



Actor Allegiance and Blockmodel Strength

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Agenda

- Blockmodel
- Necessity
- Allegiance
- Toy Example
- Real Example
- Conclusions

Acknowledgments

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Blockmodel

- D - directed graph
- E - edges(ties)
- V - vertexes(actors)
- $P = \{P_1, \dots, P_k\}$ - Partitions
- $B = \{B_{1,1}, B_{1,2}, \dots, B_{n,n-1}, B_{n,n}\}$ - Blockmodel
 - $B_{i,j}$, when $i \neq j$ - ties from actors in partition i to partition j
 - $B_{i,j}$, when $i = j$ - internal ties between actors in partition i

Necessity

- Measure blockmodel strength change
- Estimate the true number of partitions
- Turn the time separated graphs into a single graph

Allegiance

- is the measure of how much an actor is helping his block
- Help:
 - Having internal edges to other block members
 - $H_{int}(actor) = \sum_{i=N_{P_i}} E(actor)$
 - Not having external edges to non-blockmembers
 - $H_{ext}(actor) = N - N_{P_i} - \sum_{i \neq N_{P_i}} E(actor)$

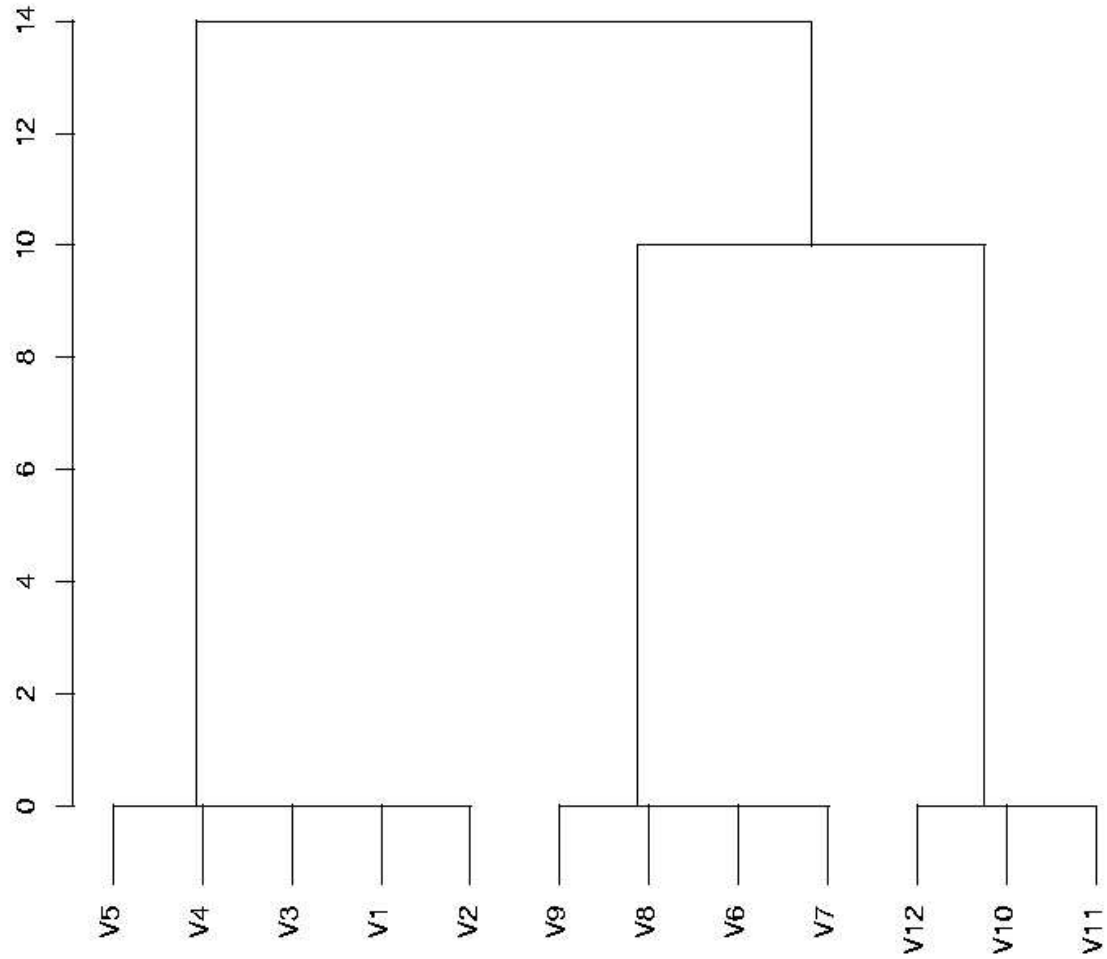
Allegiance Equation

- $A(i) = \alpha[H_{int}(i)] + (1 - \alpha)[H_{ext}(i)]$
- $\alpha \in [0, 1]$ - weight function

