$8\frac{1}{2}/10$

Quiz: Graphs

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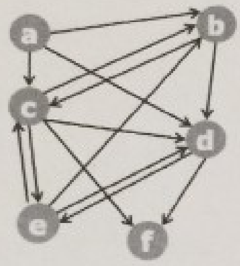
1) (3pts) Trawling: with a support threshold s = 3, find one bipartite sub-graph from the graph below (1pt). You need to first convert the graph to a market basket model (i.e., write down baskets and their contents (2pts)



a = {b, c, d}

b = {c, d}

c = {b, d, e} f

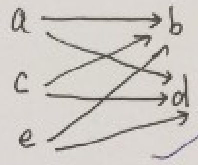
d = {e, f}

e = {c, b, d}

f = {ϕ}

are above threshold

{b, d}



$2\frac{1}{2}$

2) (3pts) In BigCLAM, given $\boldsymbol{P_A(u,v) = 1 - \exp(-F_{uA} \cdot F_{vA})}$ (the probability of a link between u and v exists considering only community A), what is the probability that at least one common community links the nodes u and v? Write your answer using $\boldsymbol{F_u}$ and $\boldsymbol{F_v}$.

3

So at least one community links

$$\cancel{P(u,v) = 1 - \exp(-\sum_C F_{uC} F_{vC})} = 1 - \prod_C (1 - P_C(u,v))$$

$$\cancel{= 1 - \exp(-F_u F_v^T)} = 1 - \prod_C (1 - (1 - \exp(-F_{uC} \cdot F_{vC}))$$

the probability that u, and v have no common community is $\prod_C (1 - P_C(u,v))$

$$= 1 - \prod_C (+\exp(-F_{uC} \cdot F_{vC})$$

$$= 1 - \exp(-F_u \cdot F_v^T)$$

3) (4pts) Give the graph and its community below, calculate P_C and P_D that support the maximum likelihood of this graph.

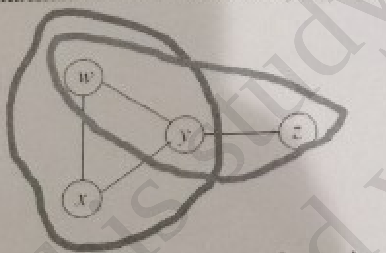


Figure 10.20: A social graph

assume C = {x, y, w} D = {w, y, z}

$$ML = \max(P_{wx} \cdot P_{wy} \cdot P_{xy} \cdot P_{yz} \cdot P_{wz} \cdot P_{xz})$$

Should maximize $P_{wx} P_{wy} P_{xy} P_{yz} (1-P_{wz})(1-P_{xz})$

$$= P_C \cdot P_C \cdot (1 - P_D (1-P_C)(1-P_D)) \cdot P_D \cdot (1-P_D) \cdot (1-\varepsilon)$$

$$= P_C^2 \cdot (P_C + P_D - P_C P_D) \cdot P_D (1-P_D) \cdot (1-\varepsilon)$$

$(1-\varepsilon)$ can be ignored

to make it maximum

let $P_C = 1 \Rightarrow (1 + P_D - P_D) \cdot P_D \cdot (1 - P_D)$

maximum so that $P_D = 0.5$

3