LAB 1 TASK 1

Alice David
Frenk

10 nodes 15 edges

Harry Iven

e) Obstering coefficient S=2

4000000  $C(i) = \frac{8 \cdot (\text{number of connections between node's neighbours)}}{\text{k!}(\text{ki}-1)}$ 

Bob

ki - number of heighbours

• Cool :  $N_c = 4$  Frank, Alice, David  $\frac{1}{3}$ ,  $k_c = 3$ Companies  $C_c = \frac{2 \cdot 2}{3 \cdot 2} = \frac{2}{3}$ 

· Alice: NA = { Cont, Frank, David, Ernst, Boby, KA = 5

$$C_A = \frac{2 \cdot 3}{5 \cdot 4} = \frac{3}{10}$$

· David: No = 4 hard, Alice y, Ko = 2

· Ernst: NE= falice, Franky, kE=2

Frank: NF = { Cerl, Alice, Ernsty, KF = 3

$$C_F = \frac{2 \cdot 2}{3 \cdot 2} = \frac{2}{3}$$

· Bob = No = 4 Alice, Goil y, kB=2

$$C_{13} = \frac{2.0}{2.1} = 0$$

• Chail: NG = 4 Bob, Henry, Irene, Jeny, k6=4
$$C_{\alpha} = \frac{2 \cdot 5}{4 \cdot 3} = \frac{1}{2}$$

• Jen: Ny = 4 Irene, Herry, Golf, Ky = 3
$$Cy = \frac{2 \cdot 3}{3 \cdot 2} = 1$$

Cmean = 
$$\frac{2}{3} \cdot \frac{3}{10} + 1 + 1 + \frac{2}{3} + 0 + \frac{4}{2} + 1 + 1 + 1 = \frac{107}{150}$$

