Structural System Property: $_{atis}$Completeness

(*Structural system properties* are those properties that are part of the theory and describe patterns of system and negasystem connectedness. The structural properties define the topology of the system, and every affect relation defines a topology on the system.)

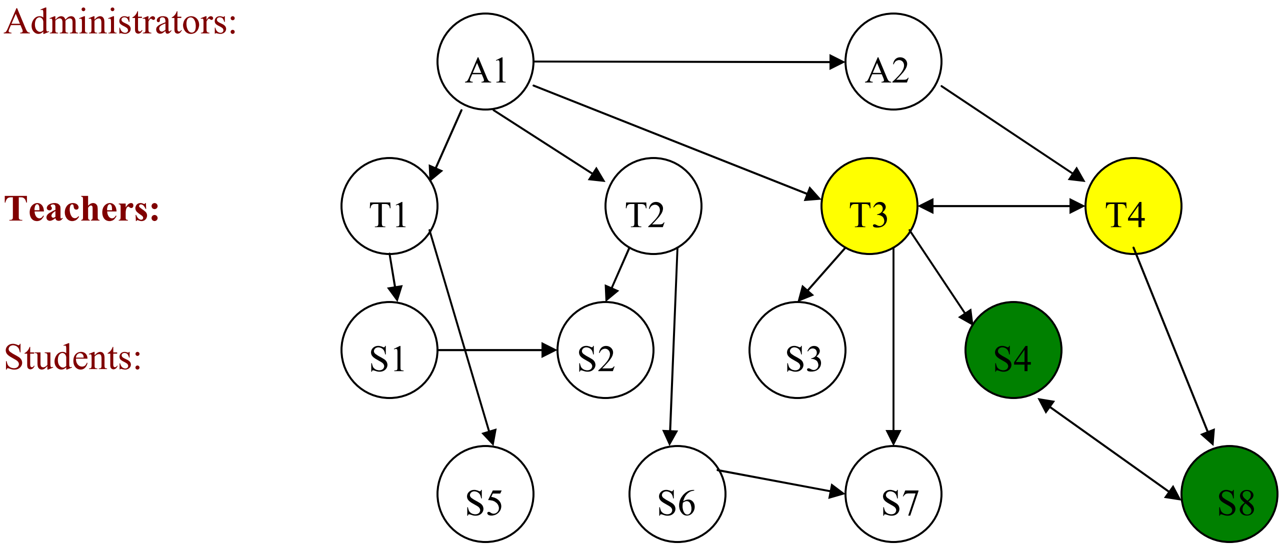
Completeness, $_{CC}\mathbb{S}$, $=_{df}$ a *partition*, $\mathcal{Y} = (\mathcal{V} \subset \mathcal{G}_{\mathcal{O}}, \mathcal{R} \subset \mathcal{G}_{\mathcal{A}})$, characterized by affect-relations incident to pair-wise directed components.

$$_{CC}\mathbb{S} =_{df} \mathcal{Y} \mid \forall \mathbf{u},\mathbf{v} \in \mathcal{Y}(\mathcal{V}) \exists \mathbf{e} \in \mathcal{Y}(\mathcal{R})[\mathbf{e} = (\mathbf{u},\mathbf{v}) \supset \exists \mathbf{e}'[\mathbf{e}' = (\mathbf{v},\mathbf{u})] \wedge \ell(\mathbf{e}) \geq 1]$$

$\mathcal{M}$: **Completeness measure**, $\mathcal{M}(_{CC}\mathbb{S})$, $=_{df}$ a measure of pair-wise directed component affect-relations.

$$\mathcal{M}(_{CC}\mathbb{S}) =_{df} \left\{[\sum_{i=1,\ldots,n} \log_2(\prod_{j=1,\ldots,m} |\ell(\mathbf{e}) \mid \mathbf{e} = (\mathbf{u},\mathbf{v}) \supset \exists \mathbf{e}'[\mathbf{e}' = (\mathbf{v},\mathbf{u})] \wedge \ell(\mathbf{e}) \geq 1|_j)_i] \div \mathbf{C}\right\} \times 100$$

