

- 1) (a) Genetic inheritance , we can get the data from the family genetic report.
 (b) Virus infection , we can get the data from medical record
 (c) Mathematics , we can get the data from the textbooks
 (d) Communication network - phone number , we can get the data by doing survey
 (e) Linear algebra and statistics , we can get the data from the textbooks too.
 (f) Friendship, we can do a survey over time to get the person's friend list.

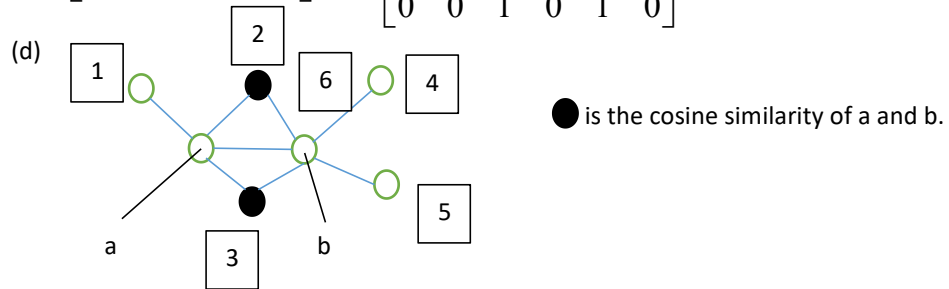
(1)(f) Each nodes is person, each edges is relationship between friends. over several times, the friend list of a person will change.

2) (a) $A = \begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$

(b)

Nodes	Adjacency list
1	5
2	1,4,3
3	
4	2,3,5
5	4

(c)
$$\begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$



	1	2	3	4	5	6	A	b
a	1	1	1	0	0	0	0	1
b	0	1	1	1	1	1	1	0

$$A=[1,1,1,0,0,0,0,0]$$

$$B=[0,1,1,1,1,1,0,0]$$

$$\frac{a \cdot b}{|a||b|} = \frac{2}{\sqrt{20}} = 0.4471 = \text{cosine similarity of a and b}$$

Collaboration: Chee Fu Yoong and assistance