• Coil: 
$$C_0 = \frac{9}{2+1+3+3+3+1+1+1} = \frac{9}{18} = \frac{1}{2}$$

· hene: 
$$C_1 = \frac{8}{ah}$$

Most central node: Alice and Bob

# g) Betweenness centrality

$$C_B(v) = \sum_{s \neq v \neq t \in V} \frac{\sigma_{st}(v)}{\sigma_{st}}$$

ALICE

BC         1         1         1           BD         1         1         1           BE         1         1         1           BF         1         1         1           BG         1         0         0           BH         1         0         0           BI         1         0         0           BJ         1         0         0           CD         1         0         0           CD         1         0         0           CE         2         1         0.5           CF         1         0         0           CG         1         1         1           CH         1         1         1           DF         2         1         0.5           DG<		σst	σst(v)	σst(v)/σst
BE         1         1         1           BF         1         1         1           BG         1         0         0           BH         1         0         0           BI         1         0         0           BJ         1         0         0           CD         1         0         0           CE         2         1         0.5           CF         1         0         0           CG         1         1         1           CI         1         1         1           DF         2         1         0.5           DG         1         1         1           DH         1         1         1           DF<	ВС	1	1	
BF         1         1         1           BG         1         0         0           BH         1         0         0           BI         1         0         0           BJ         1         0         0           CD         1         0         0           CE         2         1         0.5           CF         1         0         0           CG         1         1         1           CH         1         1         1         1           CI         1         1         1         1         1           CI         1	BD	1	1	1
BF         1         1         1           BG         1         0         0           BH         1         0         0           BI         1         0         0           BJ         1         0         0           CD         1         0         0           CE         2         1         0.5           CF         1         0         0           CG         1         1         1           CH         1         1         1         1           CI         1         1         1         1         1           CI         1	BE	1	1	1
BH       1       0       0         BJ       1       0       0         CD       1       0       0         CE       2       1       0.5         CF       1       0       0         CG       1       1       1         CH       1       1       1         CI       1       1       1         CJ       1       1       1         DE       1       1       1         DF       2       1       0.5         DG       1       1       1         DH       1       1       1         DJ       1       1       1         DJ       1       1       1         EF       1       0       0         EG       1       1       1         EH       1       1       1         EJ       1       1       1         FH       1       1       1         FH       1       1       1         FJ       1       1       1         FJ       1       0       0 <t< td=""><td>BF</td><td>1</td><td>1</td><td></td></t<>	BF	1	1	
BH       1       0       0         BJ       1       0       0         CD       1       0       0         CE       2       1       0.5         CF       1       0       0         CG       1       1       1         CH       1       1       1         CI       1       1       1         CJ       1       1       1         DE       1       1       1         DF       2       1       0.5         DG       1       1       1         DH       1       1       1         DJ       1       1       1         DJ       1       1       1         EF       1       0       0         EG       1       1       1         EH       1       1       1         EJ       1       1       1         FH       1       1       1         FH       1       1       1         FJ       1       1       1         FJ       1       0       0 <t< td=""><td>BG</td><td>1</td><td>0</td><td>0</td></t<>	BG	1	0	0
BJ 1 0 0 0 CD CD 1 0 0 CE 1 0.5 CF 1 0 0 0 CG 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ВН	1	0	
CD         1         0         0           CE         2         1         0.5           CF         1         0         0           CG         1         1         1           CH         1         1         1           DE         1         1         1           DF         2         1         0.5           DG         1         1         1           DH         1         1         1           DH         1         1         1           DJ         1         1         1           EF         1         0         0           EG         1         1         1           EH         1         1         1           EJ         1         1         1           FG         1         1         1           FH         1         1         1           FJ<	BI	1	0	0
CE         2         1         0.5           CF         1         0         0           CG         1         1         1           CH         1         1         1           CH <td>BJ</td> <td>1</td> <td>0</td> <td>0</td>	BJ	1	0	0
CF       1       0       0         CG       1       1       1         CH       1       1       1         CI       1       1       1         CJ       1       1       1         DE       1       1       1         DF       2       1       0.5         DG       1       1       1         DH       1       1       1         DI       1       1       1         DJ       1       1       1         EF       1       0       0         EG       1       1       1         EH       1       1       1         EJ       1       1       1         FG       1       1       1         FH       1       1       1         FJ       1       1       1         FJ       1       1       0         GJ       1       0       0         GJ       1       0       0         HI       1       0       0         HI       1       0       0 <td>CD</td> <td>1</td> <td>0</td> <td>0</td>	CD	1	0	0
CF       1       0       0         CG       1       1       1         CH       1       1       1         CI       1       1       1         CJ       1       1       1         DE       1       1       1         DF       2       1       0.5         DG       1       1       1         DH       1       1       1         DI       1       1       1         DJ       1       1       1         EF       1       0       0         EG       1       1       1         EH       1       1       1         EJ       1       1       1         FG       1       1       1         FH       1       1       1         FJ       1       1       1         FJ       1       1       0         GJ       1       0       0         GJ       1       0       0         HI       1       0       0         HI       1       0       0 <td></td> <td>2</td> <td>1</td> <td>0.5</td>		2	1	0.5
CG       1       1       1       1         CH       1       1       1       1         CI       1       1       1       1         CJ       1       1       1       1         DE       1       1       1       1         DF       2       1       0.5         DG       1       1       1       1         DH       1       1       1       1         DJ       1       1       1       1         EF       1       0       0       0         EG       1       1       1       1         EH       1       1       1       1         EJ       1       1       1       1         FH       1       1       1       1         FH       1       1       1       1         FJ       1       1       0       0         GJ       1       0       0       0         HI       1       0       0       0         HI       1       0       0       0	CF	1	0	0
