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Title: groh: profile1 (13.05.2015)

Date: Wed May 13 08:17:11 CEST 2015

Duration: 84:04 min

Pages: 76

Social Gaming / Social Computing SS 2015

PD Dr. Georg Groh

Applied Informatics / Cooperative Systems AICOS

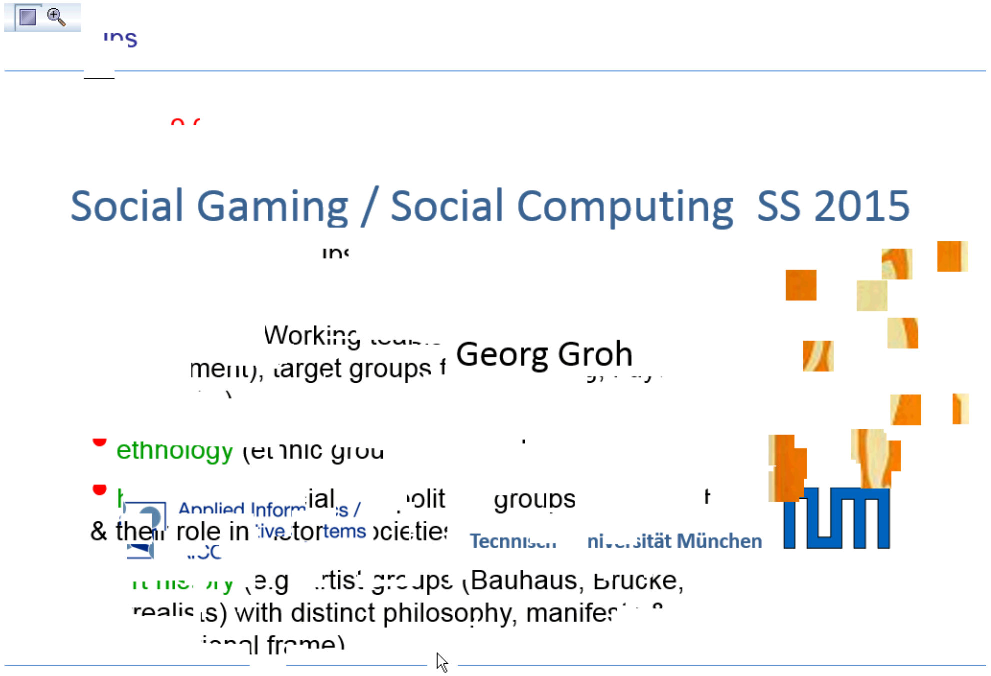
Technische Universität München

Social Gaming / Social Computing SS 2015

Working ... arget groups ... Georg Groh

Applied Informatics / Cooperative Systems AICOS

Technische Universität München



Social Gaming / Social Computing SS 2015

Working ... ment), target groups ... Georg Groh

- ethnology (ethnic grou...
- ...ial ... polit... groups ... & their role in ... societies

...e.g. artist groups (Bauhaus, Brücke, realis...s) with distinct philosophy, manifes... ...ional frame)

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Social Computing SS 2015

Tönnis (18.. ,[3]:

1930s: Small group research (see [4,5,6])

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Georg Groh

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Social Computing SS 2015

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Homans (1950) [6]: "A group is a number ... communicate with one another often over ... that each person is able ... others, not at ... face."

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Georg Groh

- Tönnis (18.. [3]:
- 1930s: Small ... are netsearch (see [4,5,6])
- ...istic: com... , comm...
- individual ... al ro... nd ... group a... es
- ... ment), ... first groups ... (e.g. political party)
- ... group (e.g. family) ... seconda... group
- ethnology (ethnic group)
- ... n view ... groups
- & their ...
- Homans (1950) [6]: "A group is a number ... communicate with ... others ... (Bauhaus, Brucke, ... real ...) with ... that each person ... able to ... others, not at ... face."

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Tönnis (18…[3]:

Su… …ing SS …15

…1930s: … netserk … [4, … a

…cti… g… gr… grou…

…istc… com… spe…

…ividual … al ro… ments … members … group a … are … es

…tur… fri… ers)

…ment), g. friends … ← Groh groups (e.g. political party)

…ary … group (e.g. family … via s … onda … group

- eth… network analysis)

(“my group” … s r

- … hers” … groups

& their …

Homo… groups (F[6]: “A group is … nbe…

…om… … with … both … Bauh… is, Brucke,

…owea… mass”, “… that … person … le

…all”, ….

Tec… Universität München

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& their … group the…

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Social Computing SS 2015

Tönnis (18…[3]:

1930s:

neighborhood in G

intra cluster

compactness: mean average path lengths are small

groups and/or connectivity is high (e.g. political party)

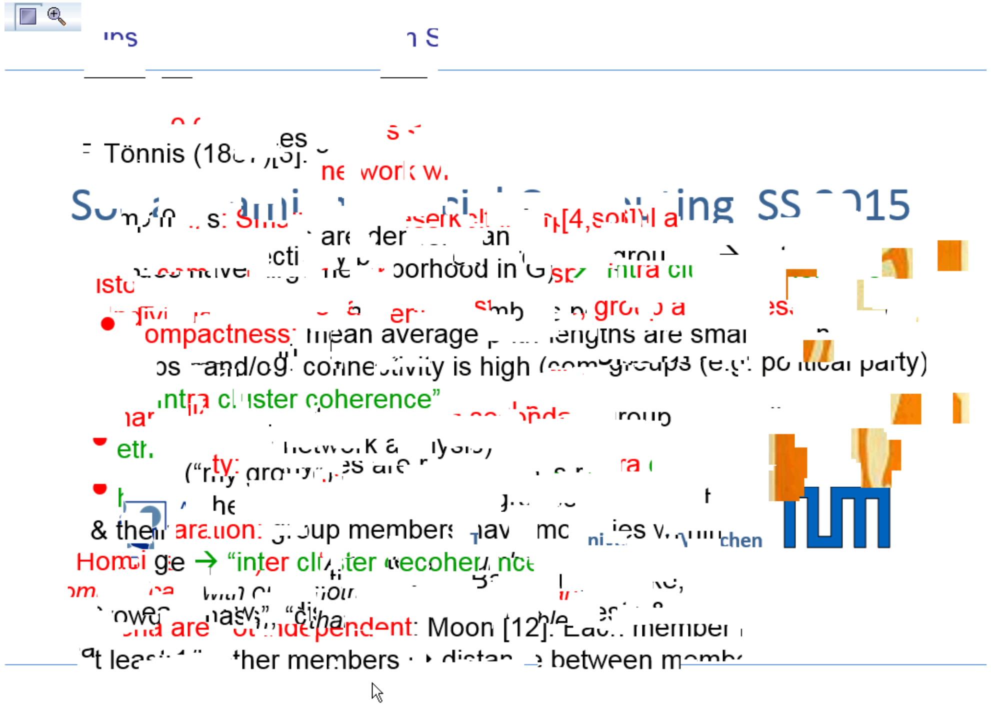
“intra cluster coherence”

network analysis

(“my group”)

separation: group members have more … ies with

Homophily → “inter cluster decoherence”



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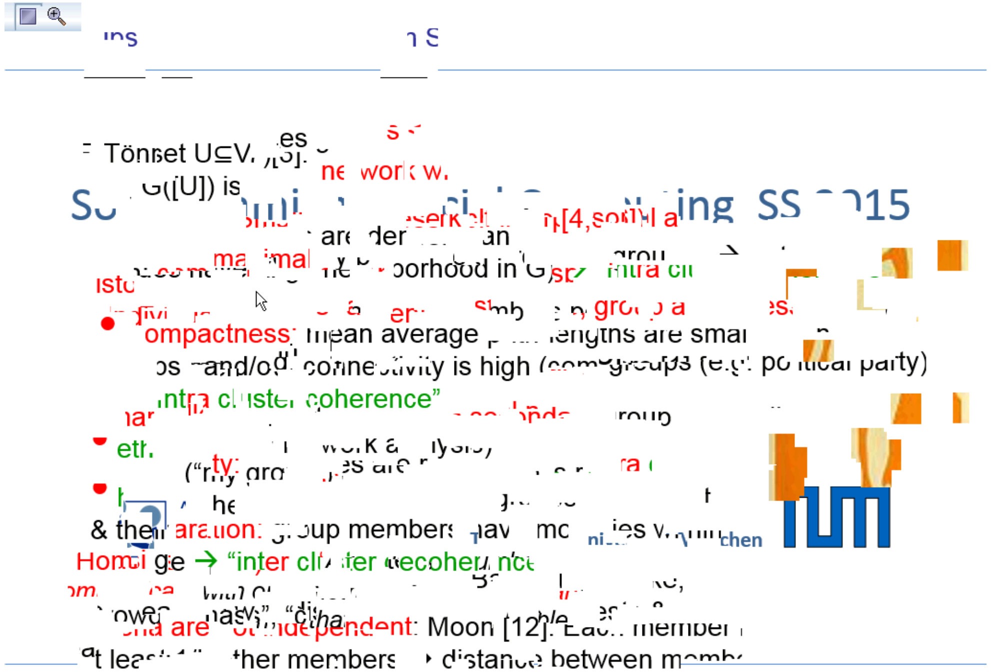
at least … other members … distance between members



Social Computing SS 2015

set U⊆V

G([U]) is

maximal

neighborhood in G

compactness: mean average path lengths are small

groups and/or connectivity is high (e.g. political party)

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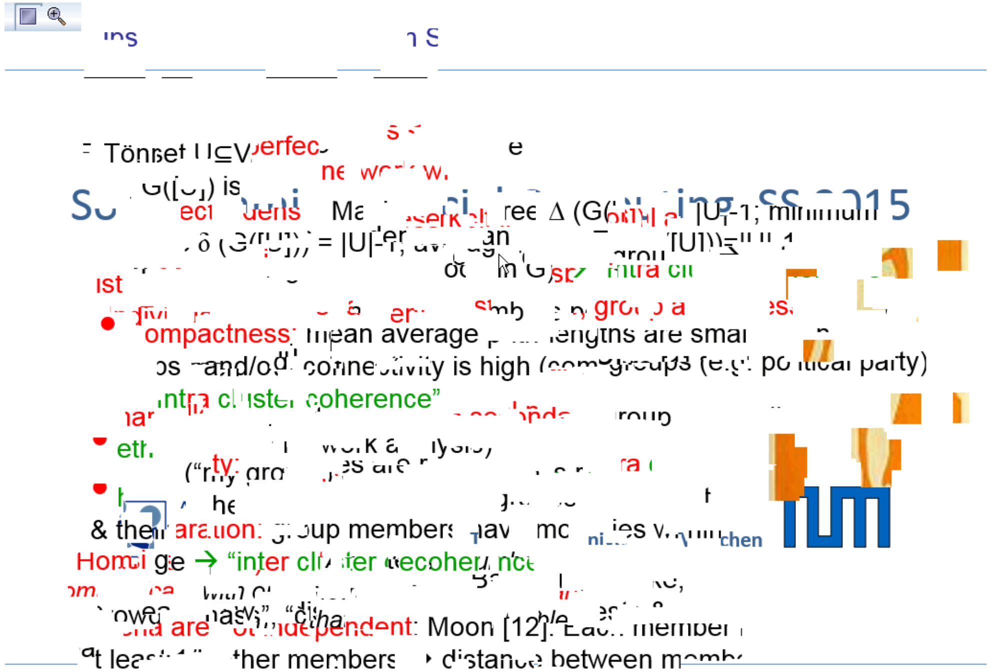

Social Computing SS 2015

set U⊆V perfect

G([U]) is

Max … ree Δ (G([U])) = |U|-1; minimum

δ (G([U])) = |U|-1

compactness: mean average path lengths are small

groups and/or connectivity is high (e.g. political party)

“intra cluster coherence”

separation: group members have more … ies with

Homophily → “inter cluster decoherence”

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at least … other members … distance between members

Tonset U⊆V perfec... e

G([U]) is ... network w...

... ree Δ (G([U])) = |U|-1; minimum

δ (G([U])) = |U|-1; average degree δ (G([U]))= ...

ist

- ...exactly co... members ... gn ... h le...s.
- compactness: mean average ... lengths are smal
- ...and/... connectivity is high ... subgroups ... e.g.: political party)
- intra cluster coherence”

etr.

(“rally group ... ty ...

& their ... aration: group members have ... then

Homog... ge → “inter cluster decoherence”

...ower ... easy”, ... independent: Moon [12]. Each member

at least ... other members ... distance between memb...

If |U|=k then G([U]) is ... (k-1) vertex- and edge-connected

G is n-vertex connected if |V| > n and G – X is connected for X ⊆ V with |X| < n;

G is n-edge connected if |V| ≥ 2 and G – Y is c... Y ⊆ E with |Y| < n;

SS 2015

$|E| > |V|^2/2\ (k-2)/(k-1)$ then

(k-1)

political party)

G is n-vertex connected if |V| > n and G – X is connected for X ⊆ V with |X| < n;

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SS 2015

$|V|^2/2\ (k-2)/(k-1)$ then

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Each clique U

political party)

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SS 2015

$|V|^2/2\ (k-2)/(k-1)$ then

is N-clique

is N-clan iff

Each clique U

political party)

G is n-vertex connected if |V| > n and G – X is connected for X ⊆ V with |X| < n;

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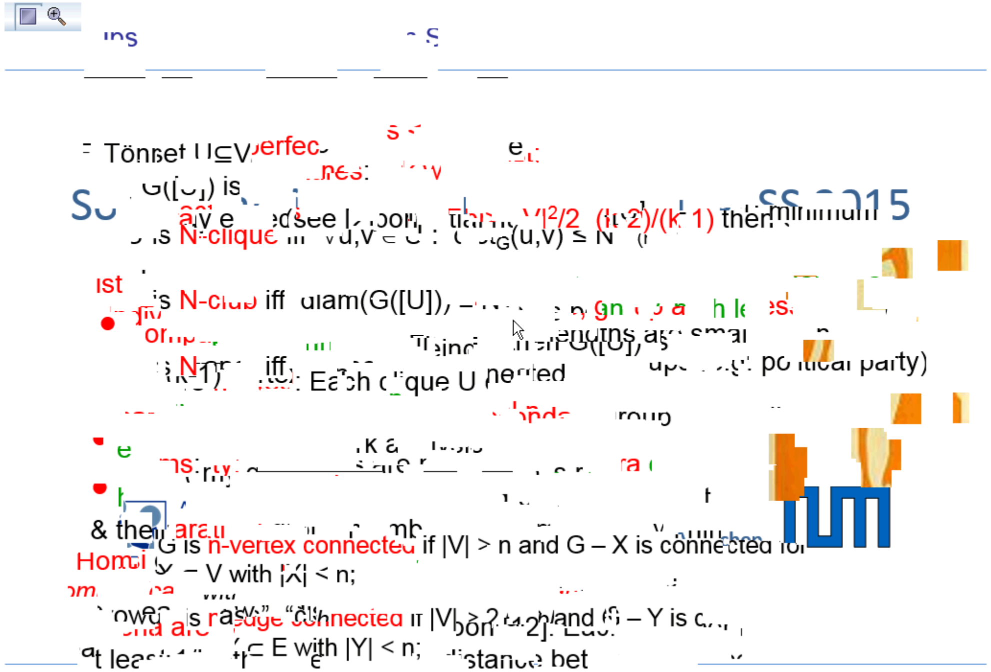


