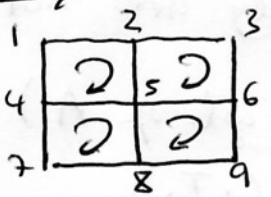
2.5.16 For a complete graph how many edges are there?
The graph has n nodes, all nodes connect to each other by a single edge, no self-loops.

This is the same as counting how many handshakes it takes for n people to shake hands with each other:

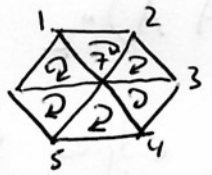
The first node connects to the others with $n-1$ edges
" 2nd " " " " " " $n-2$ edges
(we don't count the edge connecting to 1)
" 3rd " " " " " $n-3$ edges
(not counting edges to nodes 1, 2)
⋮
the $(n-1)$st " " " " " " " " 1 edge

$$N = \sum_{i=1}^{n-1} i = \frac{n(n-1)}{2}$$

2.5.17 Verify Euler's formula (# nodes) − (# edges) + (# loops) = 1

(a) 

Nodes: 9
Edges: 12
loops: 4
$9 - 12 + 4 = 1$

(b) 

Nodes: 7
edges: 12
loops: 6
$7 - 12 + 6 = 1$

2.5.18 Multiply matrices to find A^TA (A arbitrary incidence matrix) and guess how its entries come from the graph

(a) The diagonal of A^TA tells how many ___? into each node

(b) The off diagonals -1 or 0 tell which pairs of nodes are ___?.