

In the previous problems you were using visual graphs of problems.

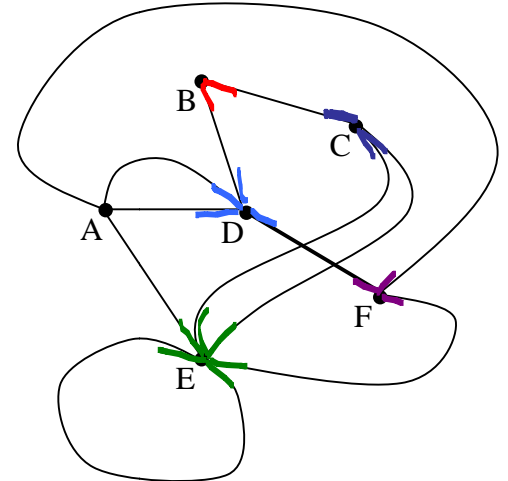
Now we need to define some common terms that will be helpful.

VERTICES are the points on the graph and the lines connecting the vertices are called **EDGES**.

1. The **DEGREE** of a vertex is defined by the number of edges that have that vertex as an endpoint. Find the degree of each vertex.

Vertex	Degree
A	4
B	2
C	3

Vertex	Degree
D	4
E	6
F	3



2. Two vertices are **ADJACENT**, if they are connected by an edge.

- List all of the vertices adjacent to vertex A: D, E, F
- List all of the vertices adjacent to vertex B: D, C
- List all of the vertices adjacent to vertex C: B, E

d. Create an **Adjacency Matrix** of the graph.

	A	B	C	D	E	F
A	0	0	0	2	1	1
B	0	0	1	1	0	0
C	0	1	0	0	2	0
D	2	1	0	0	2	1
E	1	0	2	0	2	1
F	1	0	0	1	1	0

3. A **LOOP** occurs when an edge has both endpoints being the same vertex.

- List any vertices that have a loop: E

4. **MULTIPLE EDGES** occur when 2 adjacent vertices have more than one edge connecting the same 2 vertices.

- List any pair of adjacent vertices that have multiple edges: (A,D) (C,E)

5. A **WALK** is a route you can take from one point to another and you can use multiple edges

- List all of the 2 step walks starting from vertex B (a 2 step walk uses 2 edges).

~~None~~ BDA₁, BDA₂, BDF, BDB, BCB, BCE₁, BCE₂

7 POSSIBLE 2 STEP WALKS
STARTING FROM VERTEX "B"

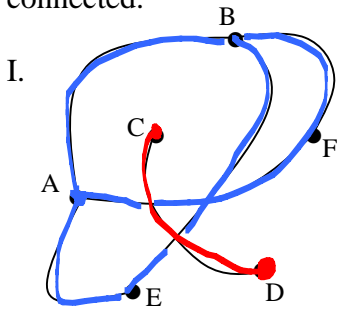
6. Square the Adjacency Matrix using your calculator and show your answer below. See if the row representing vertex B sums to the same number of walks in #5.

