

Things to note

When you formulate a real world problem as a graph problem, you have to:

- ▶ Describe the graph precisely. What are the vertices? What are the edges? Do the edges have weights? Use correct terminology (don't be sloppy about language).
- ▶ Once the graph is defined, the problem (whether a decision problem, optimization problem, or construction problem) is then defined only in terms of the graph and not in terms of the original problem.

The power in making this formulation is that there are many algorithms (and software) for most natural graph problems, and so you can use those programs to solve your problem.

Many graph problems are **NP-hard**, but sometimes you have extra structure in your problem that allows you to solve the problem in polynomial time. (For example, MIN VERTEX COLORING is NP-hard, but solvable in polynomial time on trees.)