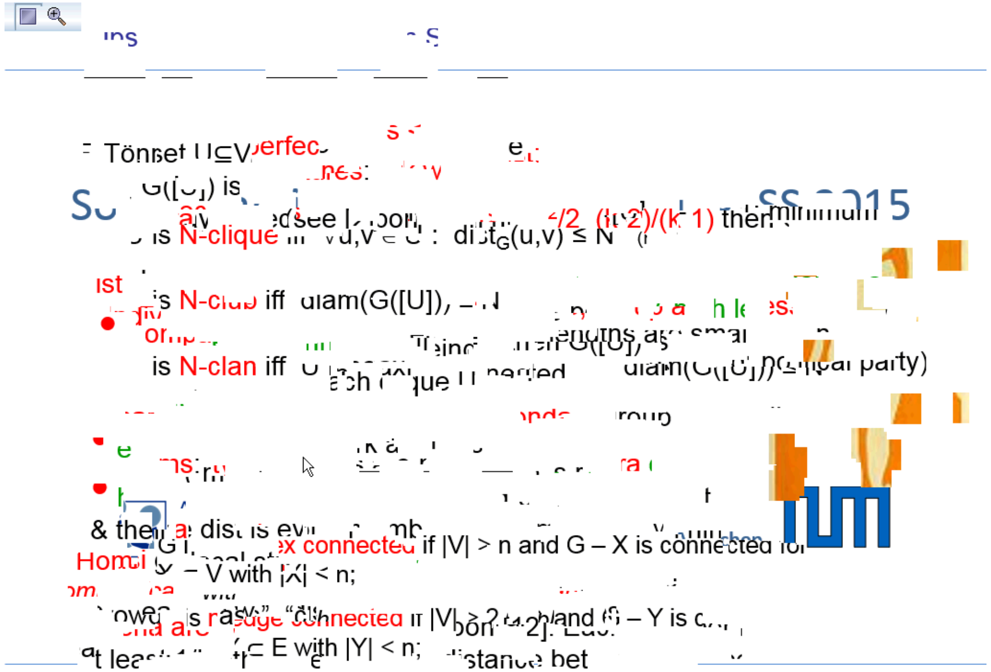
SS 2015

is N-clique iff ∀u,v ∈ U : $dist_G(u,v) \le N$

is N-club iff diam(G([U])) ≤ N

G is n-vertex connected if |V| > n and G – X is connected for X ⊆ V with |X| < n;

is n-edge connected if |V| ≥ 2 and G – Y is c… Y ⊆ E with |Y| < n;



SS 2015

is N-clique iff ∀u,v ∈ U : $dist_G(u,v) \le N$

is N-clan iff U is N-clique and diam(G([U])) ≤ N

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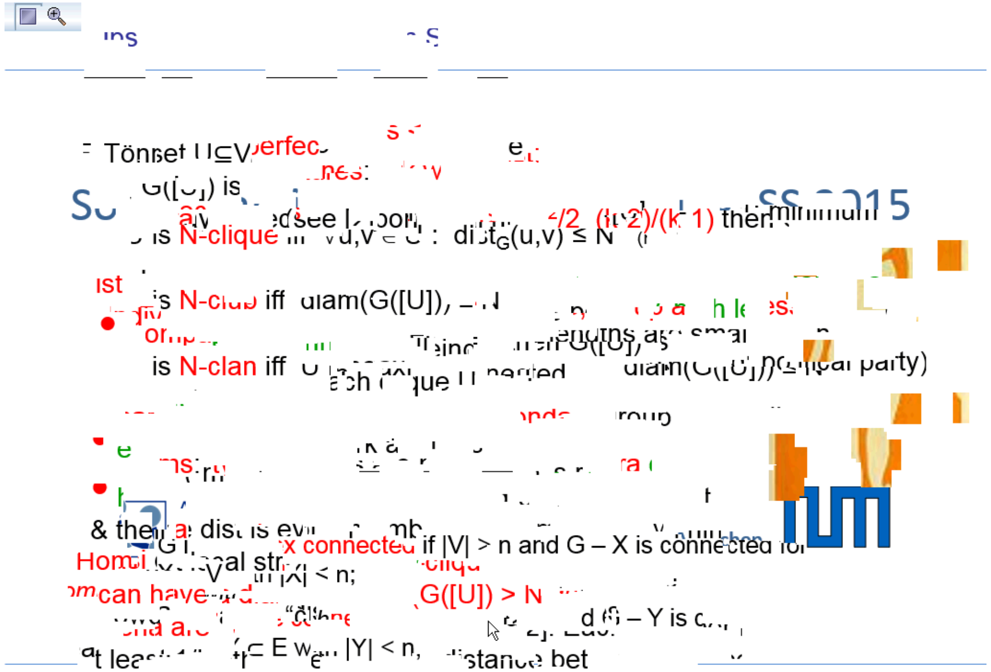
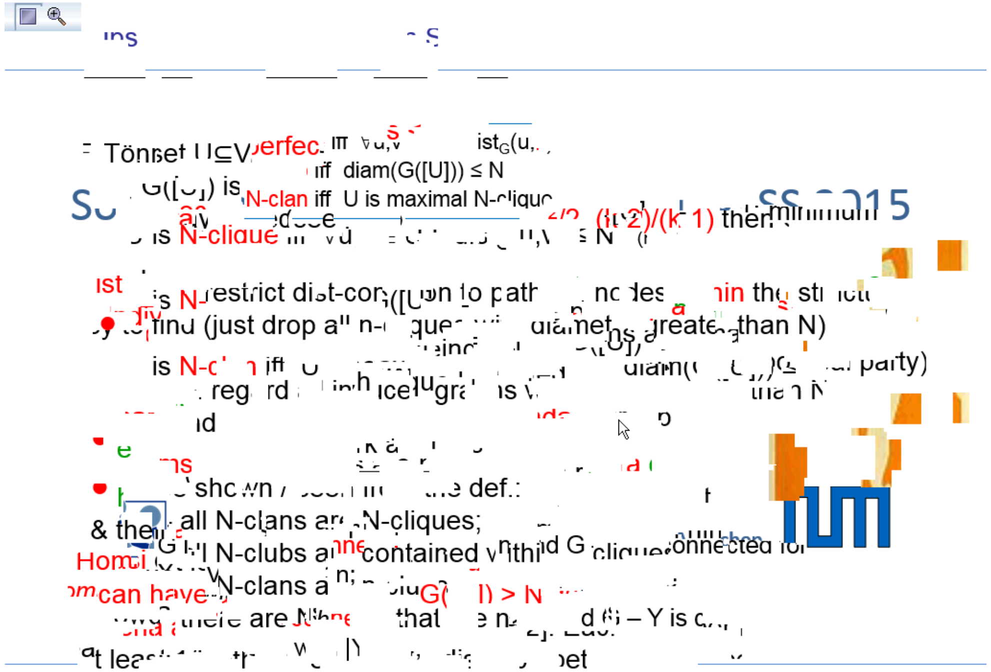


SS 2015

is N-clique iff ∀u,v ∈ U : $dist_G(u,v) \le N$

is N-clan iff U is N-clique and diam(G([U])) ≤ N

can have … G([U]) > N



SS 2015

iff diam(G([U])) ≤ N

N-clan iff U is maximal N-clique

restrict dist-comp to path nodes in the structure

find (just drop all N-cliques with diameter greater than N)

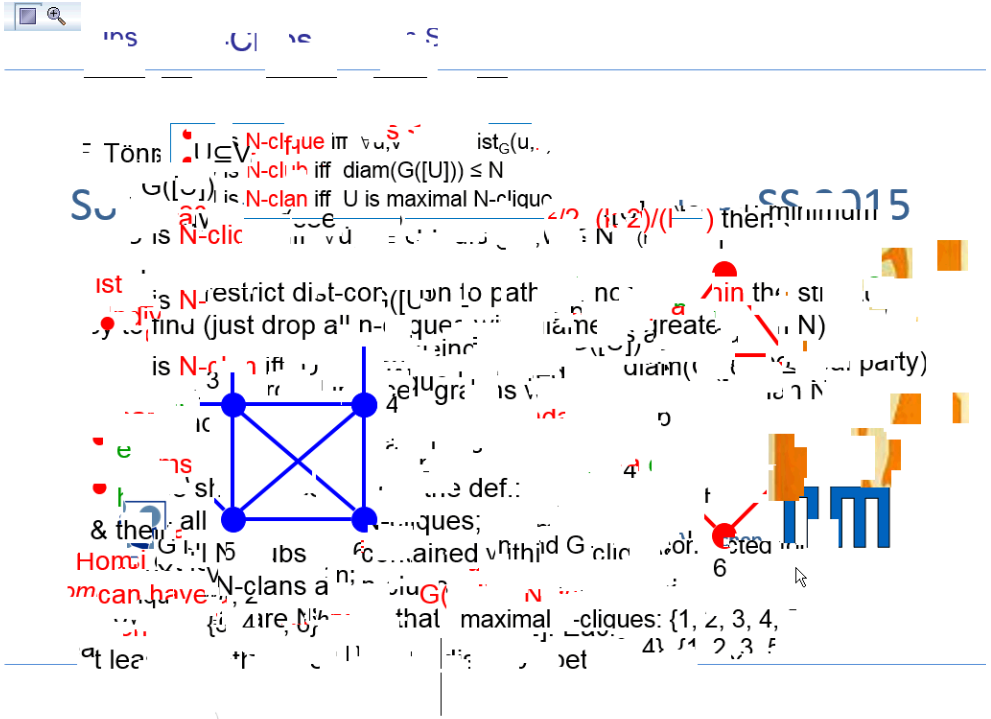
shown … the def.:

all N-clans are N-cliques;

all N-clubs are contained within N-clique

N-clans a…

can have … G([U]) > N



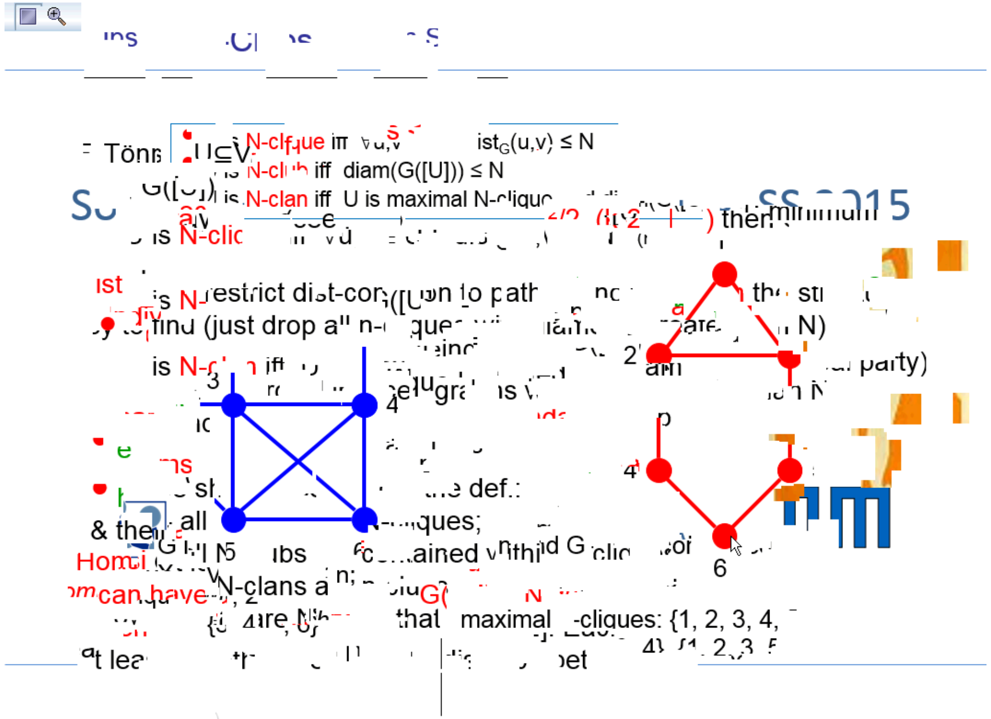
U⊆V is N-clique iff ∀u,v … $dist_G(u,$ …

U is N-club iff diam(G([U])) ≤ N

U is N-clan iff U is maximal N-clique

SS 2015

maximal 2-cliques: {1, 2, 3, 4,



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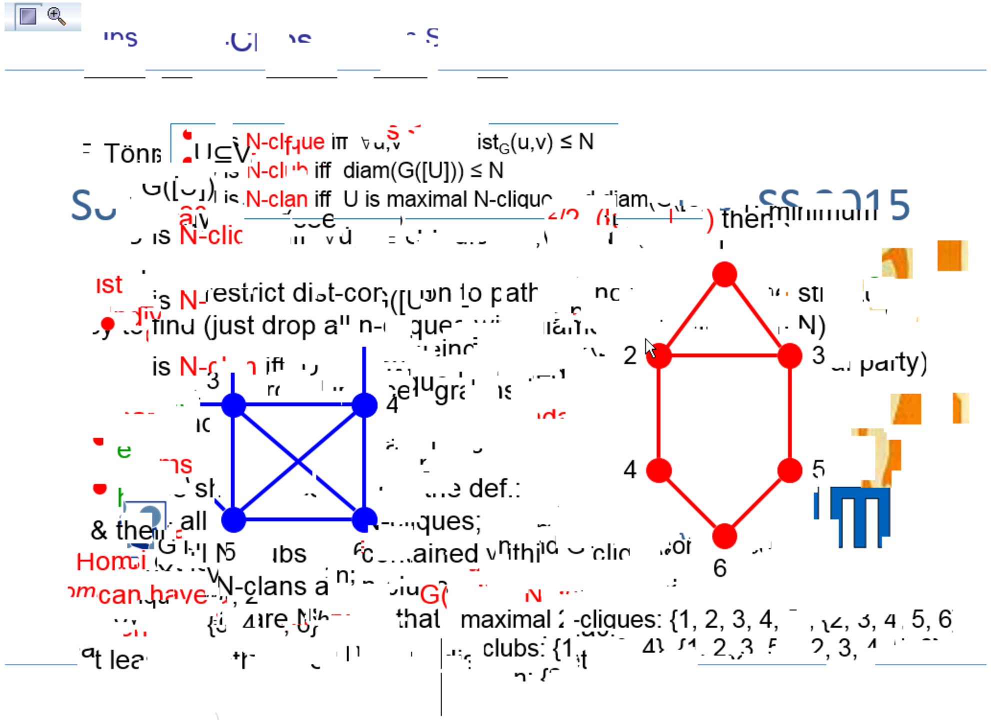