Complete Connectivity in a School System



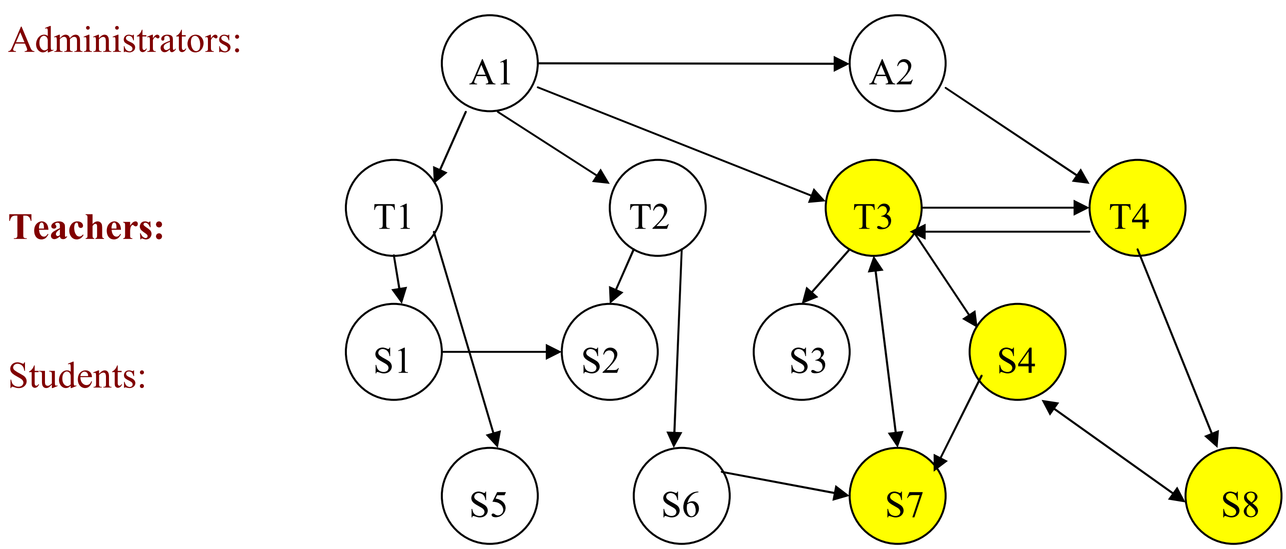
Affect Relation: *Controls Activities of*
In this system, there are 2 subsystems and 4 system components that *Control Activities of* other components with respect to *Complete Connectivity*. Since there is only 1 affect-relation and 14 components, then the total possible affect relation paths is $\boldsymbol{P}[\mathcal{Z}(\mathbb{S}_0)] = 236{,}975{,}181{,}590$; and therefore, $\mathbf{C} = \log_2(\boldsymbol{P}[\mathcal{Z}(\mathbb{S}_0)]) \approx 37$. There are 4 components related to *Complete Connectivity*. To analyze this system in more detail, this system can be reduced to a single component for each subsystem to determine the properties of the resulting system. There are 4 paths related to *Completeness*.

Therefore: $\mathcal{M}({}_{CC}\mathbb{S}) \approx 10.59$.

The previous system has been modified to make only one subsystem that is completely connected as shown by the graph below. In this new system, there are 5 system components that *Control Activities of* other components with respect to *Complete Connectivity*. Since there are 14 components, then the total possible affect relation paths is ***P***[Z(**S**O)] = 236,975,181,590; and therefore, log2(***P***[Z(**S**O)]) ≈ 37.786.

This complete connectivity can be reduced to a single component, as shown on the following page, to determine the properties of the resulting system. There are 32 paths related to *Completeness* in this system.