Toy Example

	V5	V4	V3	V1	V2	V9	V8	V6	V7	V12	V10	V11
V5	■	■	■	■	■							
V4	■	■	■	■	■							
V3	■	■	■	■	■							
V1	■	■	■	■	■							
V2	■	■	■	■	■							
V9						■	■	■	■			
V8						■	■	■	■			
V6						■	■	■	■			
V7						■	■	■	■			
V12										■	■	■
V10										■	■	■
V11										■	■	■

Equivalence Cluster



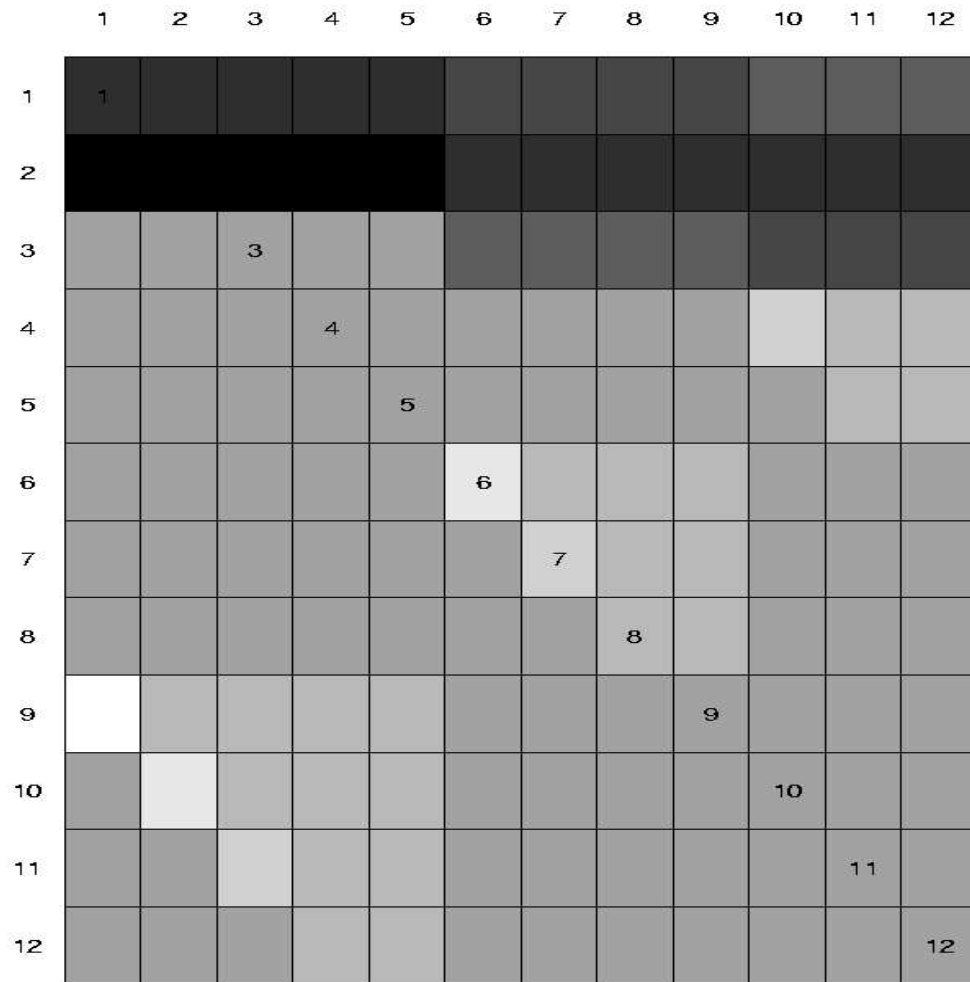
k = 4

	V5	V4	V3	V1	V2	V9	V8	V6	V7	V12	V10	V11
V5	█											
V4	█											
V3	█											
V1	█											
V2	█											
V9						█						
V8						█						
V6						█						
V7						█						
V12										█		
V10										█		
V11										█		

Measure Change in Allegiance

- $DA_{(i,k)} = A_{i,k} - A_{i,k-1}$ for $k > 1$
- At $k = 1$
 - $DA_{(i,1)} = A_{i,1}$
 - Out degree of actor i

