1.

(a) (3 pts) An acyclic (or approximately acyclic) directed network

食物鏈，生物學家調查，人為控制外來種或保育瀕臨絕種的動物

(b) (3 pts) A cyclic directed network

神經系統，vertex 是神經元，edge 是神經突觸

(c) (3 pts) A tree (or approximate tree)

族譜，區公所取得，研究遺傳性疾病

(d) (3 pts) A planar (or approximately planar) network

道路網；GOOGLE MAP 都有用顏色標示路段為暢通或堵塞，哪些路段在尖峰時間易堵塞

(e) (3 pts) A bipartite network

演員和電影，IMDB，什麼演員會演什麼類型的電影

(f) (3 pts) A temporal network (or sequence of edges)

流行病的傳染 ;透過健保單位收集資料 ;若有一個疾病發生，可能會在哪些區域較

2.

(a)

A	1	2	3	4	5
1	0	0	0	0	1
2	1	0	1	1	0
3	0	0	0	0	0
4	0	1	1	0	1
5	0	0	0	1	0

(b)

A	
1	{5,1}
2	{1,1},{3,1},{4,1}
3	
4	{2,1},{3,1},{5,1}
5	{4,1}

(c)

adjacency matrix(上)

A	1	2	3	4	5

1	0	1	1	0	0
2	1	0	1	0	0
3	1	1	0	1	0
4	0	0	1	0	1
5	0	0	0	1	0

adjacency matrix(下)

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

(d)
adjacency matrix

A	1	2	3	a	b	6	7
1	0	0	0	1	0	0	0
2	0	0	0	1	1	0	0
3	0	0	0	0	1	0	0
a	1	1	0	0	1	1	0
b	0	1	1	1	0	1	1
6	0	0	0	1	1	0	0
7	0	0	0	0	1	0	0

a:(1,1,0,0,1,1,0)
b:(0,1,1,1,0,1,1)

$$\cos \theta = \frac{1 \times 1 + 1 \times 1}{\sqrt{5}\sqrt{4}} = 0.4472$$