***Complete Connectivity* in a School System**

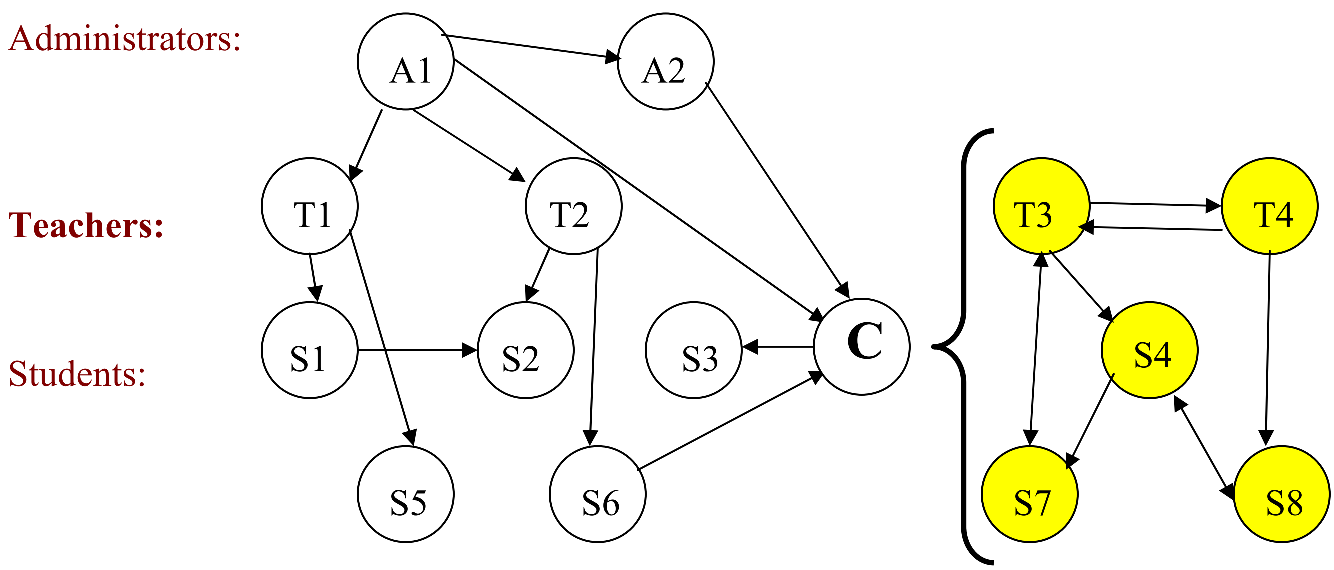


Therefore: $\mathcal{M}({}_{CC}\mathbb{S}) \approx$ **85.11.**

The previous system has been modified, as indicated by the bracket, to make only one subsystem that is completely connected. The 5 components have been reduced to one, C1. In this new system, there are 0 system components that *Control Activities of* other components with respect to *Complete Connectivity*. Since there are 10 components, then the total possible affect relation paths is ***P***[Z(**S**O)] = 9,864,090; and therefore, log2(***P***[Z(**S**O)]) ≈ 23.234.

One advantage of reducing the system to 0-Connectivity is to determine the effect of the subsystem on the system. This might be of value; e.g., when analyzing a system to see whether the isolation of a subsystem would result in a system behavior that is more desirable. Also, notice that it is irrelevant which component of the isolated subsystem each of A1, A2, S3,and S6 were related to, all that is of concern is that they were related to one of the subsystem components.

***Complete Connectivity* in a School System**



Therefore: $\mathcal{M}({}_{CC}\mathbb{S}) \approx 0.00$.

Analysis Considerations

It is significant to note that the Complete Connectivity of the three previous systems are distinctly different, the first having a measure of 10.59, the second of 85.11, and the third of 0.00.

It is clear from their measures, however, that each would have a different impact on the entire system. Therefore, although subsystems can be reduced to single components, it is important to also determine the effect of each subsystem on the entire system, or to weight the reduced component to reflect their impact.

Analyses that eliminate subsystems are of value, however, to demonstrate the impact of eliminating just such subsystem. For example, in school systems that are experiencing financial difficulties, the first program eliminations are extracurricular activities, art and music, or some other programs that are considered “non-essential.” A system analysis may demonstrate otherwise—or may not and such programs should be cut to conserve finances.