CH       1       1       1       1         CI       1       1       1       1         CJ       1       1       1       1         DE       1       1       1       1         DF       2       1       0.5         DG       1       1       1       1         DH       1       1       1       1         DI       1       1       1       1       1         DJ       1 <td< td=""><td></td><td>1</td><td>1</td><td>1</td></td<>		1	1	1
DE       1       1       1       1         DF       2       1       0.5         DG       1       1       1       1         DH       1       1       1       1         DI       1       1       1       1         DJ       1       1       1       1         EF       1       0       0       0         EG       1       1       1       1         EI       1       1       1       1         EJ       1       1       1       1         FG       1       1       1       1         FH       1       1       1       1         FJ       1       1       1       1         GH       1       0       0       0         GJ       1       0       0       0         HI       1       0       0       0         HI       1       0       0       0         HJ       1       0       0       0	СН	1	1	1
DE       1       1       1       1         DF       2       1       0.5         DG       1       1       1       1         DH       1       1       1       1         DI       1       1       1       1         DJ       1       1       1       1         EF       1       0       0       0         EG       1       1       1       1         EI       1       1       1       1         EJ       1       1       1       1         FG       1       1       1       1         FH       1       1       1       1         FJ       1       1       1       1         GH       1       0       0       0         GJ       1       0       0       0         HI       1       0       0       0         HI       1       0       0       0         HJ       1       0       0       0	CI	1	1	1
DE       1       1       1       1         DF       2       1       0.5         DG       1       1       1       1         DH       1       1       1       1         DI       1       1       1       1         DJ       1       1       1       1         EF       1       0       0       0         EG       1       1       1       1         EI       1       1       1       1         EJ       1       1       1       1         FG       1       1       1       1         FH       1       1       1       1         FJ       1       1       1       1         GH       1       0       0       0         GJ       1       0       0       0         HI       1       0       0       0         HI       1       0       0       0         HJ       1       0       0       0	CJ	1	1	1
DG       1       1       1         DH       1       1       1         DI       1       1       1         DJ       1       1       1         EF       1       0       0         EG       1       1       1         EH       1       1       1         EJ       1       1       1         EJ       1       1       1         FG       1       1       1         FH       1       1       1         FJ       1       1       1         GH       1       0       0         GJ       1       0       0         HI       1       0       0         HJ       1       0       0		1	1	1
DH         1         1         1           DI         1         1         1           DJ         1         1         1           EF         1         0         0           EG         1         1         1           EH         1         1         1           EI         1         1         1           EJ         1         1         1           FG         1         1         1           FH         1         1         1           FJ         1         1         1           FJ         1         1         1           GH         1         0         0           GJ         1         0         0           HI         1         0         0           HJ         1         0         0	DF	2	1	0.5
DI       1       1       1       1         DJ       1       1       1       1         EF       1       0       0       0         EG       1       1       1       1         EH       1       1       1       1         EJ       1       1       1       1         FG       1       1       1       1         FH       1       1       1       1         FJ       1       1       1       1         GH       1       0       0       0         GJ       1       0       0       0         HI       1       0       0       0         HJ       1       0       0       0	DG	1	1	1
DJ       1       1       1         EF       1       0       0         EG       1       1       1         EH       1       1       1         EI       1       1       1         EJ       1       1       1         FG       1       1       1         FH       1       1       1         FI       1       1       1         FJ       1       1       1         GH       1       0       0         GJ       1       0       0         HI       1       0       0         HJ       1       0       0		1	1	
EF       1       0       0         EG       1       1       1         EH       1       1       1         EI       1       1       1         EJ       1       1       1         FG       1       1       1         FH       1       1       1         FI       1       1       1         FJ       1       1       1         GH       1       0       0         GJ       1       0       0         HI       1       0       0         HJ       1       0       0	DI	1	1	1
EG       1       1       1         EH       1       1       1         EI       1       1       1         EJ       1       1       1         FG       1       1       1         FH       1       1       1         FI       1       1       1         FJ       1       1       1         GH       1       0       0         GI       1       0       0         GJ       1       0       0         HI       1       0       0         HJ       1       0       0	DJ	1	1	1
EH       1       1       1         EI       1       1       1         EJ       1       1       1         FG       1       1       1         FH       1       1       1         FI       1       1       1         FJ       1       1       1         GH       1       0       0         GI       1       0       0         GJ       1       0       0         HI       1       0       0         HJ       1       0       0	EF	1	0	0
EI       1       1       1         EJ       1       1       1         FG       1       1       1         FH       1       1       1         FI       1       1       1         FJ       1       1       1         GH       1       0       0         GI       1       0       0         GJ       1       0       0         HI       1       0       0         HJ       1       0       0	EG	1	1	
EJ       1       1       1         FG       1       1       1         FH       1       1       1         FI       1       1       1         FJ       1       1       1         GH       1       0       0         GI       1       0       0         GJ       1       0       0         HI       1       0       0         HJ       1       0       0	EH	1	1	1
FG     1     1     1       FH     1     1     1       FI     1     1     1       FJ     1     1     1       GH     1     0     0       GI     1     0     0       GJ     1     0     0       HI     1     0     0       HJ     1     0     0	EI	1	1	1
FH     1     1     1       FI     1     1     1       FJ     1     1     1       GH     1     0     0       GI     1     0     0       GJ     1     0     0       HI     1     0     0       HJ     1     0     0	EJ	1	1	
FI     1     1     1       FJ     1     1     1       GH     1     0     0       GI     1     0     0       GJ     1     0     0       HI     1     0     0       HJ     1     0     0		1	1	
FJ     1     1     1       GH     1     0     0       GI     1     0     0       GJ     1     0     0       HI     1     0     0       HJ     1     0     0		1	1	1
GH 1 0 0 GI 1 0 0 GJ 1 0 0 HI 1 0 0 HJ 1 0 0		1	1	
GI 1 0 0 GJ 1 0 0 HI 1 0 0 HJ 1 0 0	FJ	1	1	1
GJ 1 0 0 HI 1 0 0 HJ 1 0 0	GH	1	0	0
HI 1 0 0 HJ 1 0 0		1	0	
HJ 1 0 0	GJ	1	0	
	HI	1	0	0
[J] 1 0 0	HJ	1	0	0
	IJ	1	0	0