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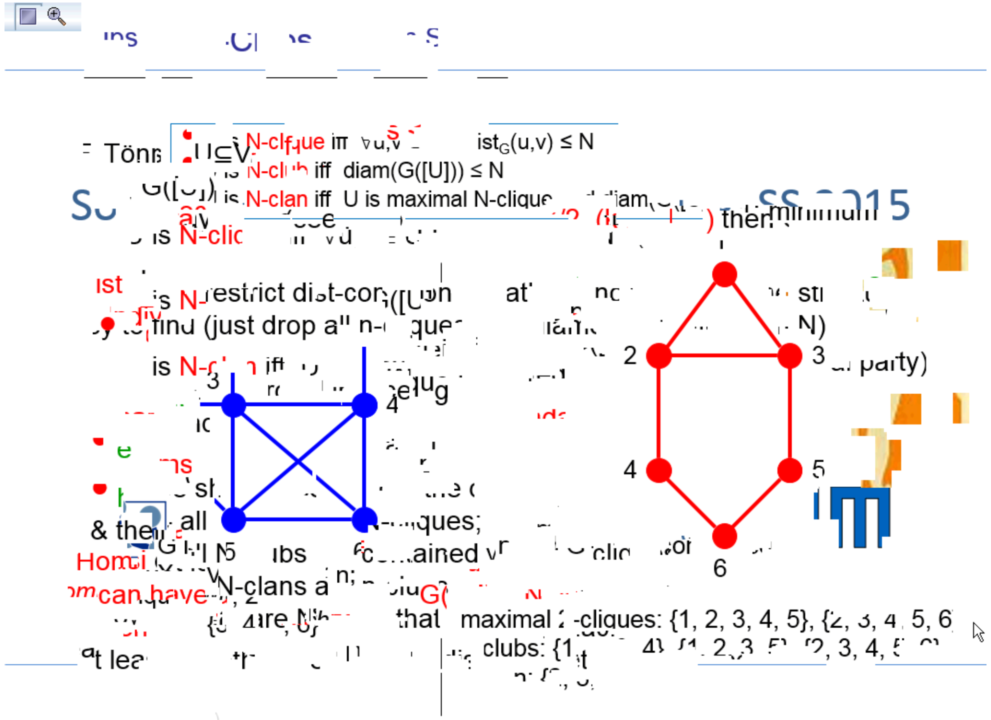
SS 2015

maximal 2-cliques: {1, 2, 3, 4, … {2, 3, 4, 5, 6

2-clubs: {1, … {1, 2, 3, 5}, {2, 3, 4, …



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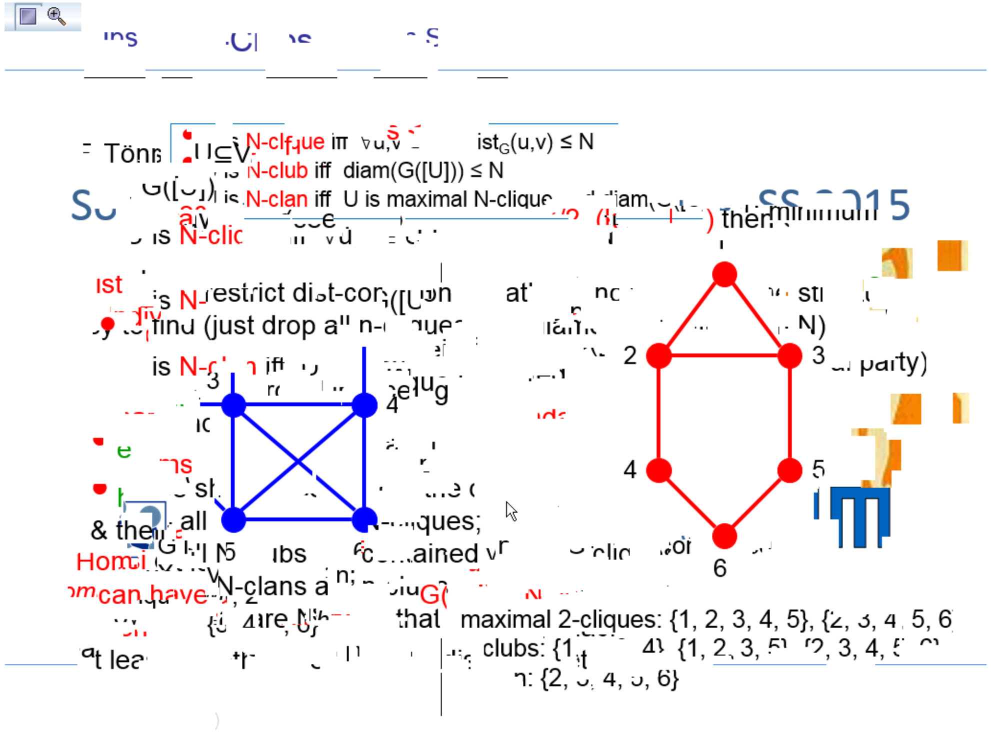
U is N-clan iff U is maximal N-clique

SS 2015

maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6

2-clubs: {1, … {1, 2, 3, 5}, {2, 3, 4, 5, 6}

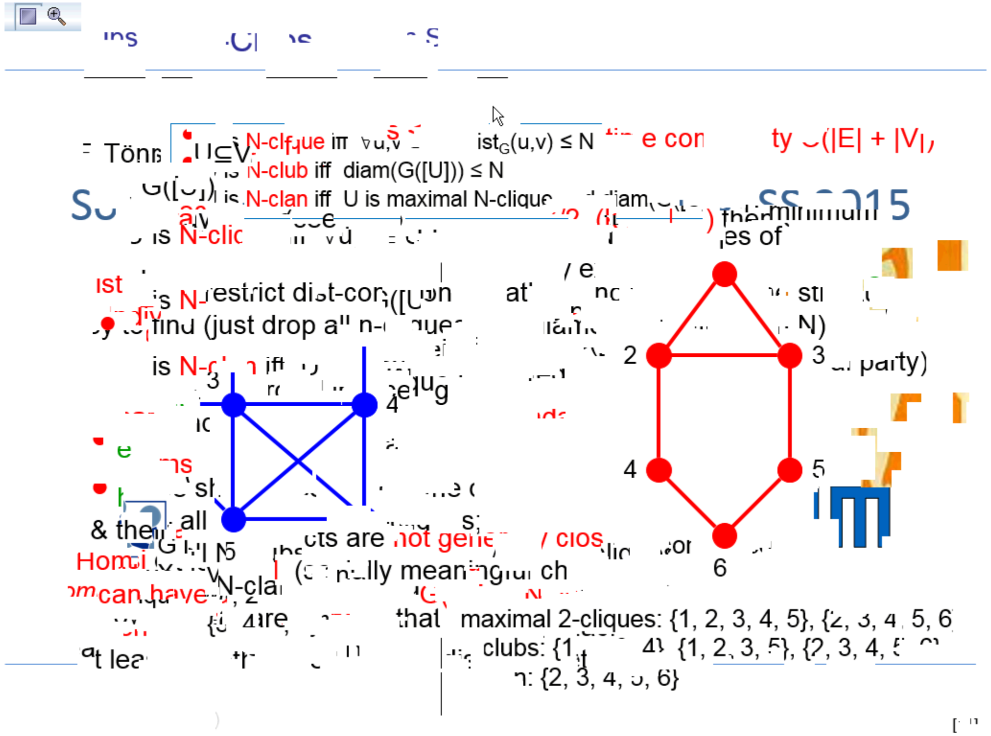


U is N-clique iff ∀u,v ∈ U: dist$_G$(u,v) ≤ N

U is N-club iff diam(G([U])) ≤ N

U is N-clan iff U is maximal N-clique

maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6}



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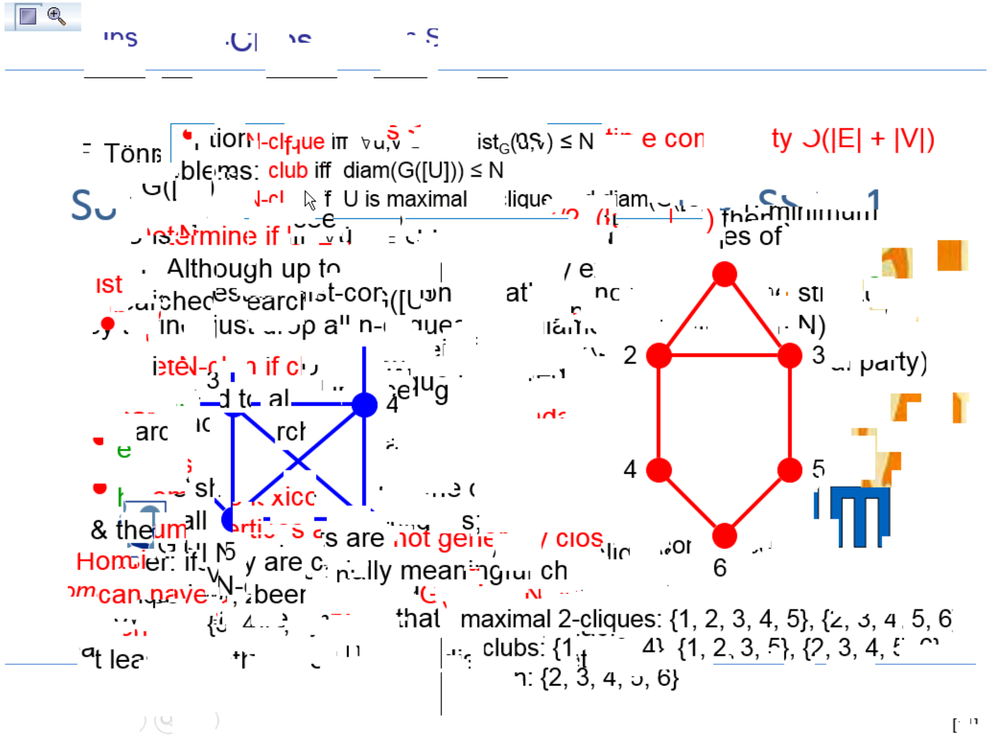
clubs: {1, 2, 3, 4}, {1, 2, 3, 5}, {2, 3, 4, 5, 6}



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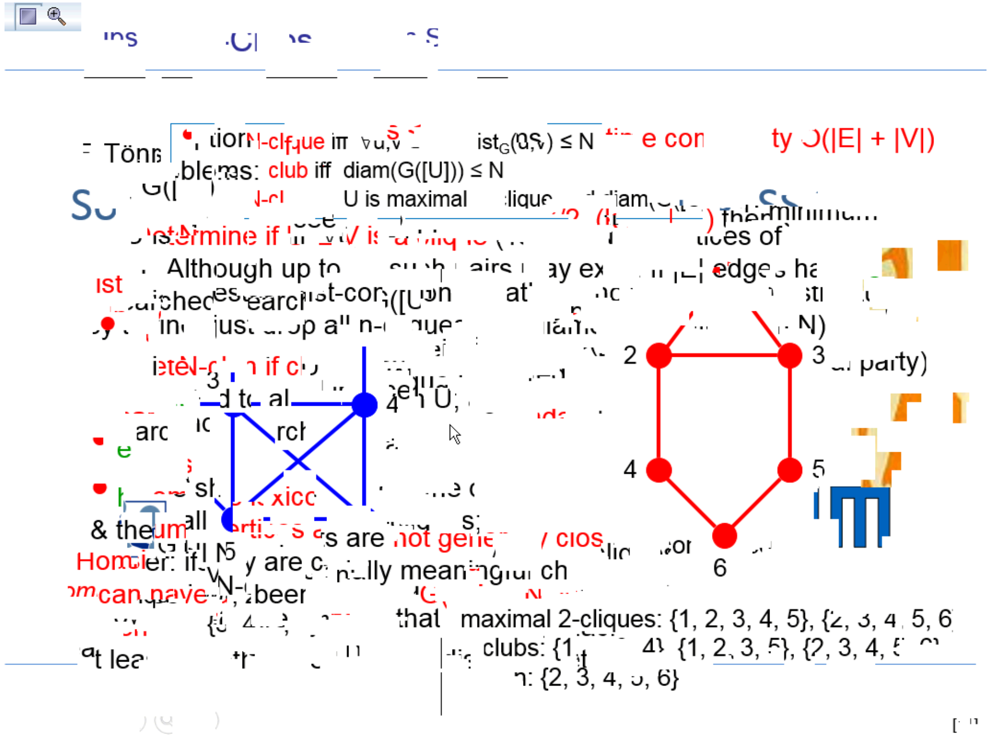
club iff diam(G([U])) ≤ N

U is maximal N-clique

Although up to

maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6}

clubs: {1, 2, 3, 4}, {1, 2, 3, 5}, {2, 3, 4, 5, 6}



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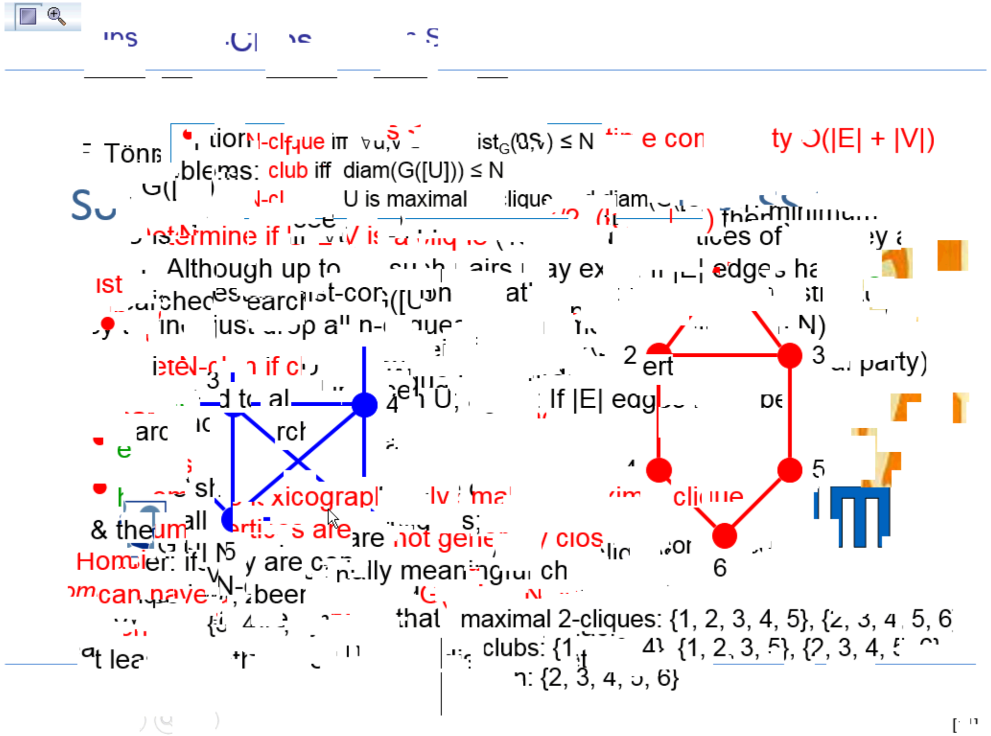


N-clique iff ∀u,v ∈ U: dist_G(u,v) ≤ N … time complexity O(|E| + |V|)

club iff diam(G([U])) ≤ N

U is maximal … clique

Determine if … is a clique

Although up to … pairs … may exist … |E| edges …

If |E| equals …

(party)