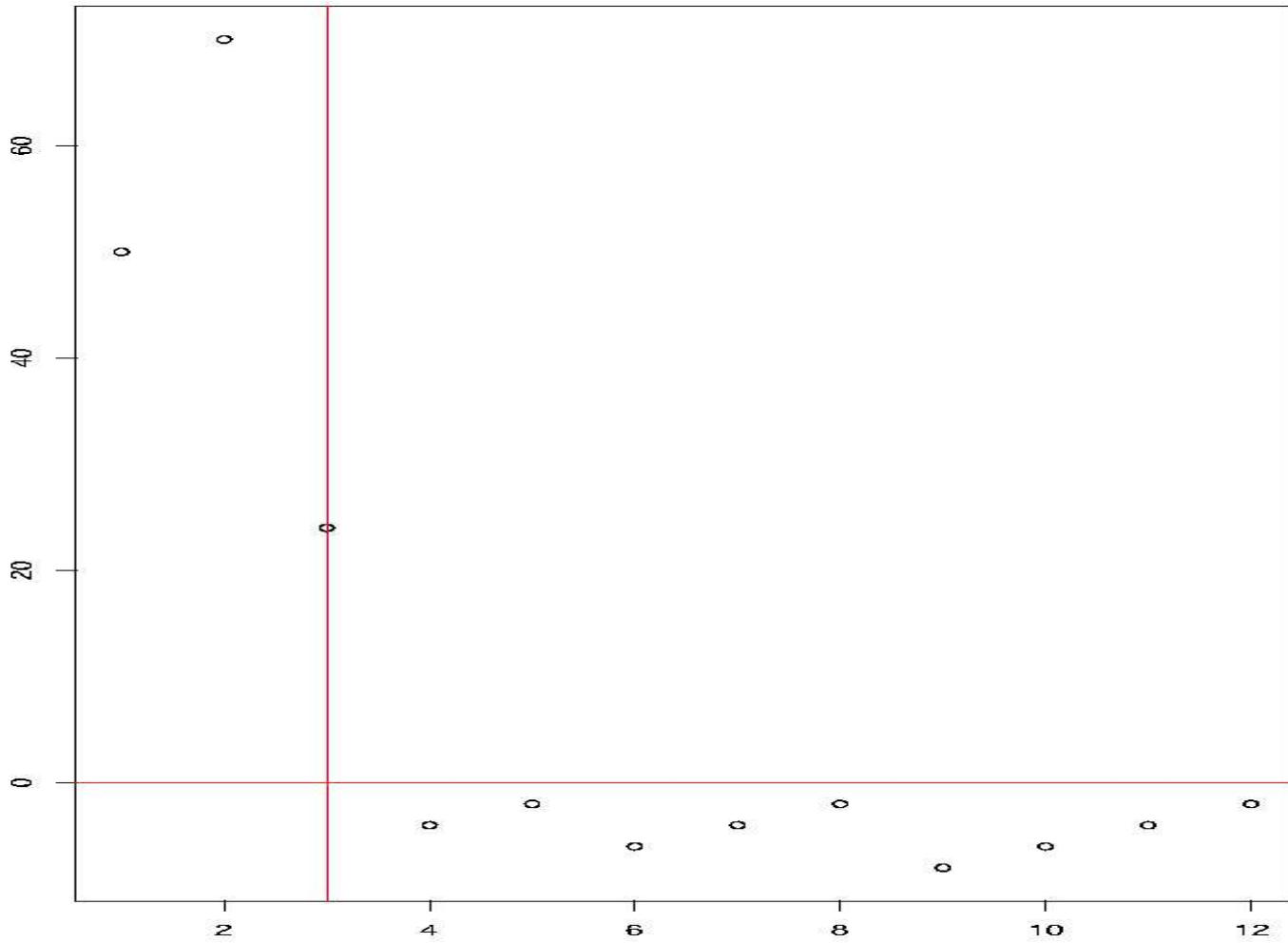
Plot of Change in Allegiance



Sum of Allegiance Change

- $SDA_k = \sum_{i=1}^n DA_{(i,k)}$
- Used to estimate k : the number of partitions