BOB:

	σst	σst(v)	σst(v)/σst
AC	1	0	0
AD	1	0	0
AE	1	0	0
AF	1	0	0
AG	1	1	1
АН	1	1	1
Al	1	1	1
AJ	1	1	1
CD	1	0	0
CE	2	0	0
CF	1	0	0
CG	1	1	1
СН	1	1	1
CI	1	1	1
CI CI	1	1	1
DE	1	0	0
DF	2	0	0
DG	1	1	1
DH	1	1	1
DI	1	1	1
DJ	1	1	1
EF	1	0	0
EG	1	1	1
EH	1	1	1
EI	1	1	1
EJ	1	1	1
FG	1	1	1
FH	1	1	1
FI	1	1	1
FJ	1	1	1
GH	1	0	0
GI	1	0	0
GJ	1	0	0
HI	1	0	0
HJ	1	0	0
IJ	1	0	0
			20

CARL

	σst	σst(v)	σst(v)/σst
AB	1	0	0
AD	1	0	0
AE	1	0	0
AF	1	0	0
AG	1	0	0
AH	1	0	0
Al	1	0	0
AJ	1	0	0
BD	1	0	0
BE	1	0	0
BF	1	0	0
BG	1	0	0
ВН	1	0	0
BI	1	0	0
BJ	1	0	0
DE	1	0	0
DF	2	1	0.5
DG	1	0	0
DH	1	0	0
DI	1	0	0
DJ	1	0	0
EF	1	0	0
EG	1	0	0
EH	1	0	0
EI	1	0	0
EJ	1	0	0
FG	1	0	0
FH	1	0	0
FI	1	0	0
FJ	1	0	0
GH	1	0	0
GI	1	0	0
GJ	1	0	0
HI	1	0	0
HJ	1	0	0
IJ	1	0	0
			0.5

DAVID			
	σst	σst(v)	σst(v)/σst
AB	1	0	0
AC	1	0	0
AE	1	0	0
AF	1	0	0
AG	1	0	0
AH	1	0	0
Al	1	0	0
AJ	1	0	0
ВС	1	0	0
BE	1	0	0
BF	1	0	0
BG	1	0	0
ВН	1	0	0
BI	1	0	0
BJ	1	0	0
CE	2	0	0
CF	1	0	0
CG	1	0	0
СН	1	0	0
CI	1	0	0
CJ	1	0	0
EF	1	0	0
EG	1	0	0
EH	1	0	0
EI	1	0	0
EJ	1	0	0
FG	1	0	0
FH	1	0	0
FI	1	0	0
FJ	1	0	0
GH	1	0	0
GI	1	0	0
GJ	1	0	0
HI	1	0	0
HJ	1	0	0
IJ	1	0	0
	-	•	0

# **ERNST**

	σst	σst(v)	σst(v)/σst
AB	1	0	0
AC	1	0	0
AD	1	0	0
AF	1	0	0
AG	1	0	0
AH	1	0	0
Al	1	0	0
AJ	1	0	0
ВС	1	0	0
BD	1	0	0
BF	1	0	0
BG	1	0	0
вн	1	0	0
ВІ	1	0	0
BJ	1	0	0
CD	1	0	0
CE	2	0	0
CG	1	0	0
CH CI	1	0	0
CI	1	0	0
CJ	1	0	0
DF	2	0	0
DG	1	0	0
DH	1	0	0
DI	1	0	0
DJ	1	0	0
FG	1	0	0
FH	1	0	0
FI	1	0	0
FJ	1	0	0
GH	1	0	0
GI	1	0	0
GJ	1	0	0
HI	1	0	0
HJ	1	0	0
IJ	1	0	0
			0