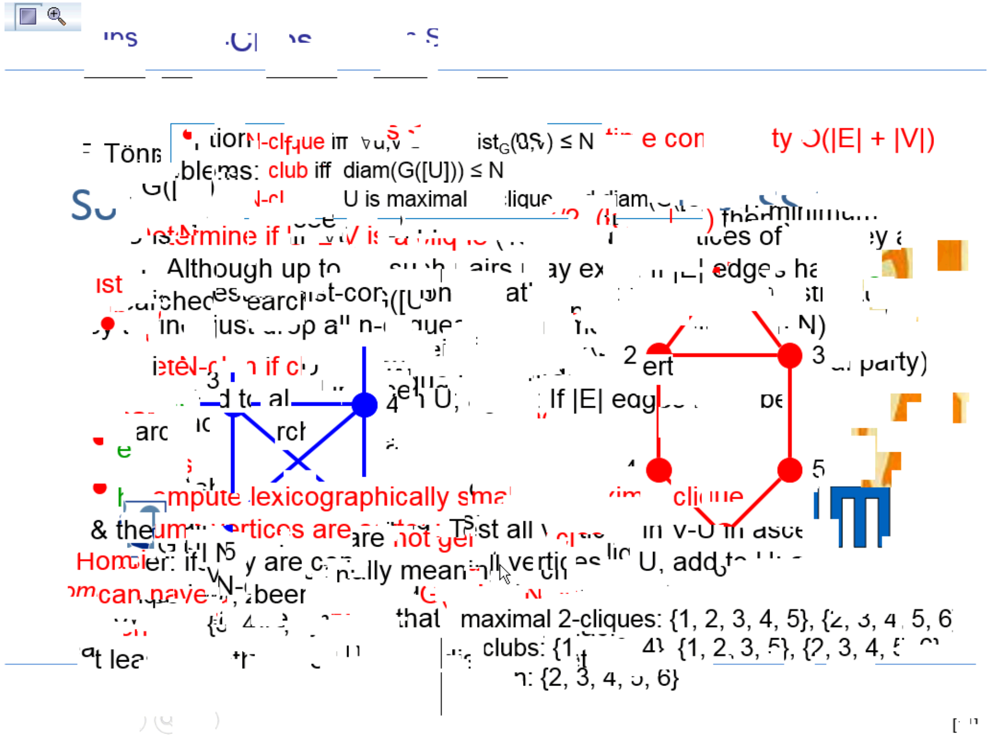
compute lexicographically smallest …

vertices are not generally closed …

maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6}

clubs: {1, … 4}, {1, 2, 3, 5}, {2, 3, 4, 5, 6}

n: {2, 3, 4, 5, 6}



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& the … vertices are not generally …: Test all vertices … in V-U in ascending order … U, add to …

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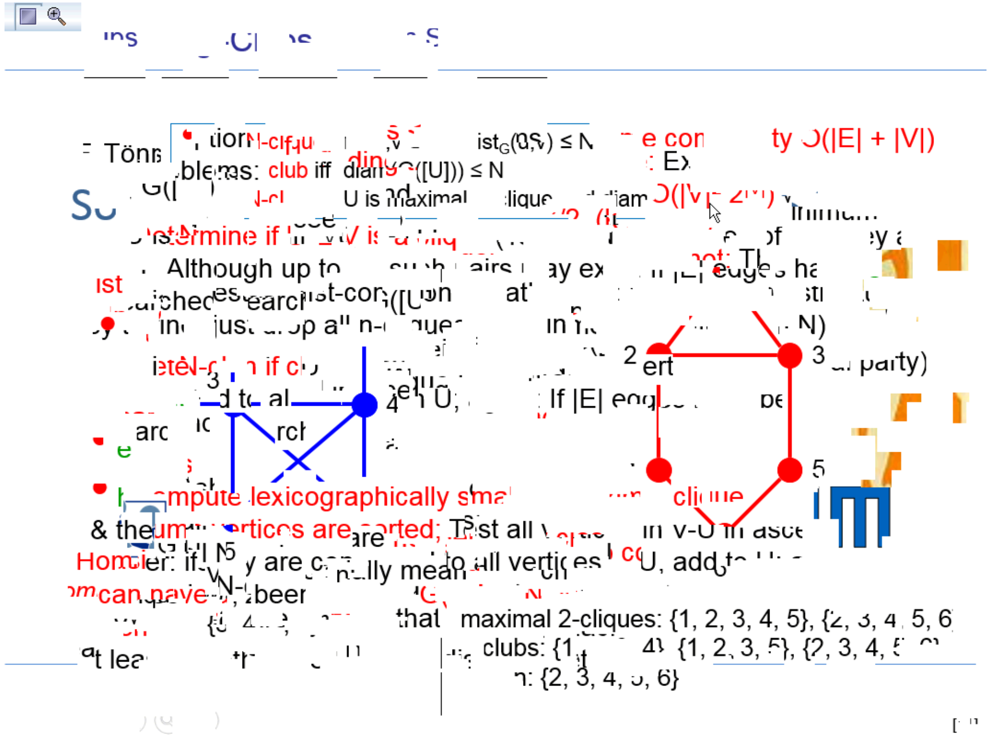


N-clique iff ∀u,v ∈ U: dist_G(u,v) ≤ N … time complexity O(|E| + |V|)

club iff diam(G([U])) ≤ N

Exhaustive search: O(|V|² 2^|V|)

U is maximal … clique

Determine if … is a clique

Although up to … pairs … may exist … |E| edges …

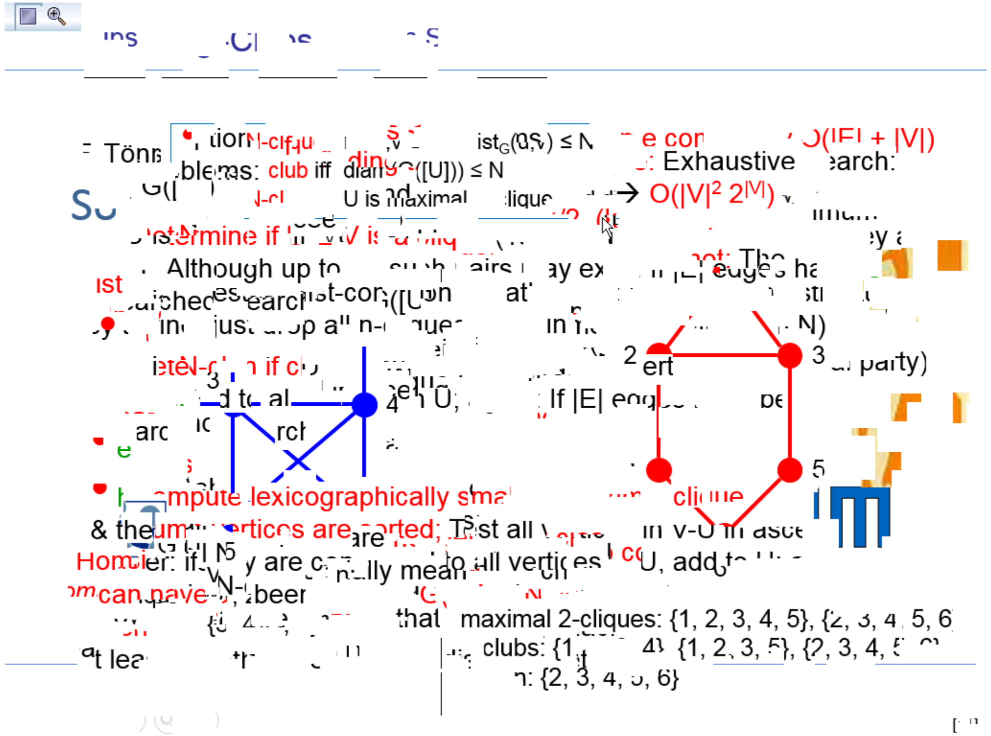
Compute lexicographically smallest …

& the … vertices are sorted; Test all vertices … in V-U in ascending order … to all vertices … U, add to …

maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6}

clubs: {1, … 4}, {1, 2, 3, 5}, {2, 3, 4, 5, 6}

n: {2, 3, 4, 5, 6}



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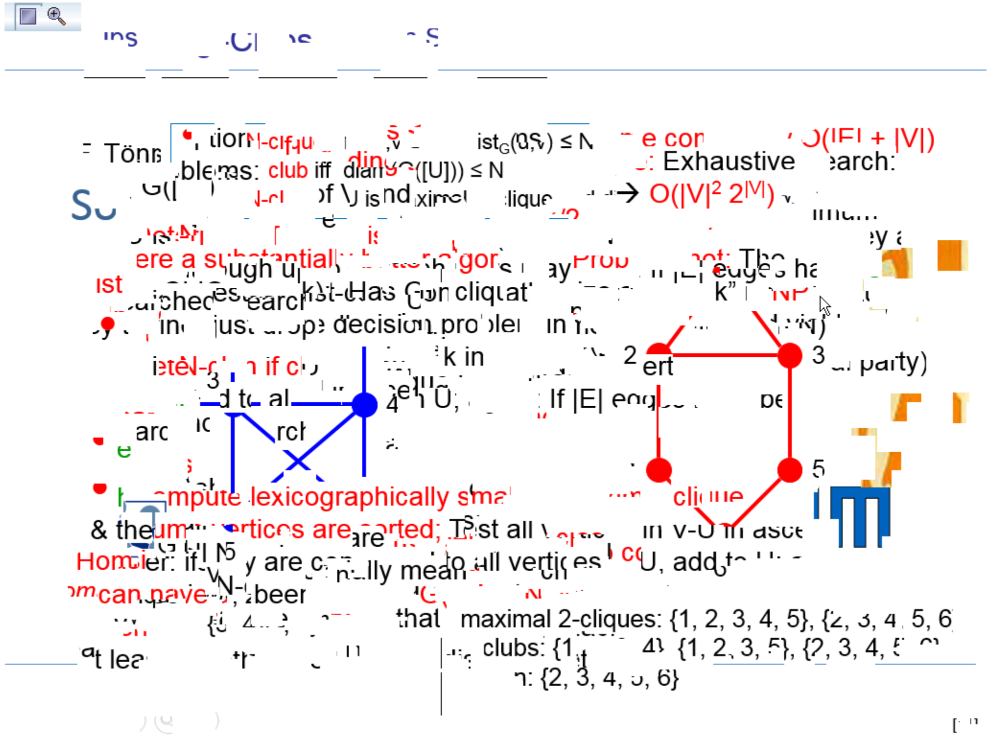
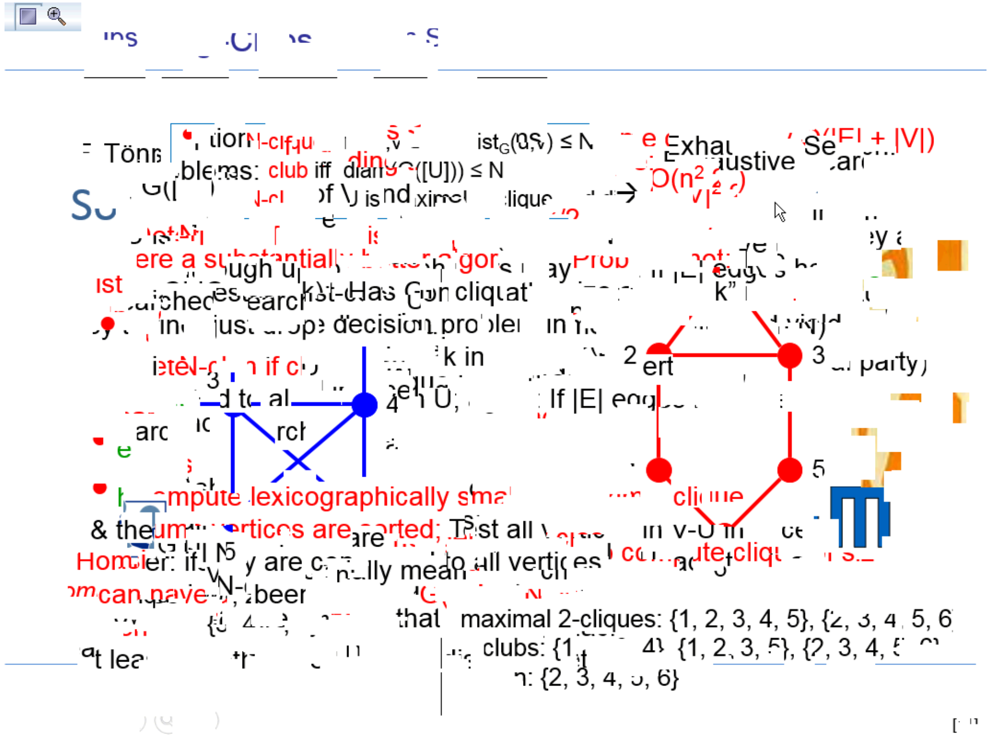

Exhaustive search:
O(|V|² 2^|V|)
If |E| equals
maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6
{2, 3, 4, 5, 6}