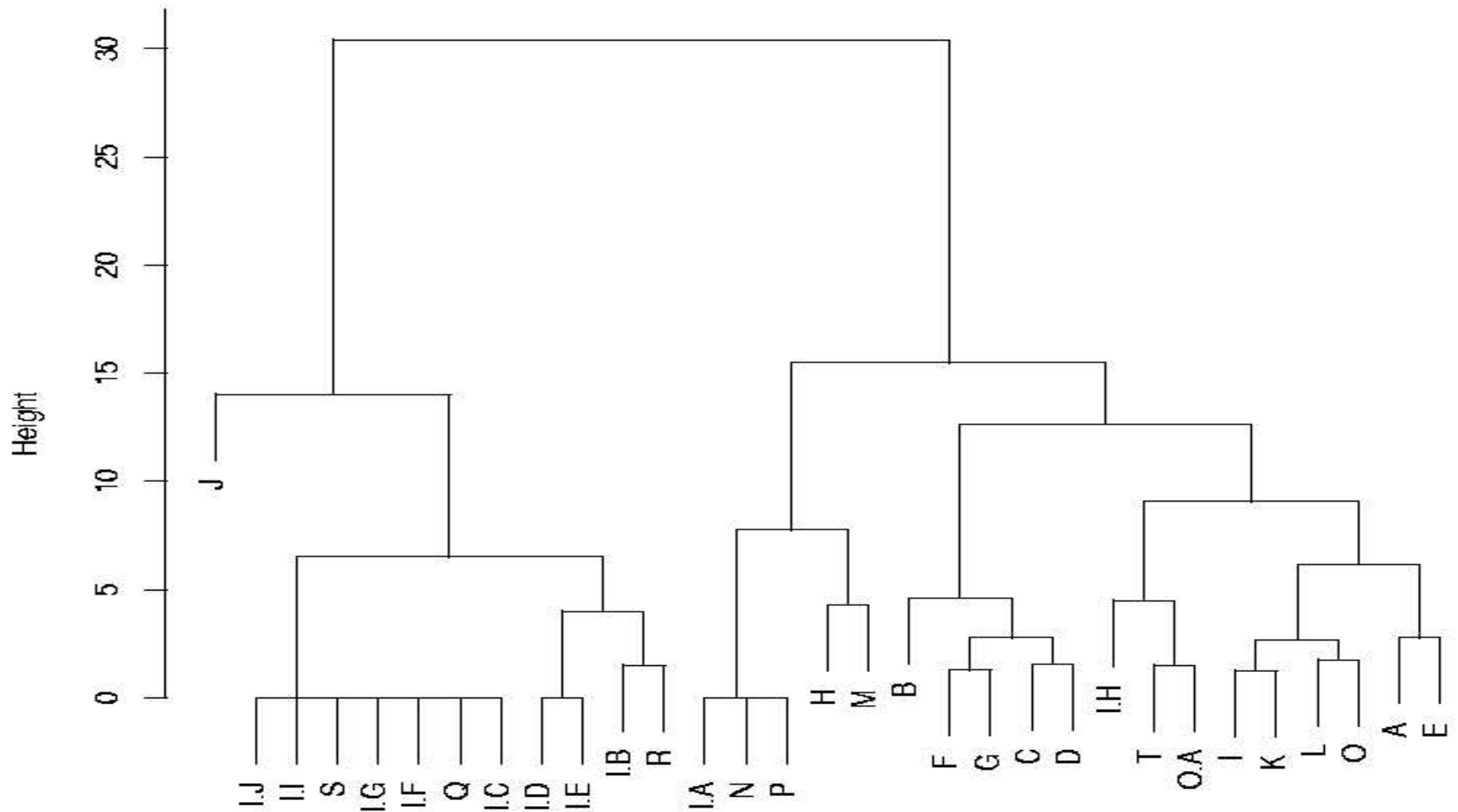
Plot of SDA_k



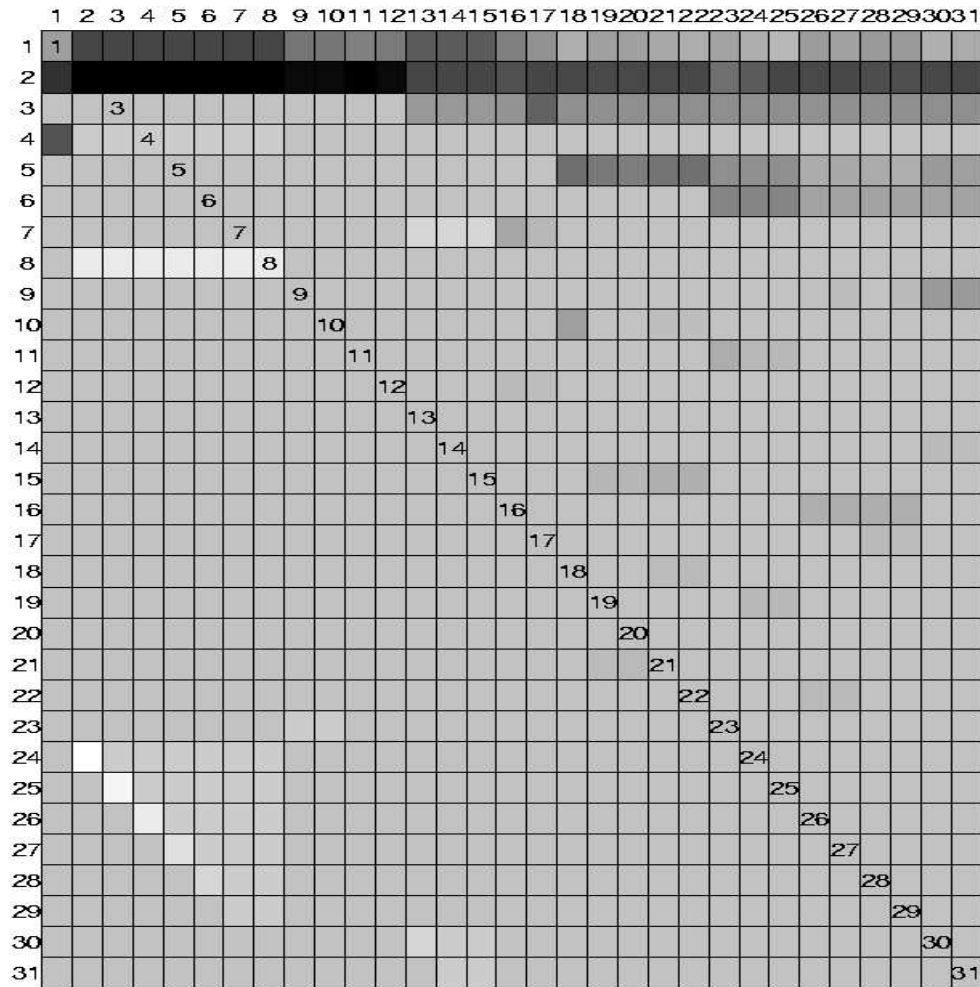
Real Example

- 5 users
- Oct 2002 - Feb 2004
- 3000 total servers accessed over 14 months
- 31 total clients
- 19 LAN computers

