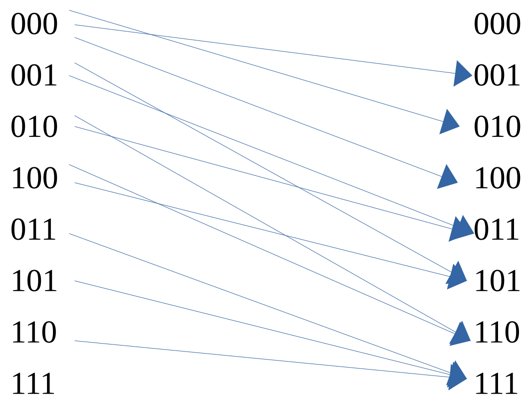
4.5.3 (a)4.1.1 (a)
(1,2), (2,1), (3,3)

4.1.4 (a)



4.2.1 (b)
Reflexive
Anti-symmetric
Transitive

4.2.4 (b)
Anti-reflexive
Anti-symmetric
Transitive

4.3.1 (a, b, c, f, h)
a) 2

b) 3

c) *b*

f) No, not a walk

h) It is neither a circuit nor a cycle unless node *c* is added to the end of the walk.

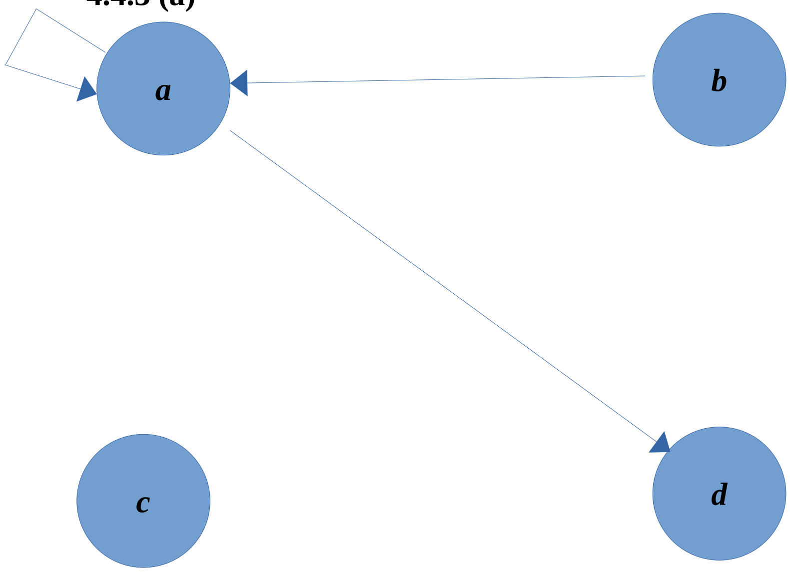
4.3.4 (b, d)
b) <1, 2, 3> This is a path because no vertexes repeat.

d) <1, 2, 3, 1> This is a cycle because it’s a closed walk and the first and last vertexes are the same.

4.4.1 (a, c)
a) {(b, d), (b, a)}

c) {(a, d), (a, a), (c, b), (c, c)}

4.4.3 (a)



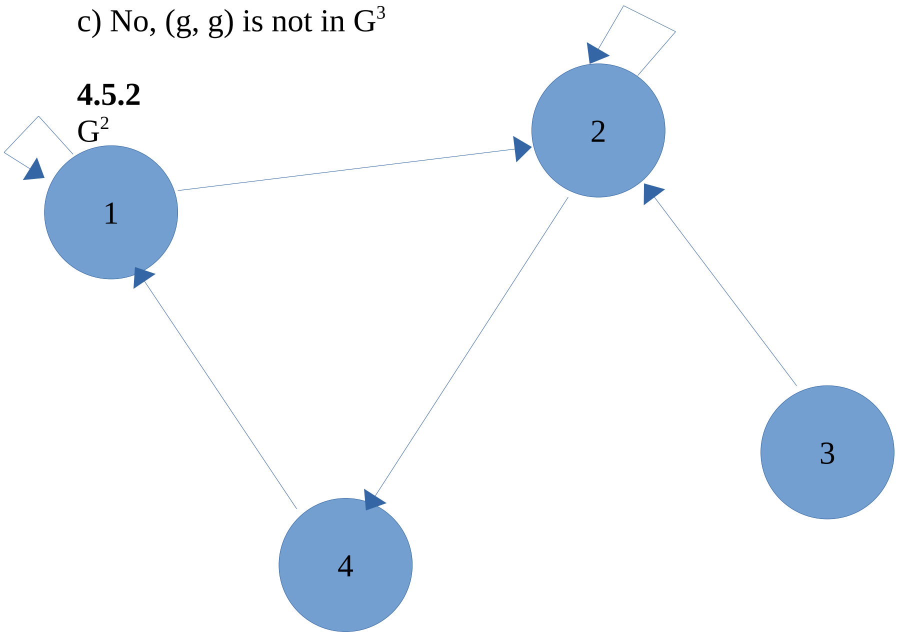
4.5.1 (a, c)