Exhaustive Search
maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6
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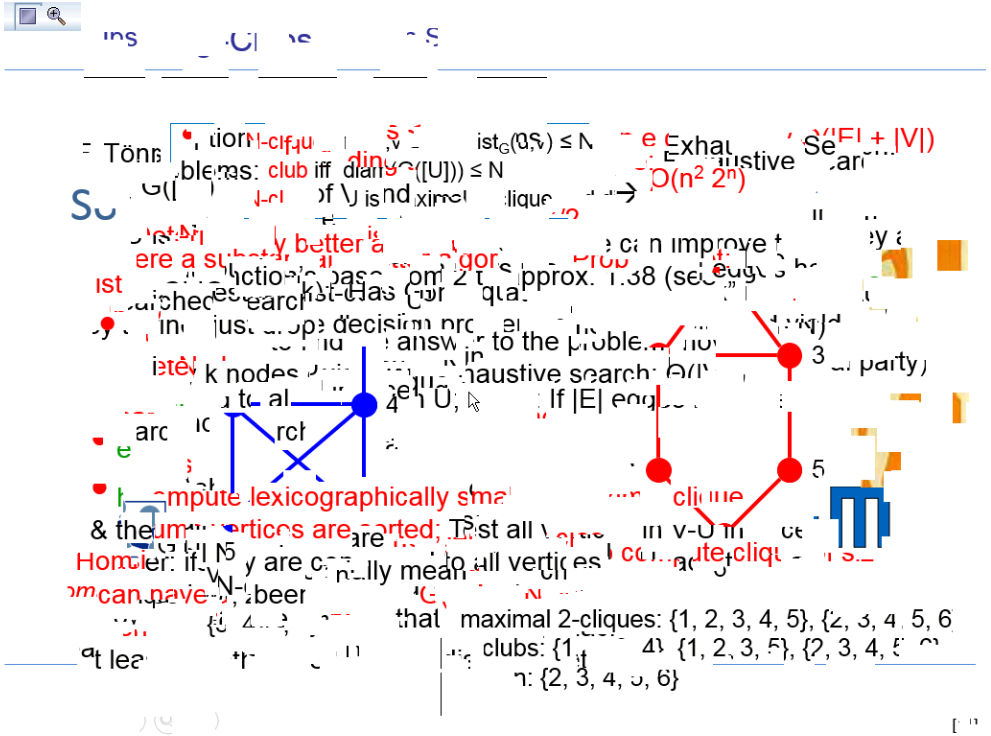
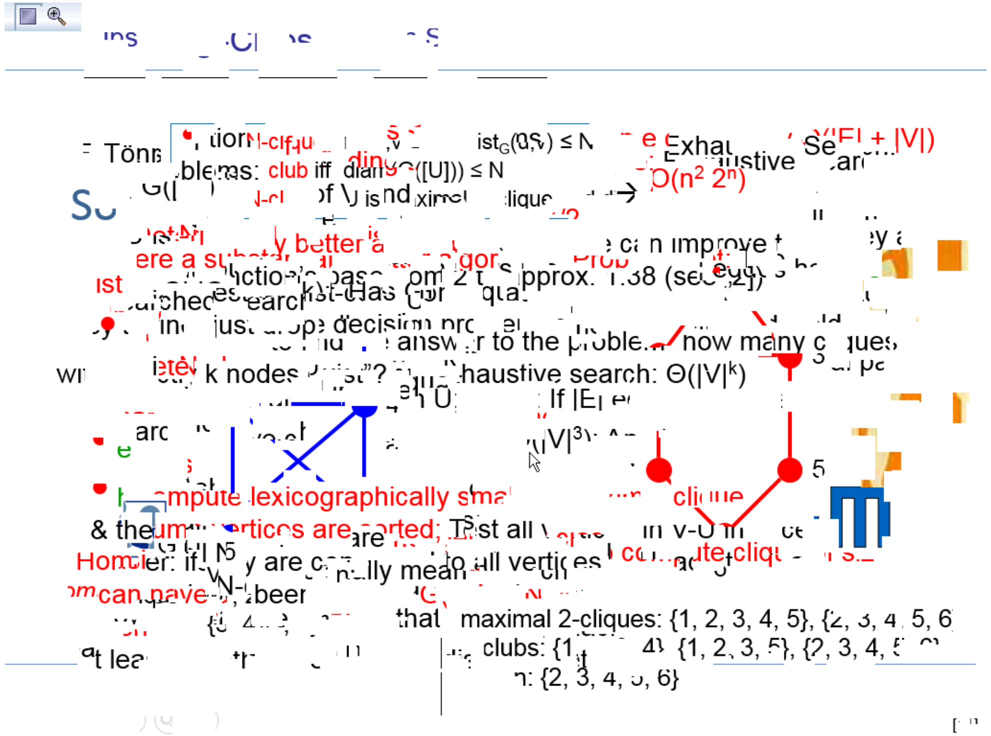
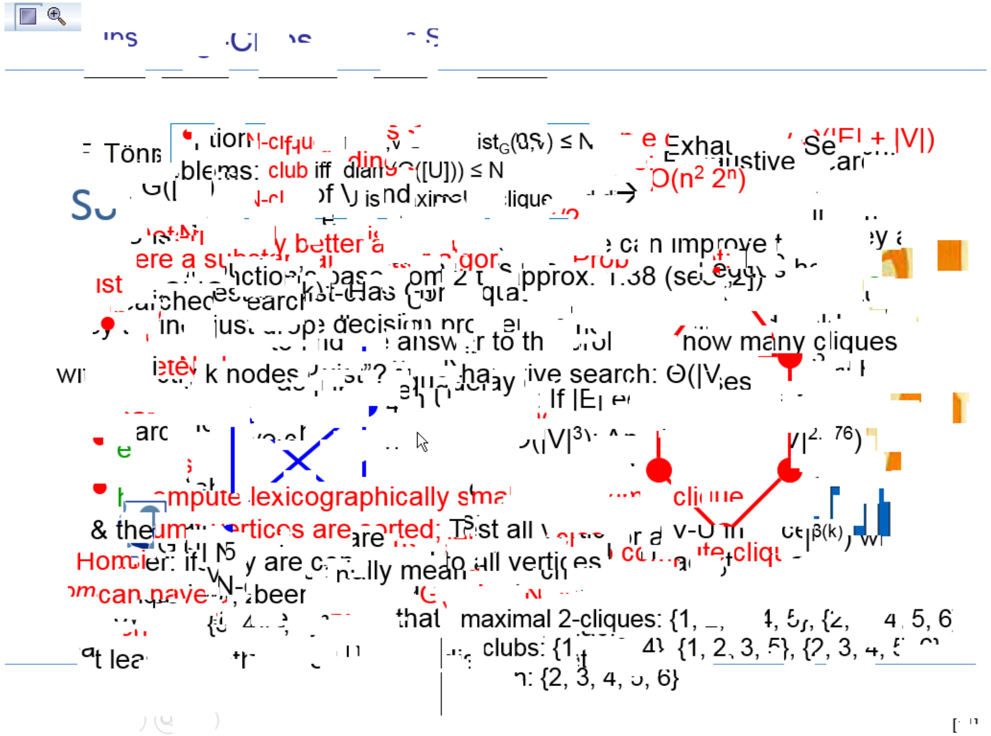
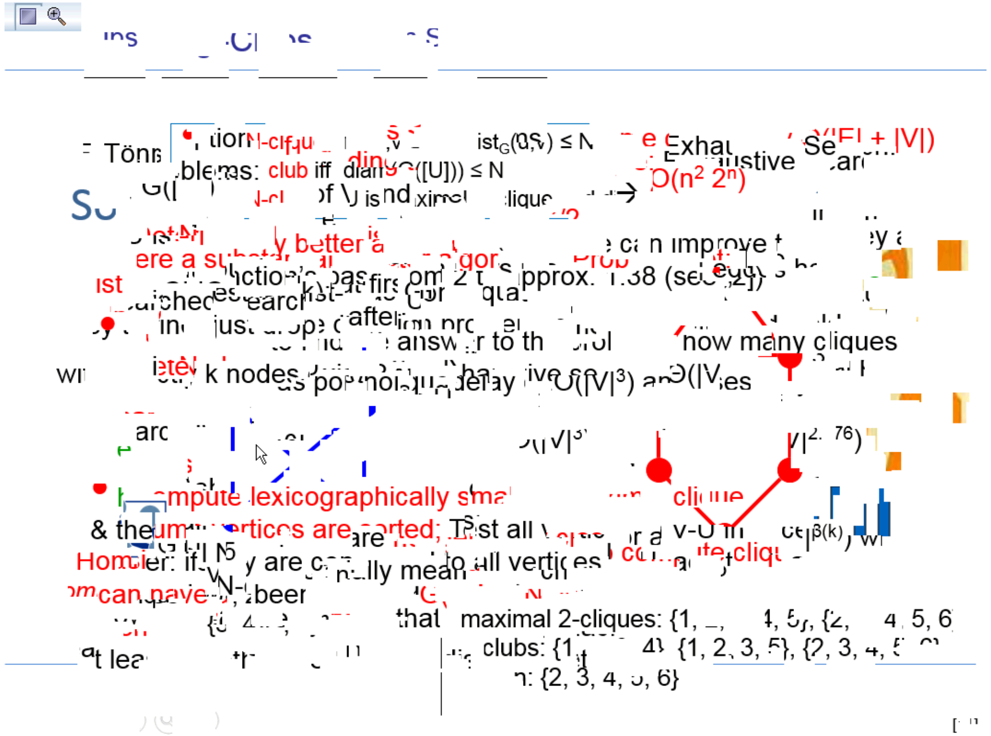
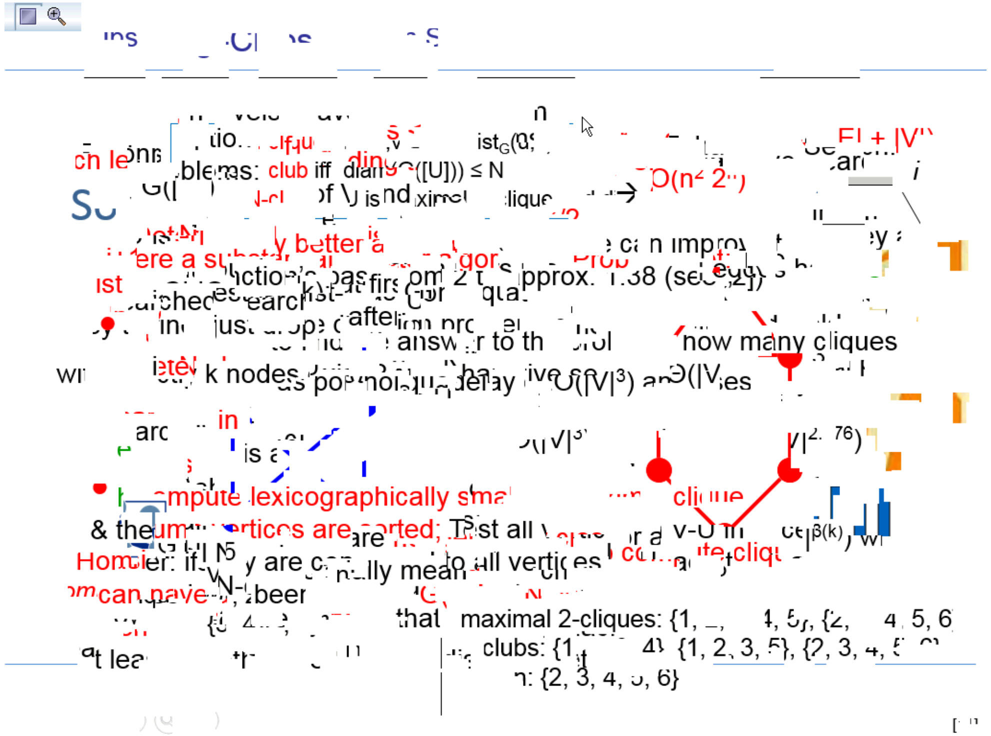
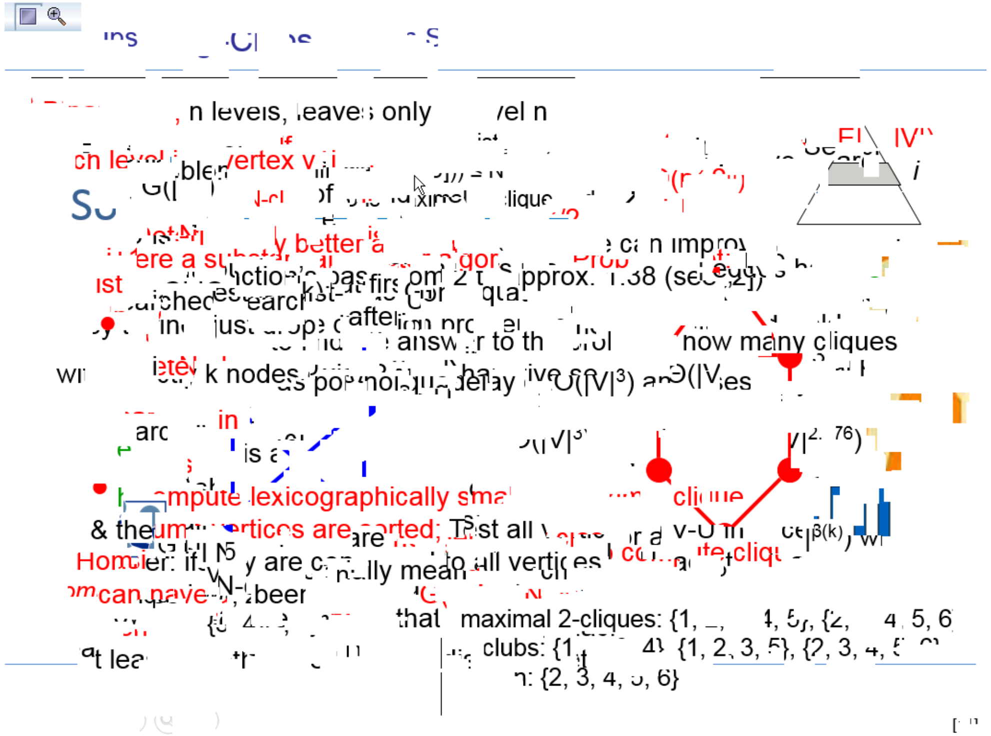

Exhaustive Search
O(n² 2ⁿ)
approx. 1.38
maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6
{2, 3, 4, 5, 6}

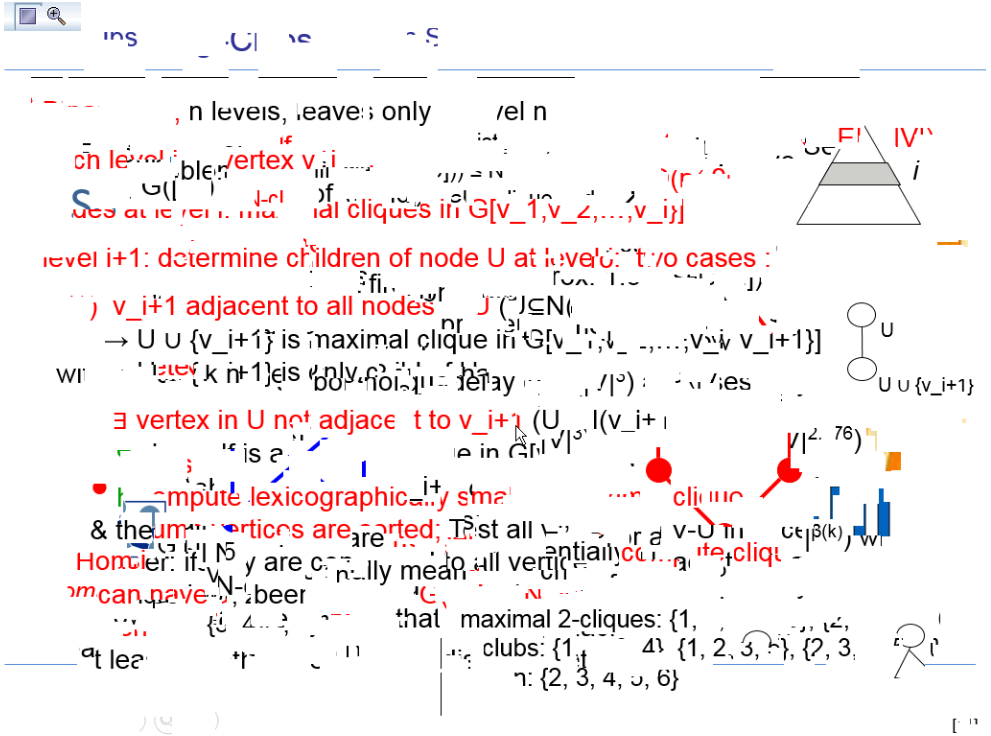

Exhaustive Search
O(n² 2ⁿ)
approx. 1.38
how many cliques
k nodes
haustive search: Θ(|V|^k)
maximal 2-cliques: {1, 2, 3, 4, 5}, {2, 3, 4, 5, 6
{2, 3, 4, 5, 6}











, n levels, leaves only … vel n

ch level … vertex v_i

… at level i: maximal cliques in G[v_1,v_2,…,v_i]

level i+1: determine children of node U at level i: two cases :

) v_i+1 adjacent to all nodes … U (U⊆N(…

→ U ∪ {v_i+1} is maximal clique in G[v_1,v_2,…,v_i, v_i+1]

