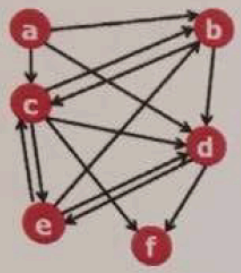
Quiz 10 Graphs

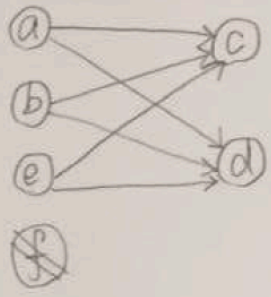
1

(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 (1pts)

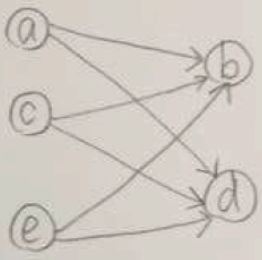


a = {b, c, d}
b = {c, d}
c = {e, f, d, b}
d = {e, f}
e = {b, c, d}
f = { }

{c, d} : support 3
{b, d} = 3



OR:



2

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

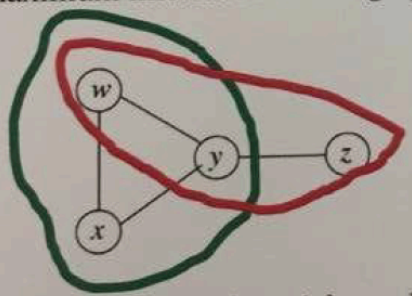


Figure 10.20: A social graph

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

$P_{wx} = 1 - (1 - P_C) = P_C$

$P_{xy} = P_C$

$P_{yz} = P_D$

$P_{wz} = P_D$

$P_{wy} = 1 - (1 - P_C)(1 - P_D)$

P_{xz} = a tiny value ε

$L = P_{wx} P_{wy} P_{xy} P_{yz} (1 - P_{wz})(1 - P_{xz})$

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

To make L maximum. P_C should be as large as possible

Given $P_C = 1$. $L = P_D(1 - P_D)$ => when $P_D = 0.5$, L has its maximum

∴ $P_C = 1$, $P_D = 0.5$

What does the maximum likelihood mean in terms of finding communities for this graph?

The maximum likelihood for the graph in Fig. 10.20 occurs when members of C are certain to have an edge between them and there is a 50% chance that joint membership in D will cause an edge between the members.

3

(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 $\boldsymbol{F_v}$.

$$P(u,v) = 1 - \prod_{\text{community}} (1 - P_c(u,v)) \quad (1pt)$$

$$= 1 - \exp(-\textstyle\sum_c F_{uc} \cdot F_{vc})$$

$$= 1 - \exp(-F_u \cdot F_v^T) \quad (2pt)$$