theories, social relations are considered channels that transport information, services, or goods between people or organizations. In this perspective, social structure helps to explain how information, goods, or even attitudes and behavior diffuses within a social system. Network analysis reveals social structure and helps to trace the routes that goods and information may follow. Some social structures permit rapid diffusion of information, whereas others contain sections that are difficult to reach. This is a bird's-eye view of an entire social network. However, we can also focus on the position of specific people or organizations within the network. In general, being well connected is advantageous. Contacts are necessary to have access to information and help. The number and intensity of a person's ties are called his or her sociability or social capital,

which is known to correlate positively to age and education in Western societies.

Some people occupy central or strategic positions within the system of channels and are crucial for the transmission process.

Wegman et al – p. 21 cont.; Rezazad, p. 17

[~~Some~~ ~~positions may exert pressure on their occupants, but they also yield power and profit.~~ ~~The direction of ties is not very important in social network structures that capture the exchange of information.~~ **]**

Centrality – **[**~~This is one of the oldest concepts in network analysis.~~**]** Most social networks contain **[**~~people or organizations~~**]** **{**actors**}** that are central. Because of their position, they have better access to information, and better opportunity to spread information. This is known as the ego-centered-approach to centrality. The network is centralized from socio-centered perspective. The notion of centrality refers to the positions of individual vertices within the network, while centralization is used to characterize an entire network. A network is highly centralized if there is a clear boundary between the center and the periphery. In a highly centralized network, information spreads easily, but the center is indispensable for the transmission of information.

There are several ways to measure the centrality of vertices and the centralization of networks.

Wegman et al – p. 22; Rezzad - p. 17

The concepts of vertex centrality and network centralization are best understood by considering undirected communication networks. If social relations are channels that transmit information between **[**~~people~~**]**, **{**actors**}** central **[**~~people~~**]** **{**actors**}** are those **[**~~people~~**]** **{**actors**}** who have access to information circulating in the network or who may control the circulation of information.

Closeness - The accessibility of information is linked to the concept of distance. If **[**~~you are~~**]** **{** a node A is**}** closer to the other **[**~~people~~**]** **{**nodes**}** in the network, the paths that information has to follow to reach **[**~~you~~**]** **{**node A**}** are shorter, so it is easier for **[**~~you~~**]** **{**node A**}** to acquire information. If **[**~~we take into account~~**]** only direct neighbors **{**were taken into account, then**}** the number of neighbors (the degree of a vertex in a simple undirected network) is a simple measure of centrality. If **[**~~we also want to consider~~**]** other indirect contacts **{** were considered, then **}** **[**~~we use~~**]** closeness centrality **{**could be used **}**, which measures **[**~~our~~**]** **{** the **}** distance to all other vertices in the network.

Section 6.1, p. 123

Such positions may put pressure on their occupants, but they may also yield power and profit. …[W]e focus on social networks as structures that allow for the exchange of information. In this approach, the direction of ties is not very important.

[W]e present the concepts of centrality and centralization, which are two of the oldest concepts in network analysis. Most social networks contain people or organizations that are central. Because of their position, they have better access to information and better opportunities to spread information. This is known as the ego-centered approach to centrality. Viewed from a sociocentered perspective, the network as a whole is more or less centralized. Note that we use centrality to refer to positions of individual vertices within the network, whereas we use centralization to characterize an entire network. A network is highly centralized if there is a clear boundary between the center and the periphery. In a highly centralized network, information spreads easily but the center is indispensable for the transmission of information.

In this chapter, we discuss several ways of measuring the centrality of vertices and the centralization of networks…

Section 6.5, p. 133

The concepts of vertex centrality and network centralization are best understood by considering undirected communication networks. If social relations are channels that transmit information between people, central people are those who either have quick access to information circulating in the network or who may control the circulation of information.

The accessibility of information is linked to the concept of distance: if you are closer to the other people in the network, the paths that information has to follow to reach you are shorter, so it is easier for you to acquire information. If we take into account direct neighbors only, the number of neighbors (the degree of a vertex in a simple undirected network) is a simple measure of centrality. If we also want to consider indirect contacts, we use closeness centrality, which measures our distance to all other vertices in the network.

Wegman et al – p. 22 cont.; Rezazad, p. 18

The closeness centrality of a vertex is higher if the total distance to all other vertices is shorter.

Betweeness - The importance of a vertex to the circulation of information is captured by the concept of betweenness centrality. From this perspective, a **[**~~person~~**]** **{**node**}** is central if **[**~~he or she~~**]** **{**it**}** is a link in more information chains between other people in the network. High betweenness centrality indicates that a **[**~~person~~**]** **{**link**}** is an important intermediary in the communication network. Information chains are represented by geodesics and the betweenness centrality of a vertex is simply the proportion of geodesics between other pairs of vertices that include the vertex. **[**~~The centralization of a network is higher if it contains very central vertices as well as very peripheral vertices.~~**]**

Section 6.5, p. 133 cont.

The closeness centrality of a vertex is higher if the total distance to all other vertices is shorter.

The importance of a vertex to the circulation of information is captured by the concept of betweenness centrality. In this perspective, a person is more central if he or she is a link in more information chains between other people in the network. High betweenness centrality indicates that a person is an important intermediary in the communication network. Information chains are represented by geodesics and the betweenness centrality of a vertex is simply the proportion of geodesics between pairs of other vertices that include the vertex. The centralization of a network is higher if it contains very central vertices as well as very peripheral vertices.

References

1. Hadi Rezadad, *Enhancement of Network Robustness and Efficiency through Evolutionary Computing, Statistical Computation and Social Network Analysis,* PhD dissertation, George Mason University, 2008.
2. Edward J. Wegman, David W. Scott and Yasmin H. Said; *Ad Hoc Committee Report on the "Hockey Stick" Reconstruction* A Report to Chairman Barton, House Committee on Energy and Commerce and to Chairman Whitfield, House Subcommittee on Oversight and Investigations, 2006.
3. Wikipedia article – **Social Networks** (January 2, 2006 version) - Available online at: http://en.wikipedia.org/w/index.php?title=Social_network&oldid=33590649
4. Stanley Wasserman and Katherine Faust**, Social Network Analysis: Methods and Applications**. New York, Cambridge University Press, 1994.
5. Wouter de Nooy, Andrej Mrvar and Vladimir Batagelj; **Exploratory Social Network Analysis with Pajek.** New York, Cambridge University Press, 2005.
6. Yasmin H. Said, Edward J.Wegman,Walid K. Sharabati and John T. Rigsby; *Social networks of author–coauthor relationships*; **Computational Statistics and Data Analysis**; 52 (2008) 2177 – 2184