∃ vertex in U not adjacent to v_i+1 (U … (v_i+1 …

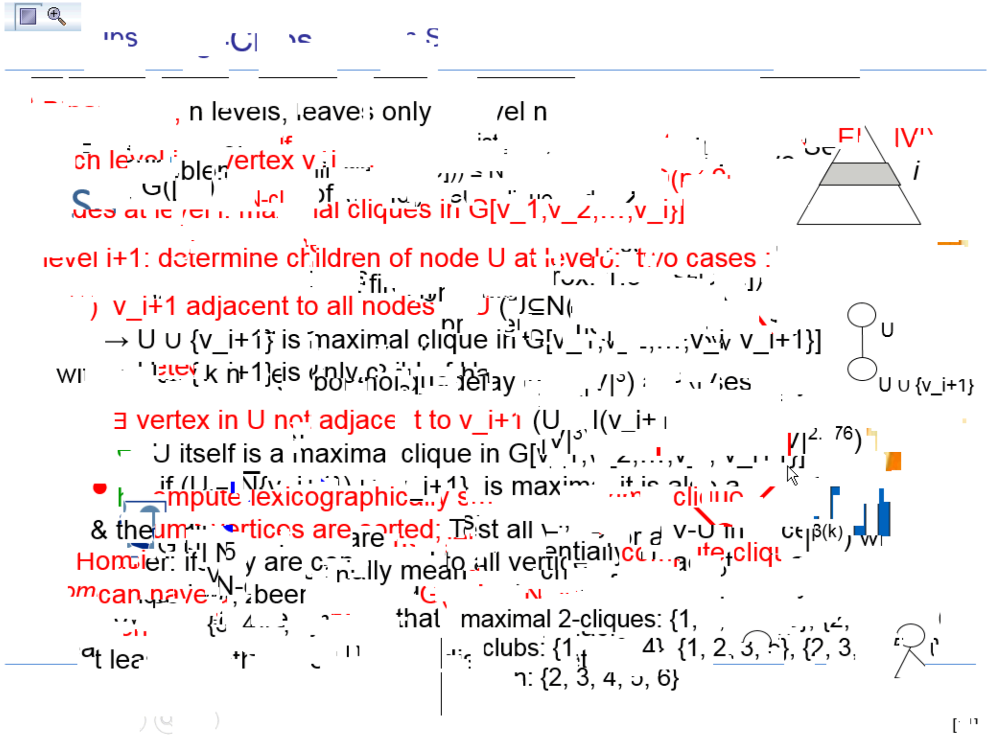
compute lexicographically sma… clique

& the … vertices are sorted; first all …

maximal 2-cliques: {1, …

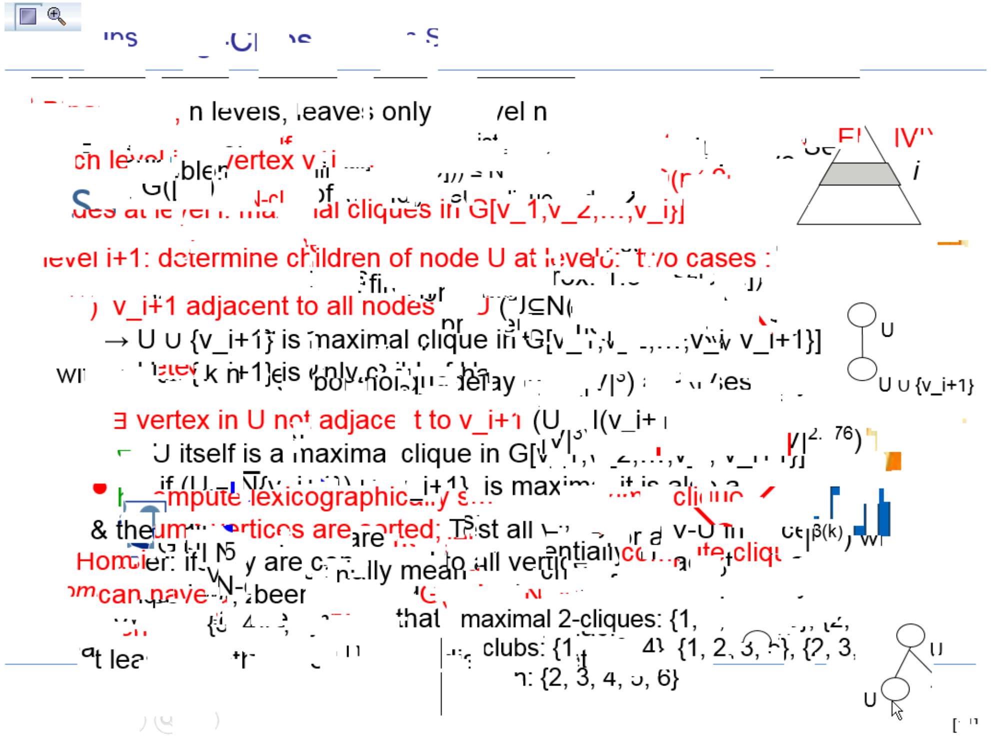
clubs: {1, … 4} {1, 2, 3, …}, {2, 3,

n: {2, 3, 4, 5, 6}



U itself is a maximal clique in G[v_1, v_2,…,v_i, v_i+1]

if (U – N̄{v_i+1}) ∪ {v_i+1} is maxim… it is also a



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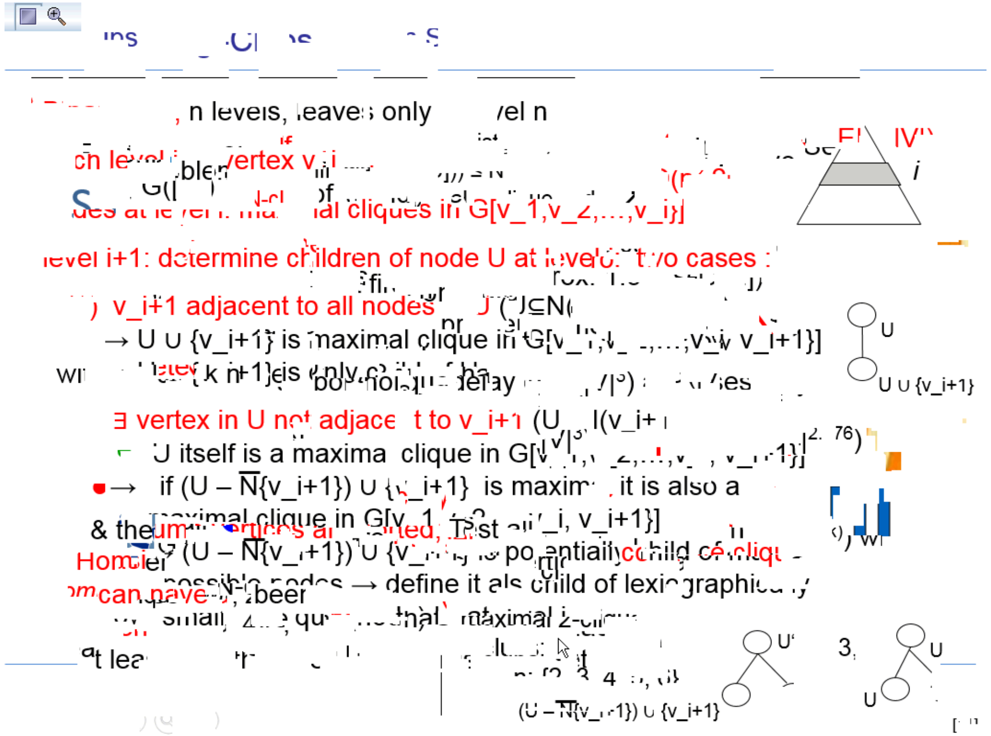
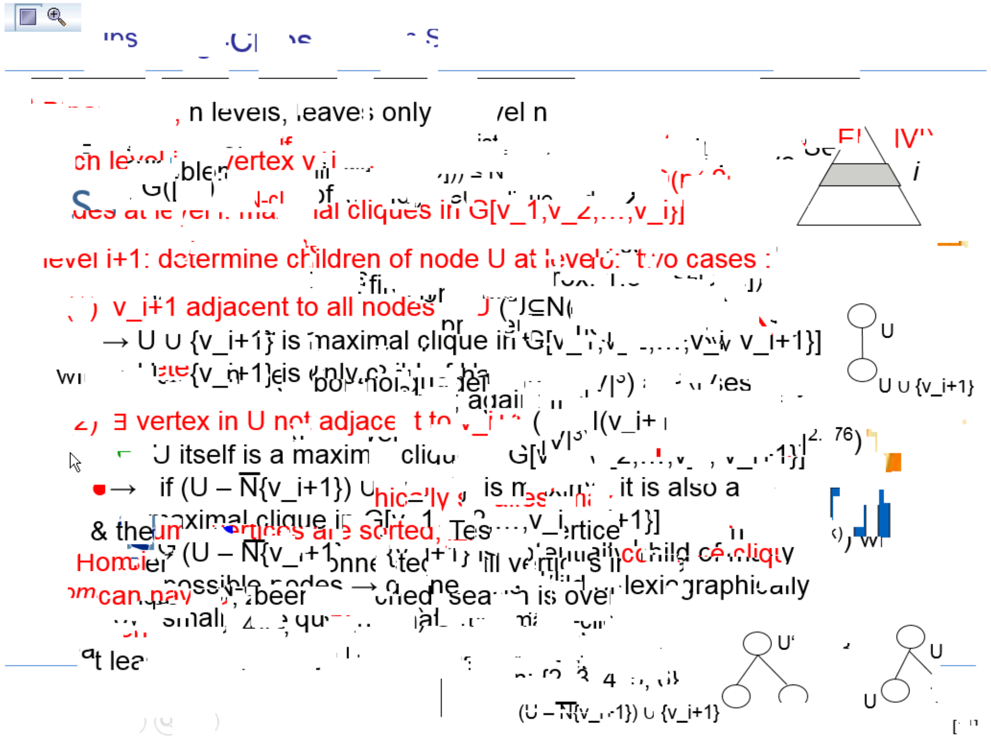


→ if (U – N̄{v_i+1}) ∪ {v_i+1} is maxim… it is also a maximal clique in G[v_1, v_2, …, v_i, v_i+1]

(U – N̄{v_i+1}) ∪ {v_i+1} is potentially child of … possible nodes → define it als child of lexicographically small…



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ch level … vertex v_i

des at le… …al cliques in G[v_1,v_2,…,v_i]

level i+1: determine children of node U at level i: two cases :

(1) v_i+1 adjacent to all nodes … U ⊆ N(

→ U ∪ {v_i+1} is maximal clique in G[v_1,v_2,…,v_i, v_i+1]

… {v_i+1} is only c… …der

again

(2) ∃ vertex in U not adjacent to v_i+1 … I(v_i+1

→ U itself is a maximal clique … G[v_1,v_2,…,v_i, v_i+1]

→ if (U – N̄{v_i+1}) ∪ … is maximal … it is also a maximal clique in G[v_1,…,v_i+1]

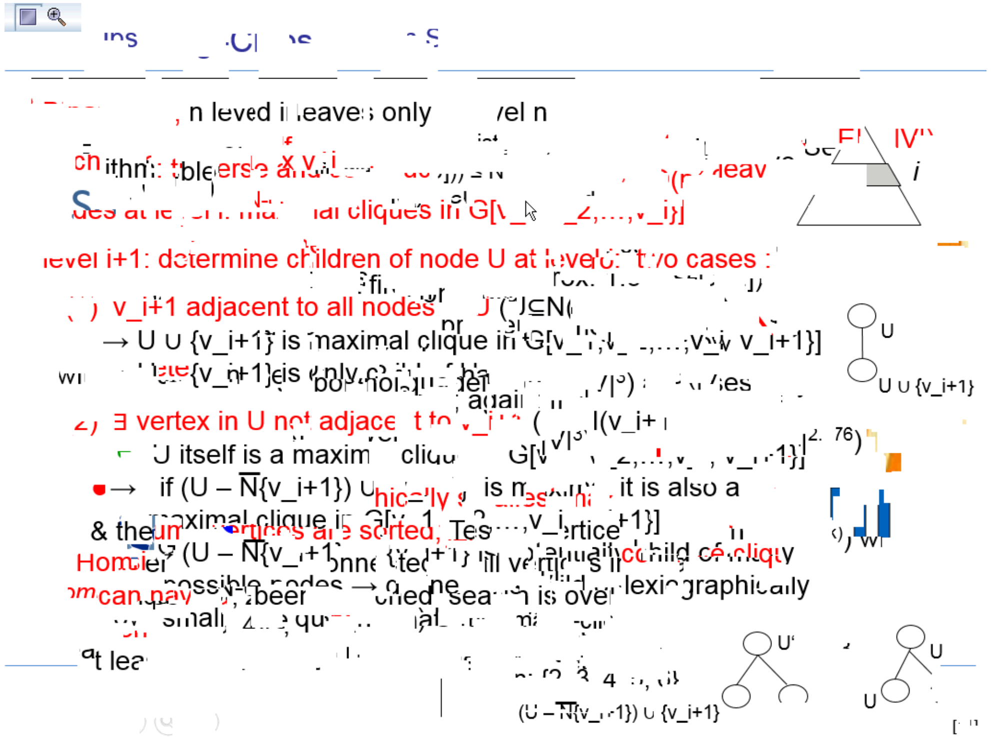
& the … sorted, Tes… …rtice

Homier … (U – N̄{v_i+1}) … child of cliqu

… possible nodes → … lexicographically

small …

at lea…



, n level i leaves only … vel n

ithm: traverse and … vertex v_i

des at le… …al cliques in G[v_1,…,v_i]

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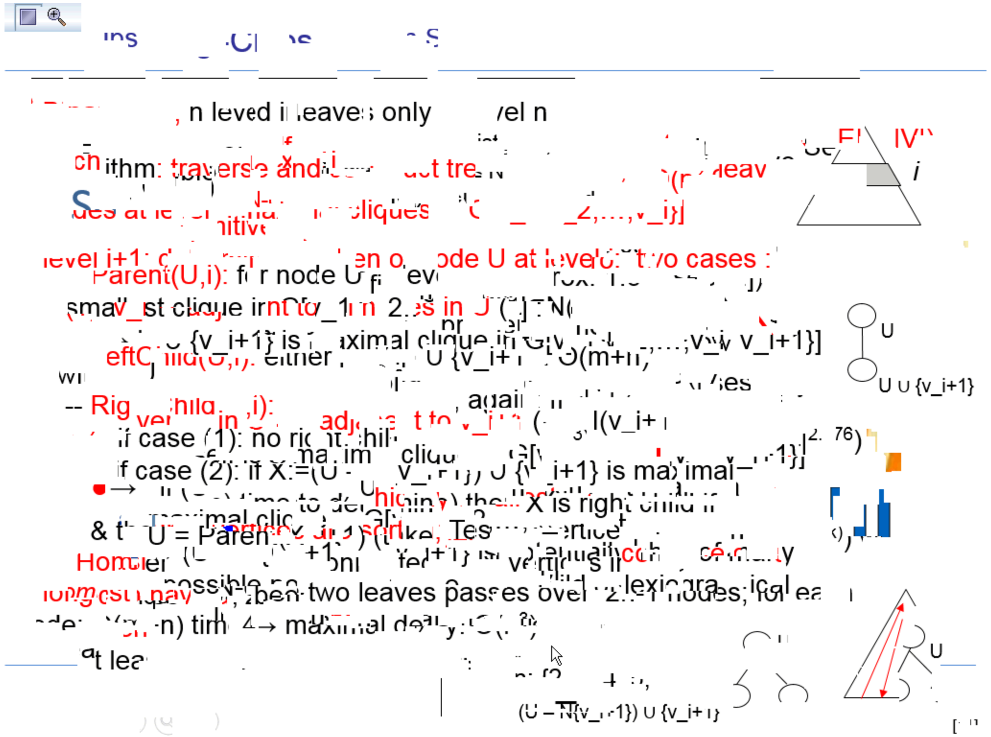


, n level i leaves only … vel n

ithm: traverse and … tree … leav

des at le… …al cliques … G[v_1,…,v_i]

level i+1: … node U at level i: two cases :

Parent(U,i): for node U … level

smallest clique in … v_1 … 2 … in … N(

… ∪ {v_i+1} is maximal clique in G[v_1,…,v_i, v_i+1]