a) No, (a, a) is not in G^2

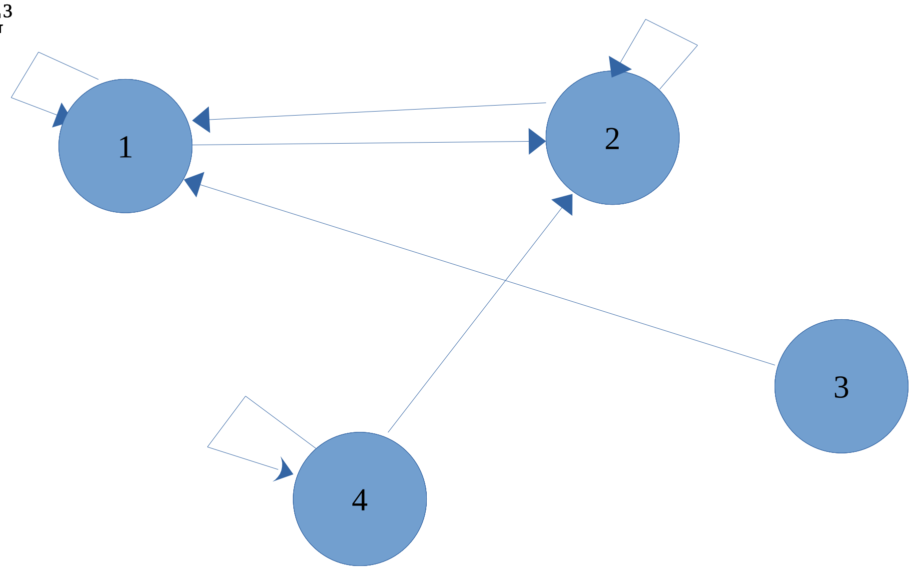
c) No, (g, g) is not in G^3

4.5.2

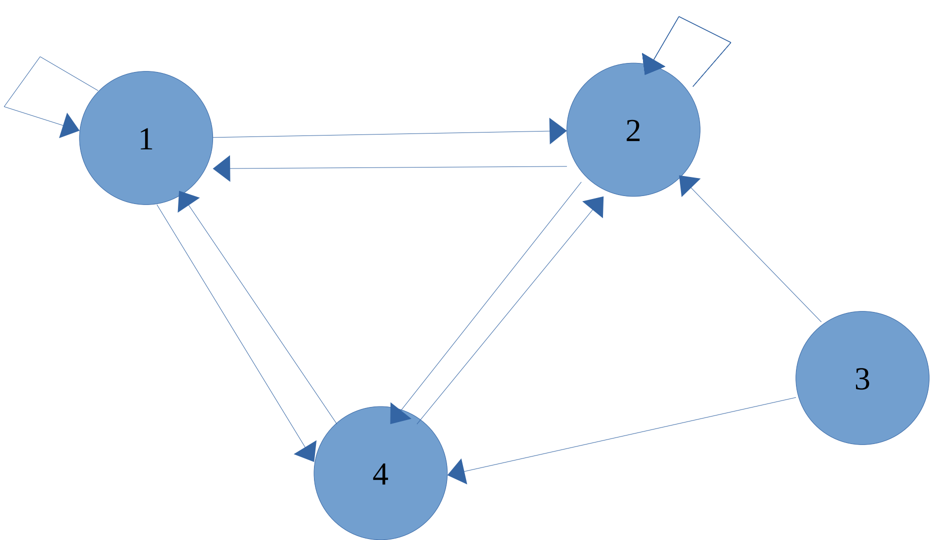
G^2

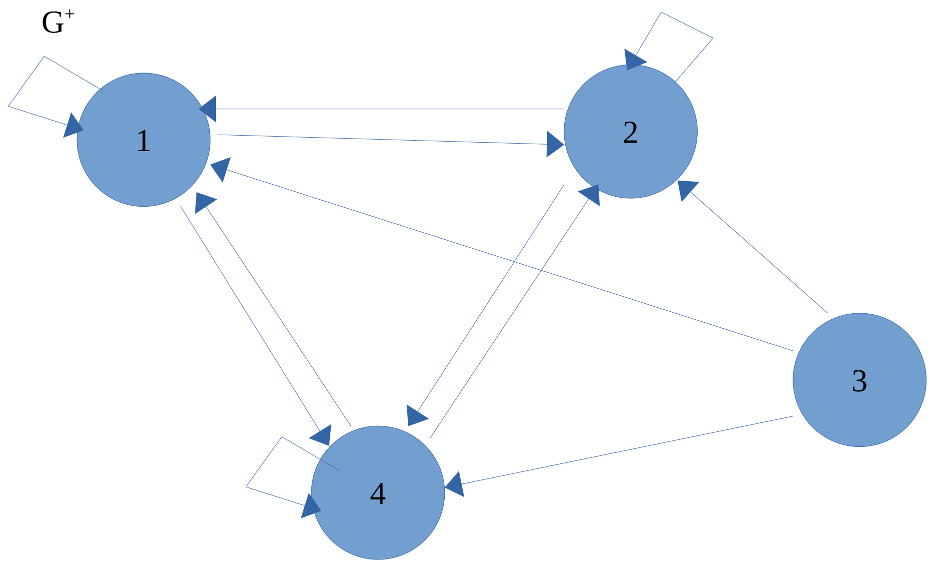


G^3

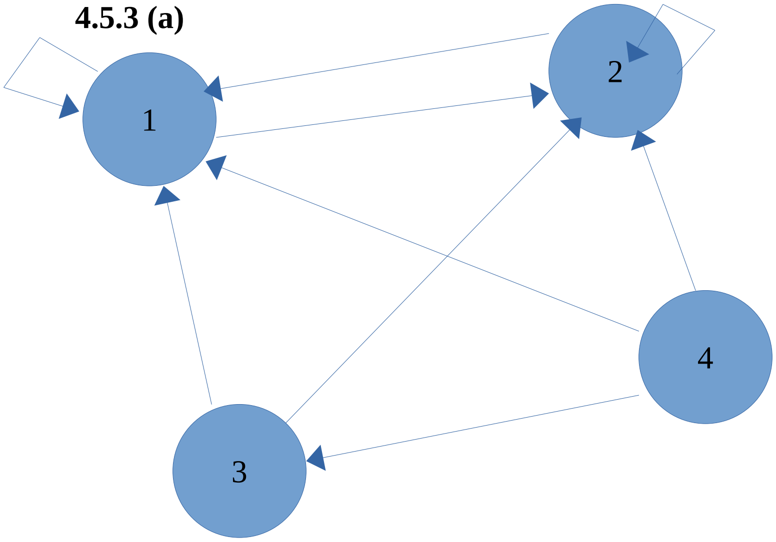


G^4




G$^+$
1
2
3
4

4.5.3 (a)



4.5.4 (c, e)

c) Yes, there's a closed walk of length 3

e) Yes, there is a walk of length 5 from vertex 2 to 3

4.6.1

Adjacency Matrix:

0	1	0	0
0	0	1	0
0	0	0	1
0	1	0	0

G^2 Matrix:

0	0	1	0
0	0	0	1
0	1	0	0
0	0	1	0

G^3 Matrix:

0	0	0	1
0	1	0	0
0	0	1	0
0	0	0	1

G^4 Matrix:

0	1	0	0

0	0	1	0
0	0	0	1
0	1	0	0

G^+ Matrix:

0	1	1	1
0	1	1	1
0	1	1	1
0	1	1	1

4.6.3 (a, d)

a) Vertex 2, 4, and 5

d) Yes, because (2, 2) is a walk in 3 steps

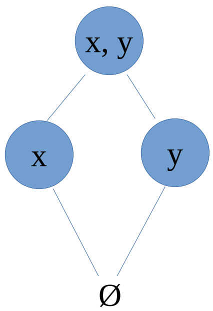
4.7.1

a) *J*, *I*, *A*, *F*

b) *J*, *H*, *D*, *G*

c) (*A*, *D*), (*G*, *F*), (*D*, *B*), (*H*, *I*)

4.7.2 (a)

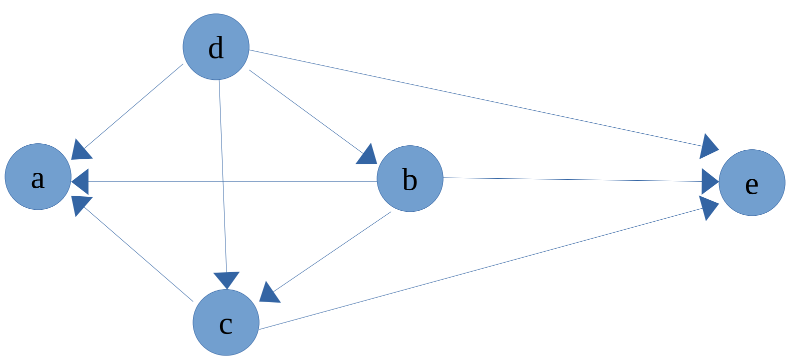


4.8.1 (a)
Strict order and total order. It is a strict order because it is transitive (Bake < Cake, Cake < Take, therefore Back < Take) and Anti-reflexive because no word of the same spelling is compared to itself. It is a total order because every word is comparable to every other word since only one word can come before it and only one word can come after it (except for the first and last word).

4.8.2 (a)
{b, d, c, f, e, a, g}
{b, f, d, c, e, a, g}

4.8.4 (a)
The graph is acyclic.

Transitive closure graph:



4.9.1 (b)
This is an equivalence relation. It is reflexive, because an individual as the same mother as him/herself. It is symmetric because a boy is a sibling to his sister and a girl is a sibling to her brother, given the same mother. It is transitive because anyone with the same mother are automatically each other's siblings. Partitions are formed around different mothers in this domain.

4.9.2
<u>Partitions of *S*</u>
Remainder 0: {44, 56, 4}
Remainder 1: {13, 17}

Remainder 2: {2, 34}
Remainder 3: {7, 99, 31}