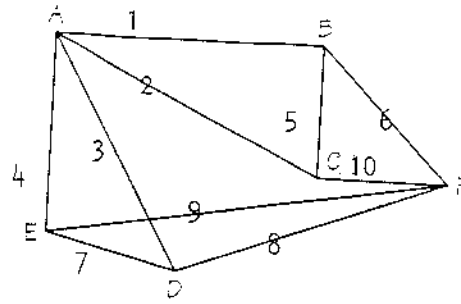


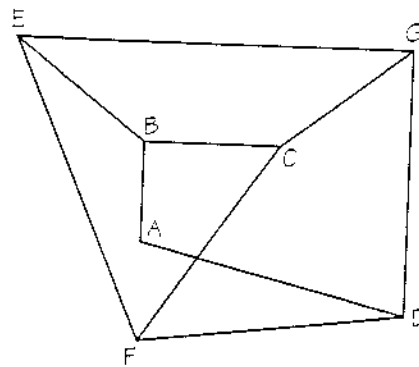
## GRAPHS

Graphs can be represented using spreadsheets. Label the vertices by letters (A, B, C, etc.) and the edges (1, 2, 3, etc.). Suppose each column represents a vertex and each row represents an edge of the graph. Then we can record each edge of the graph in the following way: in the first row, put a 1 in the two columns that represent the endpoints of edge 1. Continue, so that each row has two 1's in it. Calculate the degree of a vertex by using the **sum** command to calculate the sum of each column. For example, the graph shown at the right can be represented by the spreadsheet shown below it. Recall that a connected graph has an Euler circuit exactly when each vertex has an even degree. Similarly, a connected graph has an Euler path when exactly two vertices have odd degree. The **sum** command provides a quick method to detect when a connected graph has an Euler circuit or an Euler path.



A	B	C	D	E	F
	1	1			
	1		1		
	1			1	
	1				1
		1			1
		1	1		
				1	1
				1	1
			1		1
	4	3	3	3	4

1. Create a spreadsheet to represent the graph at the right.  
Does it have an Euler circuit?  
Does it have an Euler path?



2. Draw a graph represented by the spreadsheet at the right.  
Does it have an Euler circuit?  
Does it have an Euler path?

	A	B	C	D	E
1	1		1		
2		1	1		
3		1		1	
4		1			1
5				1	1
6	1				1