LeftChild(U,i): either … U ∪ {v_i+1} … O(m+n)

-- Right Child(U,i):

if case (1): no right child

if case (2): if X:=(U – N̄{v_i+1}) ∪ {v_i+1} is maximal

→ … X is right child …

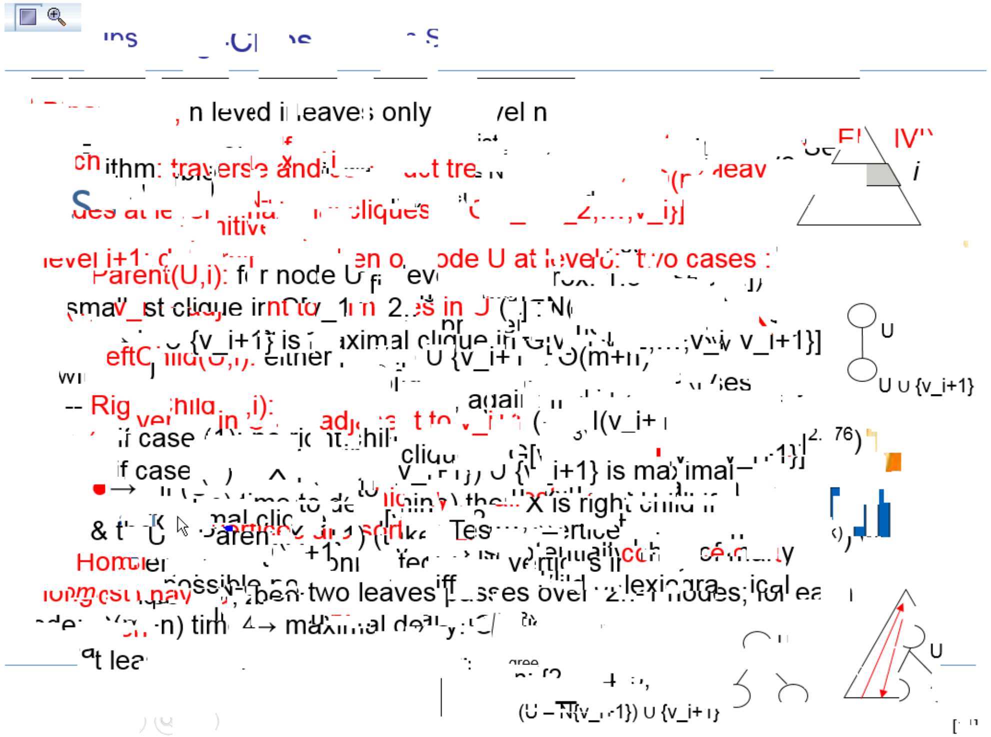
U = Parent(X, i+1) …

Homier …

… between two leaves passes over … 2n nodes, for each … lexicographical

… O(m+n) time → maximal delay: O(…)

at lea…



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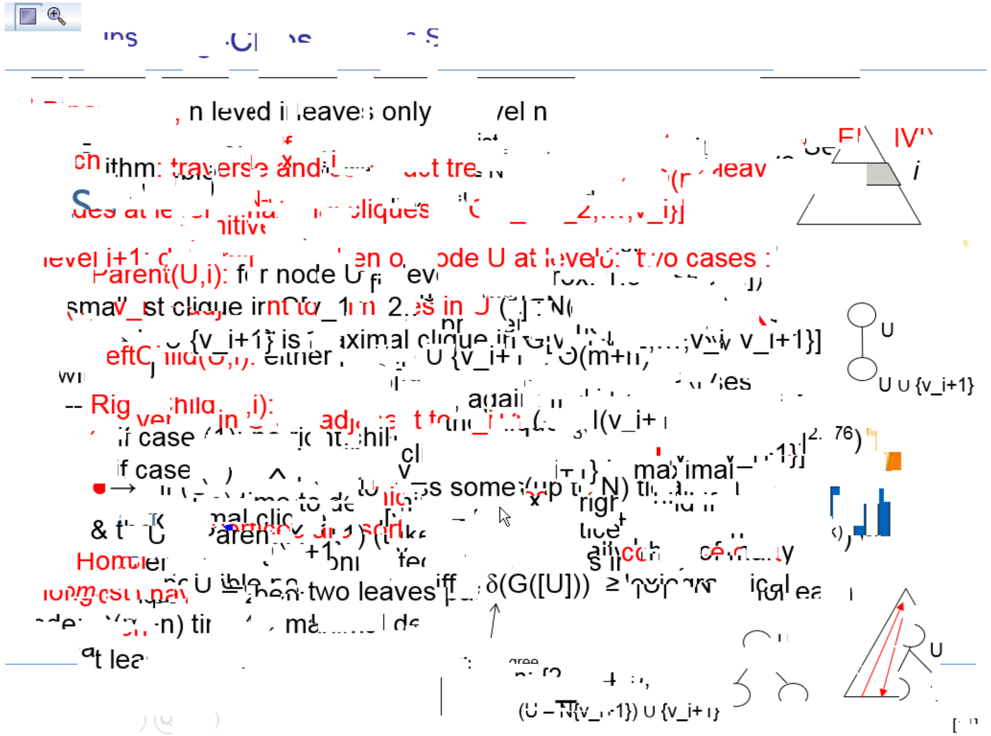

n leved i leaves only vel n

ithm: traverse and ut tree leav

des at le itive cliques {v_1, v_2,...,v_i}]

level i+1: en o ode U at level i: two cases :

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smallest clique in 2. is in

{v_i+1} is aximal clique in G[v v_i+1}]

LeftChild(U,i): either U ∪ {v_i+1} O(m+n) ves

-- RightChild(U,i): adj t to N(v_i+1)

if case child

if case some maximal

→ right

& t parent (v_i+1)

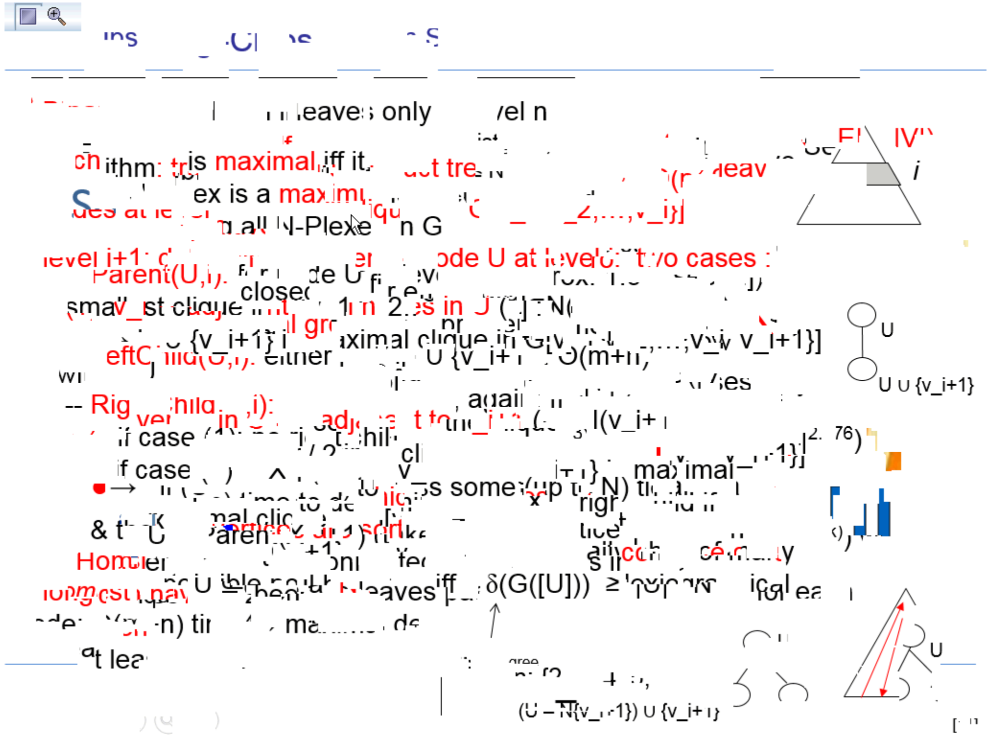
Homer

two leaves iff δ(G([U])) ≥

n) tim ma ds

at lea

(U – N(v_i+1)) ∪ {v_i+1}



leaves only vel n

ithm: is maximal iff it ut tree leav

ex is a maximal iqu {v_1, v_2,...,v_i}]

all N-Plexe n G

level i+1: ode U at level i: two cases :

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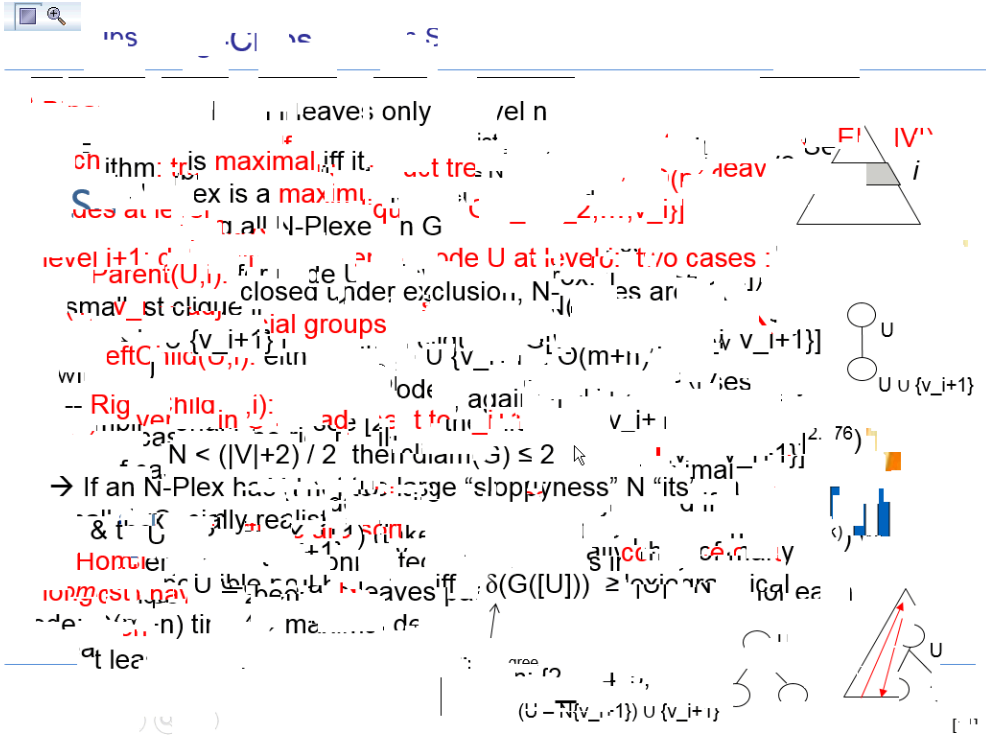


leaves only vel n

ithm: is maximal iff it ut tree leav

ex is a maximal iqu {v_1, v_2,...,v_i}]

all N-Plexe n G

level i+1: ode U at level i: two cases :

Parent(U,i): closed under exclusion, N- es are

smallest clique ial groups

LeftChild(U,i): eith U ∪ {v_ O(m+n) ves

-- RightChild(U,i): ode again

N < (|V|+2) / 2 then diam(G) ≤ 2

→ If an N-Plex has large “sloppyness” N “its”

& t ally realist

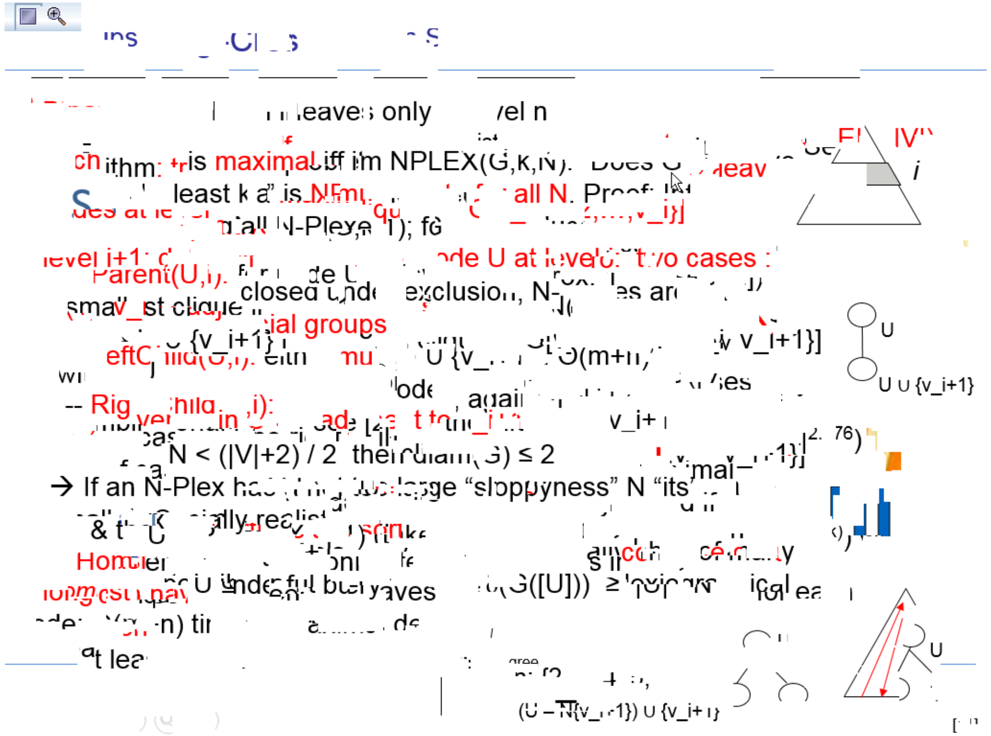
Homer

leaves iff δ(G([U])) ≥

n) tim ma ds

at lea

(U – N(v_i+1)) ∪ {v_i+1}



leaves only vel n

ithm: is maximal iff im NPLEX(G,k,N). Does G leav

least k a is N- all N. Proof:

all N-Plexe); fo

level i+1: ode U at level i: two cases :

Parent(U,i): closed unde exclusion, N- es are

smallest clique ial groups

LeftChild(U,i): eith mu U ∪ {v_ O(m+n) ves

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Homer

U understanding leaves

n) tim ds

at lea

(U – N(v_i+1)) ∪ {v_i+1}

leaves only … vel n

is maximal iff … NPLEX(G,k,N): "Does …

least k a" is NP-complete for all N. Proof: Informal argumer

CLIQUE(G,k) … PLEX(G,k,1); formal: reduce CLIQUE/C

two cases :

closed under exclusion

ial groups

{v_i+1} … O(m+n) … v_i+1]]

-- Right child(…,i):

N < (|V|+2) / 2 then diam(G) ≤ 2

→ If an N-Plex has a large "sloppyness" N "its"

& t … ally realist

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U under ful behaves

(G([U])) ≥ … logical

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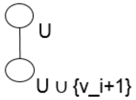

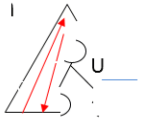

(U – N[v_i+1]) ∪ {v_i+1}

If U1 …

ery desirable

is maximal iff … NPLEX(G,k,N): "Does …

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CLIQUE(G,k) … PLEX(G,k,1); formal: reduce CLIQUE/C

two cases :

closed under exclusion

ial groups

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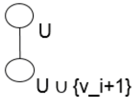
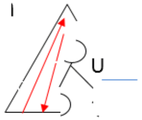
U = V is adjacent to … o(G([U … v_i+1