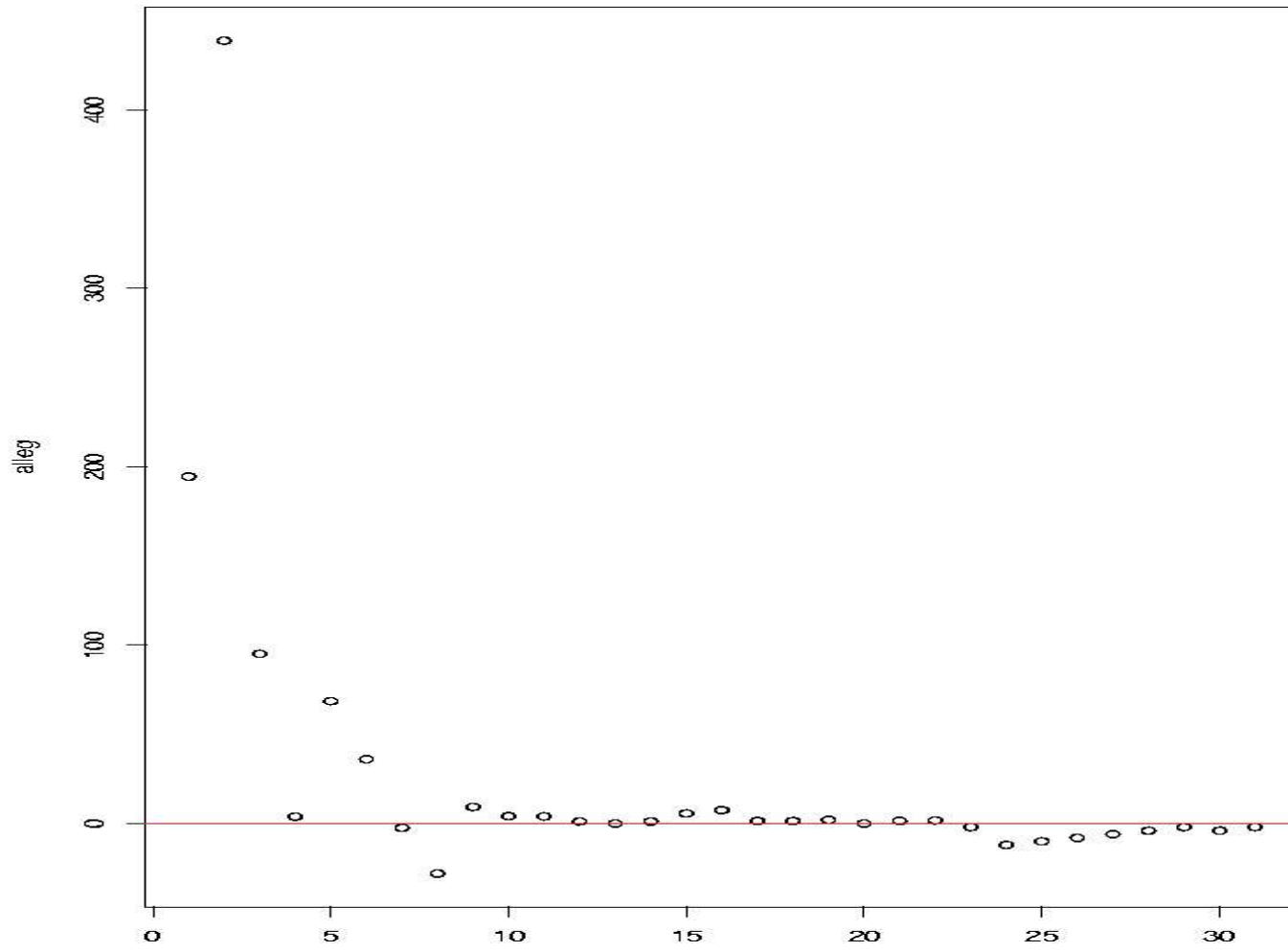
Equivalence Cluster



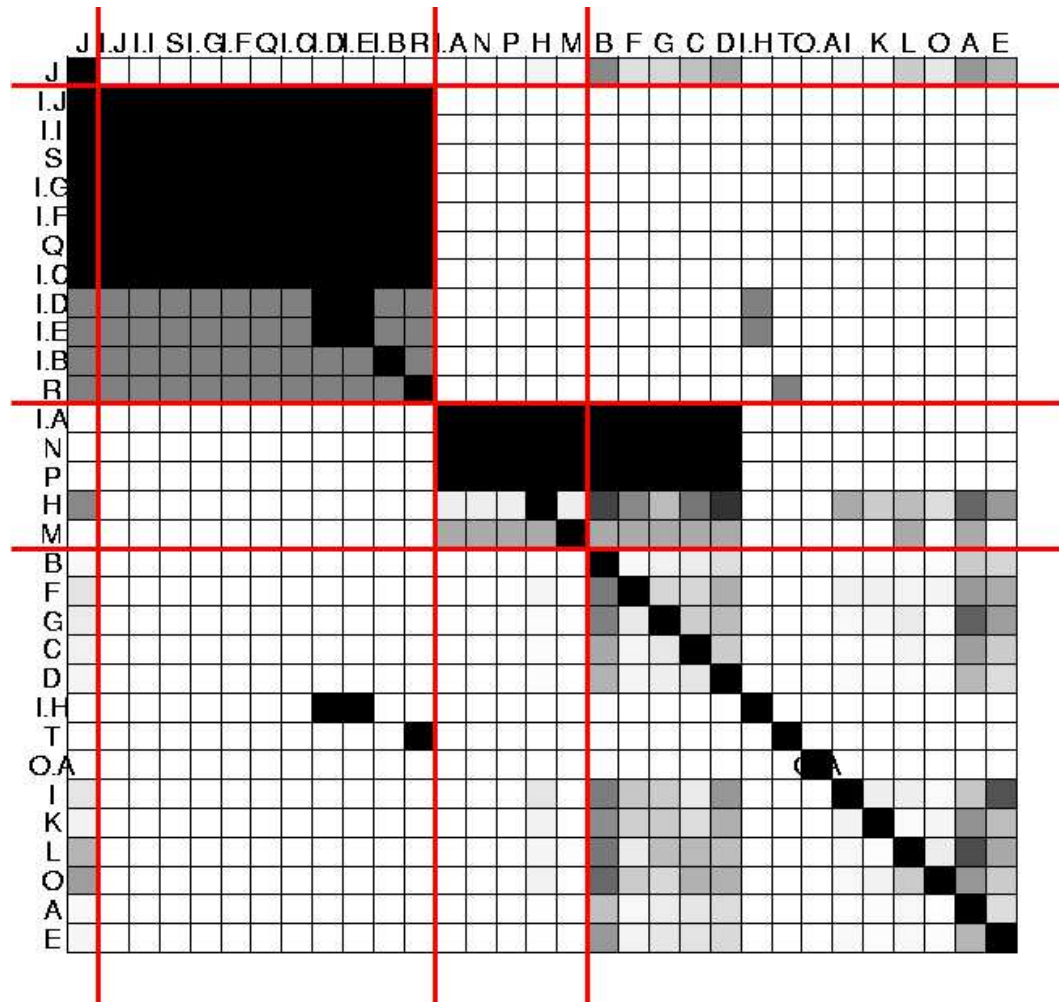
Individual allegiance Change