[A]	A	B	C	D	E	F
A	0	0	0	2	1	1
B	0	0	1	1	0	0
C	0	1	0	0	2	0
D	2	1	0	0	0	1
E	1	0	2	0	2	1
F	1	0	0	1	1	0

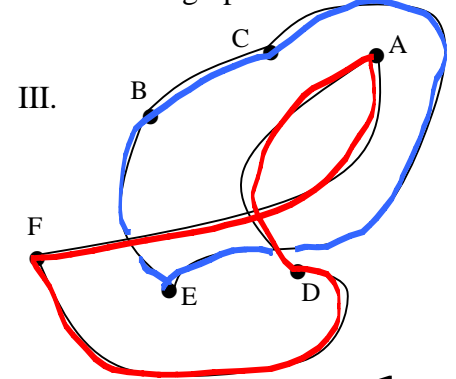
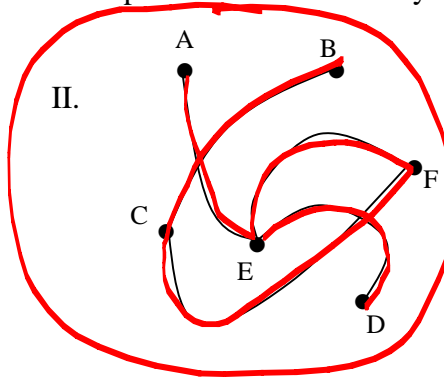
[A] ²	A	B	C	D	E	F
A	6	2	2	1	3	3
B	2	2	0	0	2	1
C	2	0	5	1	4	2
D	1	0	1	6	3	2
E	3	2	4	3	10	3
F	3	1	2	2	3	3

= 7 PATHS OF
2 STEP WALKS
STARTING FROM
VERTEX "B"

7. A graph is **CONNECTED** if at least one path exists between any two points. Circle the graphs below that are connected.

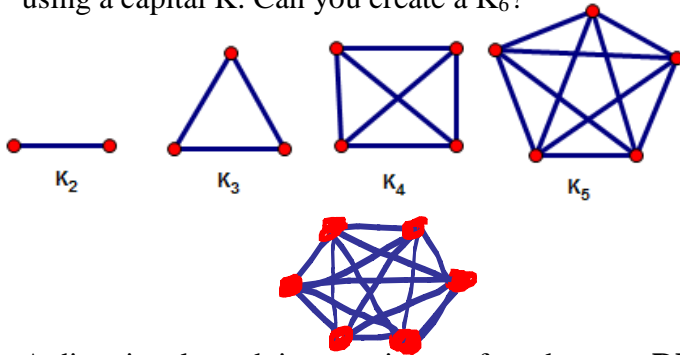


NOT CONNECTED



NOT CONNECTED

8. A complete graph is a graph in which all vertices are adjacent to one another and they are usually denoted using a capital K. Can you create a K_6 ?



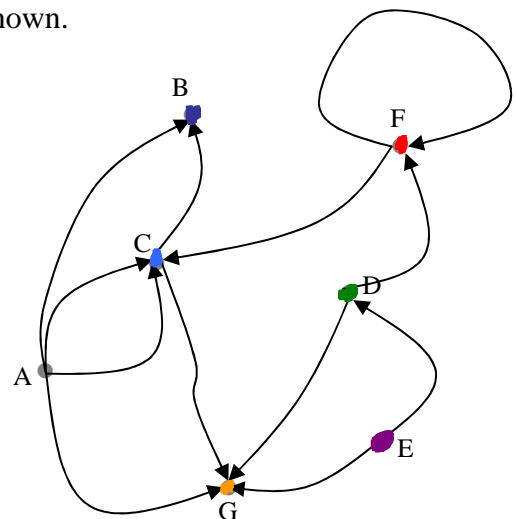
Graph	# of Vertices	# of Edges
K_2	2	1
K_3	3	3
K_4	4	6
K_5	5	10
K_6	6	15
K_{15}	15	105

OF EDGES = $1+2+3+4+5+6+7+8+9+10+11+12+13+14$
 $K_{15} = 105$

9. A directional graph is sometimes referred to as a **DI-GRAPH**. A di-graph is one with edges that are one directional (similar to a one way street). The vertices of di-graphs have an **INDEGREE** and an **OUTDEGREE**. The indegree is simply the number of edges coming into the vertex and the outdegree is the number of edges leaving the vertex. A vertex that only has edges coming in to the vertex is called a **RECIEVER**. A vertex that only has outgoing edges is called a **TRANSMITTER**.

A. List the indegree and outdegree of each vertex in the graph shown.

Vertex	Indegree	Outdegree	Total Degree
A	0	4	4
B	2	0	2
C	3	2	5
D	1	2	3
E	0	2	2
F	2	2	4
G	4	0	4



B. List all of the vertices that are TRANSMITTERS: A AND E

c. List all of the vertices that are RECIEVERS: B AND G