Constraint Programming: Applications

The University of Melbourne
School of Computing and Information Systems

COMP90048
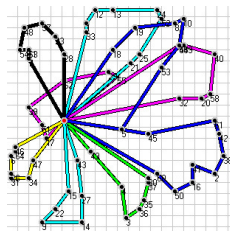**Declarative Programming**

Section Bonus

Semester 1, 2019

Constraint Programming: Applications

Constraint Programming is state-of-the-art for solving a range of optimisation problems, including:

- Vehicle Routing;

- Project Scheduling (Resource Constrained Scheduling Problems);

- Rostering.

Vehicle Routing

Given a logistics network of potentially thousands of nodes, and a potentially heterogeneous fleet of capacitated vehicles, find a set of routes that services all customers at minimum cost. We must determine which customers each vehicle services and in what order.

Further complications include the presence of time windows (individual customers must be serviced within a specific time period), packing and compatibility constraints, and transshipment.

Resource Constrained Scheduling Problems
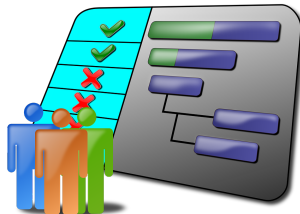
We have a set of activities or jobs that need to be completed, and we want to minimise makespan (time required to complete all jobs). Precedence constraints require that certain jobs be completed before others, and each job requires certain resources. In a job shop setting – our resources are machines; each job is assigned to a machine; and no two jobs can be scheduled on a machine at the same time.

Rostering and Employee Scheduling

The Nurse Scheduling or Rostering Problem is an example of a class of rostering problems for which CP techniques are well suited. We must assign shifts (day, night, and late-night shifts) and holidays to nurses.

Each shift must be adequately staffed by nurses with an appropriate combination of qualifications, while each nurse cannot be assigned to multiple shifts on a single day.