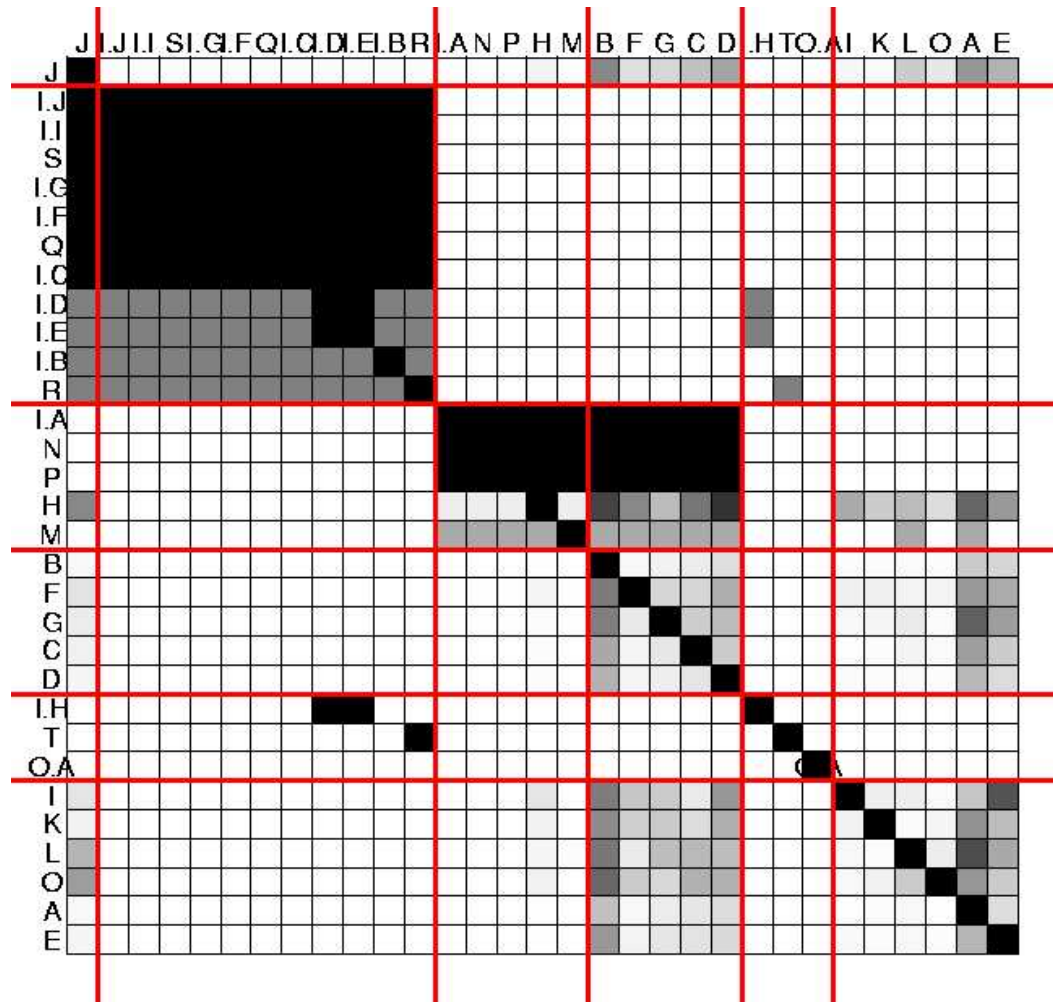
Total Allegiance Change



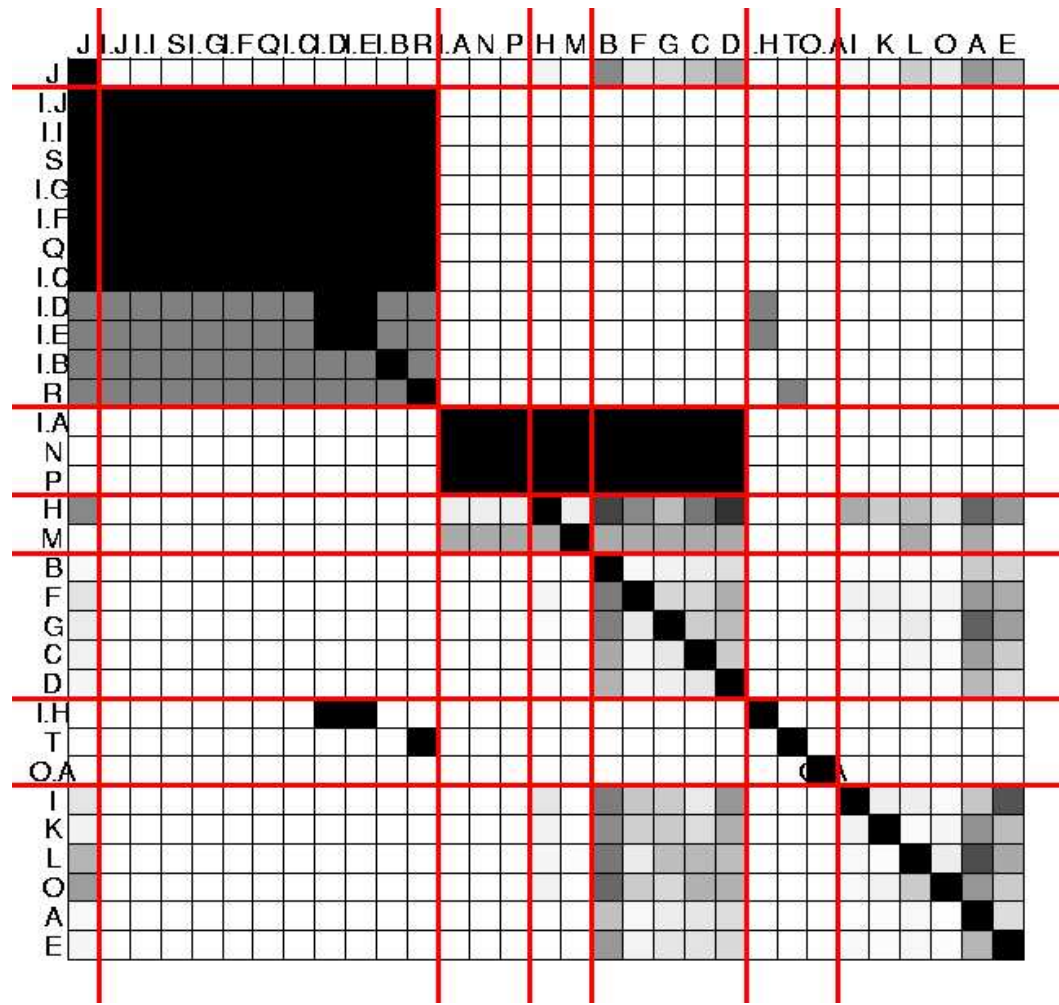
k = 4