→ If an N-Plex has a large "sloppyness" N "its"

II. N-cores under … behaves





(U – N[v_i+1]) ∪ {v_i+1}

If U1 …

ery desirable

is max … path: … maximum N-clique) … is (…)

least k a" is NP-complete for all N. Proof: Informal argumer

are connected maximal N-cores

ery desirable

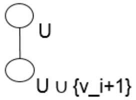
are … closed under exclusion (Example: cycle …)

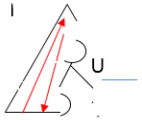
are generally not …

-- Right child(…,i):

→ If an N-Plex has a large "sloppyness" N "its"

II. N-cores under … behaves





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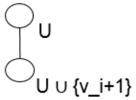
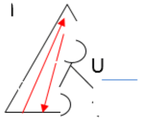
II. N-cores …





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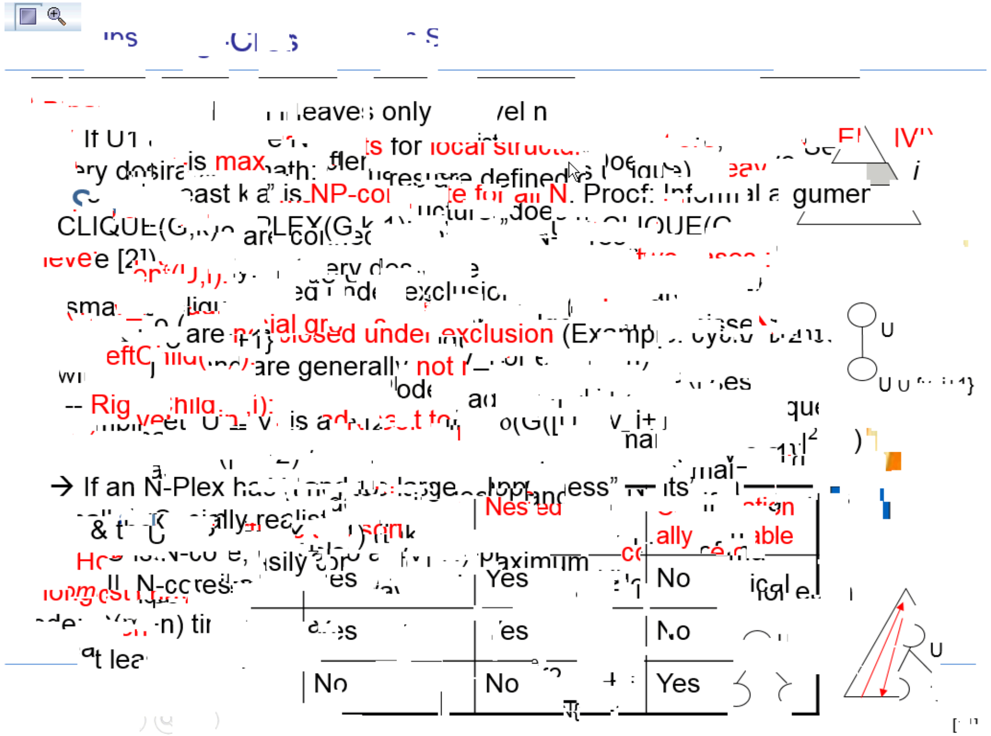


leaves only … vel n

If U1 … is max … fler … ts for local structu … define … (clique) … leav …

… is NP-co … te for all N. Proof: Informal argumer

CLIQUE(G,k) … PLEX(G,k) … structure „doe … CLIQUE(G

… are partial gr … closed under exclusion (Example: cycle …

… are generally not r …

-- Rig … hild … i):

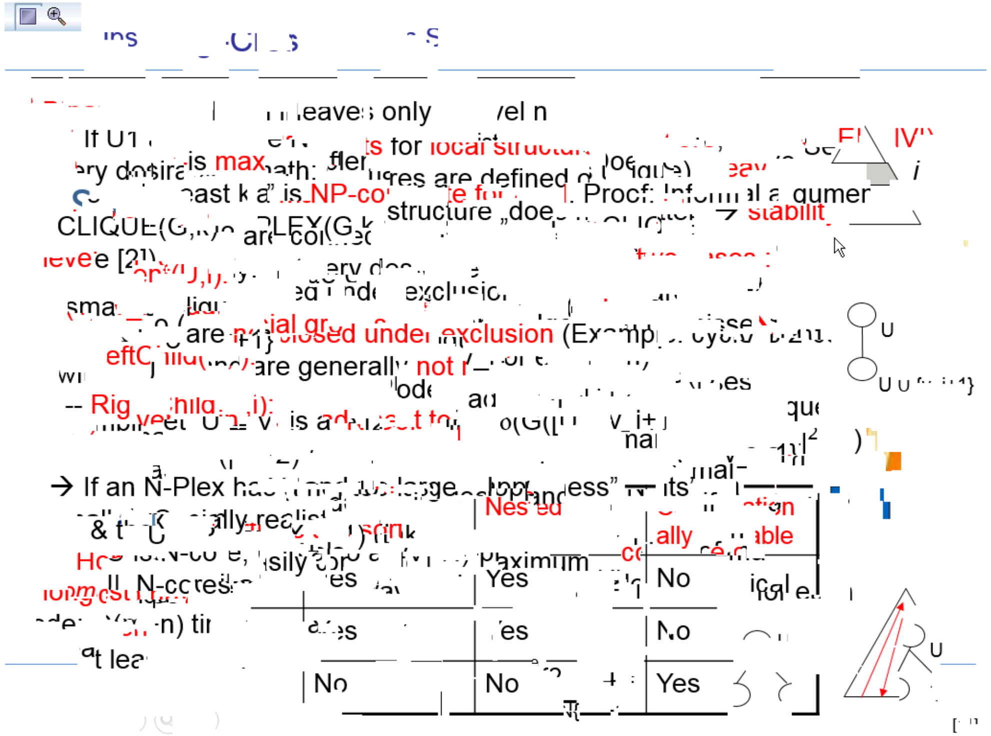
… V is a … t to … o(G([… V_i+1 … nal

→ If an N-Plex has … large … “ … ness” … its …

& t … ally realis …

	Nes ed		ally	able
	Yes		No	
	es		No	
No	No		Yes	

… t lea …



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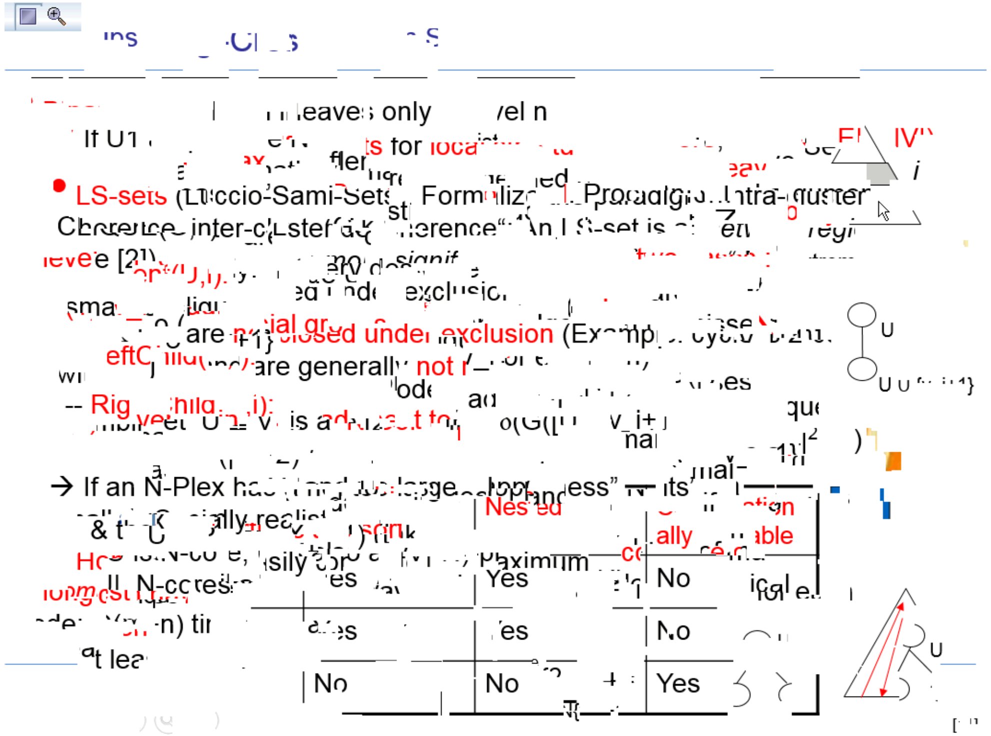
CLIQUE(G,k) … PLEX(G,k) … structure „doe … → stabilit

… are partial gr … closed under exclusion (Example: cycle …

… are generally not r …

→ If an N-Plex has … large … “ … ness” … its …

	Nes ed		ally	able
	Yes		No	
	es		No	
No	No		Yes	



leaves only … vel n

If U1 … ts for loca …

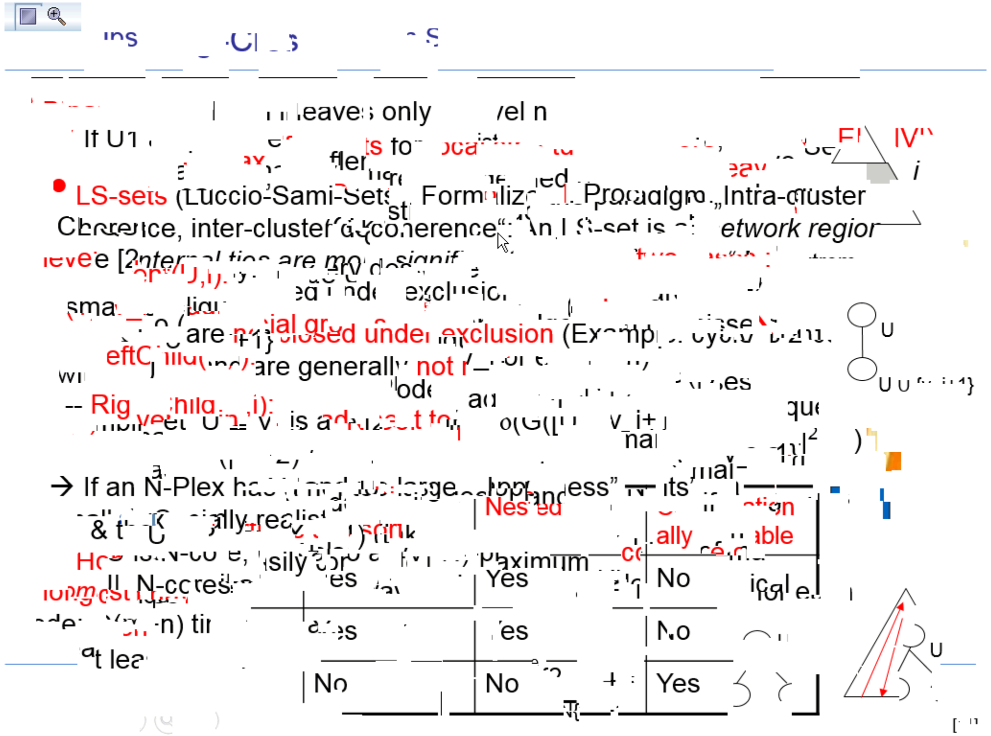
LS-sets (Luccio-Sami-Sets … Formalized … Proc algo … „Intra-cluster Coherence, inter-cluster … coherence“: An LS-set is … regi

… are partial gr … closed under exclusion (Example: cycle …

… are generally not r …

→ If an N-Plex has … large … “ … ness” … its …

	Nes ed		ally	able
	Yes		No	
	es		No	
No	No		Yes	



leaves only … vel n

If U1 … ts to … loca …

LS-sets (Luccio-Sami-Sets … Formalized … Proc algo … „Intra-cluster Coherence, inter-cluster coherence“: An LS-set is … etwork region

… Internal ties are mo … signif …

… are partial gr … closed under exclusion (Example: cycle …

… are generally not r …

→ If an N-Plex has … large … “ … ness” … its …

	Nes ed		ally	able
	Yes		No	
	es		No	
No	No		Yes	

leaves only ... vel n

If U1 ...

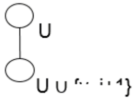
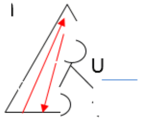
- LS-sets (Luccio-Sami-Sets): Formalized Paradigm „Intra-cluster Coherence, inter-cluster incoherence“: An LS-set is a „network region

... exclusion

... closed under exclusion ... are generally not ...

→ If an N-Plex has ... large ... less” ... its

	Nested	ally	able
	Yes	No	
	es	No	
No	No	Yes	

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leaves only ... vel n

If U1 ...

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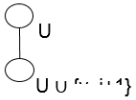
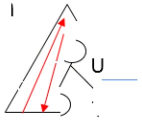
... exclusion

... closed under exclusion ... are generally not ...

ties with the network ...

→ If an N-Plex has ... large ... less” ... its

	Nested	ally	able
	Yes	No	
	es	No	
No	No	Yes	

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leaves only ... vel n

If U1 ...

- LS-sets (Luccio-Sami-Sets): Formalized Paradigm „Intra-cluster Coherence, inter-cluster incoherence“: An LS-set is a „network region

... exclusion ... clique))

... closed under exclusion ... are generally not ...

ties with the network ...

U′⊂ U →

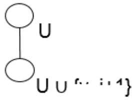
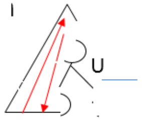
→ If an N-Plex ... me interesting properties ... no trival overlap

u1 ∩ u2 ≠ ∅ → u1⊆u2 or u2⊆u1; min degree ... LS ... is at least hal

number of ... may be good candidates ...

can ... a co...

	es	No
No	No	Yes

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leaves only ... vel n

If U1 ...

Lambda-sets are ... Lambda

... connected to other members by more (edge disjoint) paths ... cluster

- LS-sets ... Coherence, inter-cluster incoherence ... is a „network region

... exclusion ... clique))

... closed under exclusion ... are generally not ...

ties with the network ...

U′⊂ U →

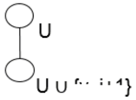
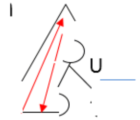
→ If an N-Plex ... me interesting properties ... no trival overlap

u1 ∩ u2 ≠ ∅ → u1⊆u2 or u2⊆u1; min degree ... LS ... is at least hal

number of ... may be good candidates ...

can ... a co...

	es	No
No	No	Yes y ( )

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leaves only vel n

If U1 ambda-sets are ts to ambda

- LS-sets connected to other members by more (edge disjoint) paths cluster

Coherence, inter-clu coherence it is a „*network region*"

level e [2*internal ties are more significant*] trem

λ(u,v) de excluded clique)) ies

sm v;

partial gr sed under exclusio

eft U ⊆ a Lambda set if proper

ties with t U does

min λ(u,v) > max λ(u,v)

u,v ∈ U u ∈U, v ∈ V-U

→ If an N-Plex I

ally re interesting properties no trival overlap

u1 ∩ u2 ≠ ∅ → u1⊆u2 or u2⊆u1; min degree LS is at least hal

number of N-cores may be good candid

longest (lo

order n) tin es No

at least

ca No No Yes y (