# $\mathsf{FRANK}$

	σst	σst(v)	σst(v)/σst
AB	1	0	0
AC	1	0	0
AD	1	0	0
AE	1	0	0
AG	1	0	0
AH	1	0	0
Al	1	0	0
AJ	1	0	0
ВС	1	0	0
BD	1	0	0
BE	1	0	0
BG	1	0	0
ВН	1	0	0
BI	1	0	0
BJ	1	0	0
CD	1	0	0
CE	2	1	0.5
CG	1	0	0
CH CI	1	0	0
CI	1	0	0
CJ	1	0	0
DE	1	0	0
DG	1	0	0
DH	1	0	0
DI	1	0	0
DJ	1	0	0
EG	1	0	0
EH	1	0	0
EI	1	0	0
EJ	1	0	0
GH	1	0	0
GI	1	0	0
GJ	1	0	0
HI	1	0	0
HJ	1	0	0
IJ	1	0	0
-			0.5

	σst	σst(v)	σst(v)/σst
AB	1	0	0
AC	1	0	0
AD	1	0	0
AE	1	0	0
AF	1	0	0
AH	1	1	1
Al	1	1	1
AJ	1	1	1
ВС	1	0	0
BD	1	0	0
BE	1	0	0
BF	1	0	0
ВН	1	1	1
BI	1	1	1
BJ	1	1	1
CD	1	0	0
CE	2	0	0
CF	1	0	0
СН	1	1	1
CI	1	1	1
CJ	1	1	1
DE	1	0	0
DF	2	0	0
DH	1	1	1
DI	1	1	1
DJ	1	1	1
EF	1	0	0
EH	1	1	1
EI	1	1	1
EJ	1	1	1
FH	1	1	1
FI	1	1	1
FJ	1	1	1
HI	1	0	0
HJ	1	0	0
IJ	1	0	0
_			18

HARRY			
	σst	σst(v)	σst(v)/σst
AB	1	0	0
AC	1	0	0
AD	1	0	0
AE	1	0	0
AF	1	0	0
AG	1	0	0
Al	1	0	0
AJ	1	0	0
ВС	1	0	0
BD	1	0	0
BE	1	0	0
BF	1	0	0
BG	1	0	0
BI	1	0	0
BJ	1	0	0
CD	1	0	0
CE	2	0	0
CF	1	0	0
CG	1	0	0
CI	1	0	0
CJ	1	0	0
DE	1	0	0
DF	2	0	0
DG	1	0	0
DI	1	0	0
DJ	1	0	0
EF	1	0	0
EG	1	0	0
EI	1	0	0
EJ	1	0	0
FG	1	0	0
FI	1	0	0
FJ	1	0	0
GI	1	0	0
GJ	1	0	0
IJ	1	0	0
	•	-	0

# IRENE

	σst	σst(v)	σst(v)/σst
AB	1	0	0
AC	1	0	0
AD	1	0	0
AE	1	0	0
AF	1	0	0
AG	1	0	0
AH	1	0	0
AJ	1	0	0
ВС	1	0	0
BD	1	0	0
BE	1	0	0
BF	1	0	0
BG	1	0	0
ВН	1	0	0
BJ	1	0	0
CD	1	0	0
CE	2	0	0
CF	1	0	0
CG	1	0	0
СН	1	0	0
CJ	1	0	0
DE	1	0	0
DF	2	0	0
DG	1	0	0
DH	1	0	0
DJ	1	0	0
EF	1	0	0
EG	1	0	0
EH	1	0	0
EJ	1	0	0
FG	1	0	0
FH	1	0	0
FJ	1	0	0
GH	1	0	0
GJ	1	0	0
HJ	1	0	0
			0

	σst	σst(v)	σst(v)/σst
AB	1	0	0
AC	1	0	0
AD	1	0	0
AE	1	0	0
AF	1	0	0
AG	1	0	0
АН	1	0	0
Al	1	0	0
ВС	1	0	0
BD	1	0	0
BE	1	0	0
BF	1	0	0
BG	1	0	0
ВН	1	0	0
BI	1	0	0
CD	1	0	0
CE	2	0	0
CF	1	0	0
CG	1	0	0
CH	1	0	0
CI	1	0	0
DE	1	0	0
DF	2	0	0
DG	1	0	0
DH	1	0	0
DI	1	0	0
EF	1	0	0
EG	1	0	0
EH	1	0	0
EI	1	0	0
FG	1	0	0
FH	1	0	0
FI	1	0	0
GH	1	0	0
GI	1	0	0
HI	1	0	0
			0

Alice is the most central node.