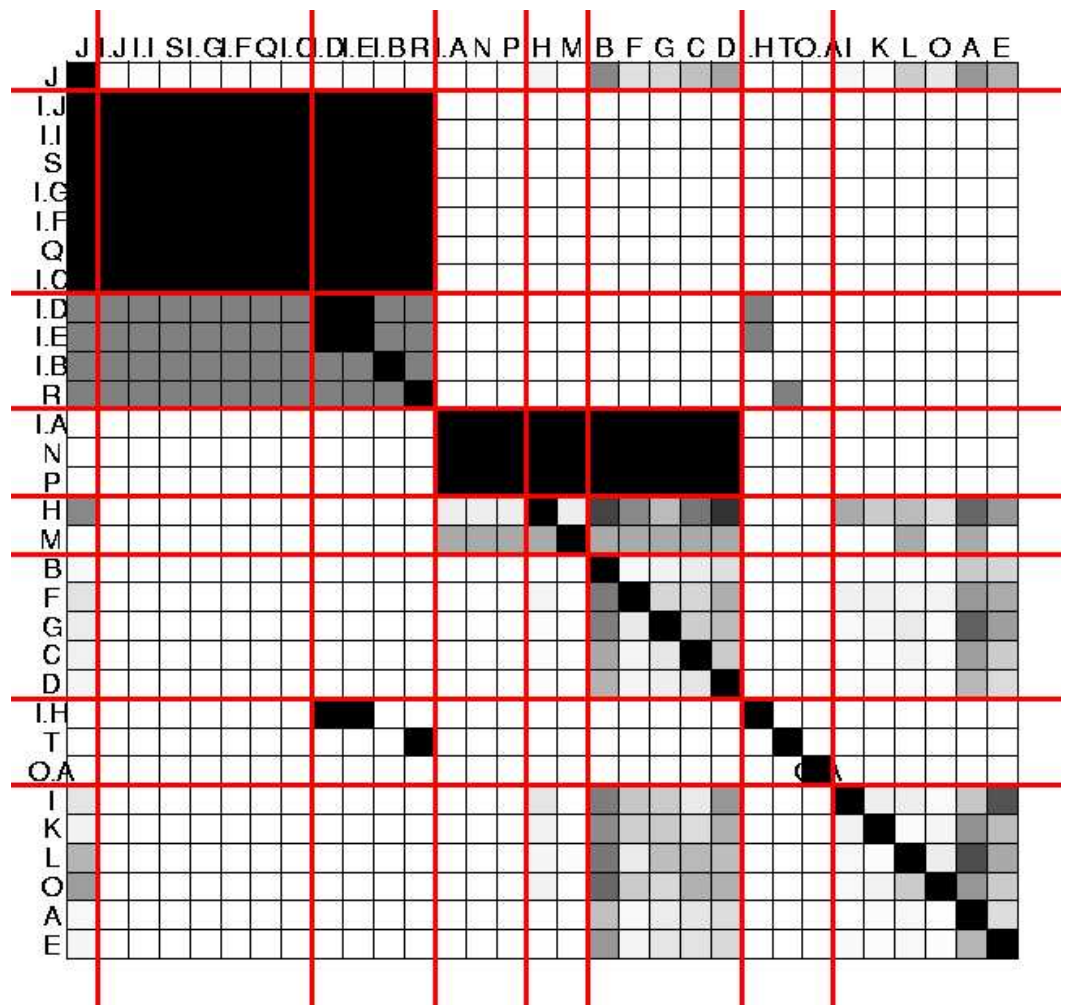
k = 6



$k = 7$



k = 8



Conclusions

- Allegiance
 - Can be used to estimate number of partitions
 - Used to estimate maximum number of partitions at a minimum
 - Gives a measure for block strength change as partition size changes